NADC-79239-60

# COMPILATION OF ENERGY EFFICIENT CONCEPTS IN ADVANCED AIRCRAFT DESIGN AND OPERATIONS

## Volume II
## Abstract Data Base

Information Spectrum, Inc.
955 Louis Drive
Warminster, PA 18974

5 November 1980

**Final Report for Period: 10 March 1980 - 5 November 1980**





Prepared for
Naval Air Development Center
Warminster, PA 18974

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## NOTICES

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| CODE | OFFICE OR DIRECTORATE |
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| Advanced Aeronautical Technology | Aircraft Energy Consumption |
| Advanced Aircraft Design | Aircraft Engines |
| Advanced Energy Efficient Concepts | Aircraft Fuel Conservation |

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This final report (contained in two volumes) presents the results of research into published literature. The search addressed the technologies necessary to support next generation (IOC 1990+) air vehicle design and operation concepts that will reduce the requirement for natural petroleum-derived energy. The Advanced Concepts Evaluation (ACE) Data Base consists of 599 unique abstracts listed as 948 entries.

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19.

Aircraft Fuel Consumption
Aircraft Fuel Efficiency
Aircraft Fuels
Aircraft Materials
Aircraft Operations Concepts
Aircraft Propulsion Efficiency
Aircraft Structures
Aircraft Unconventional Systems
Alternative Energy Concepts
Alternative Fuels
Alternative Propulsion
Bibliography
Citations
Compilation
Data Base
Energy Conservation
Energy Consumption
Energy Management
National Energy Crisis

20.

The ACE Data Base is arranged into eleven areas of R&D effort, each subdivided into Navy and non-Navy funded programs.

The contents of the respective volumes of this report are as follows:

Volume I - Technical Report - includes introduction, Data Bases searched, research methodology for creation of the ACE Data Base, summary of search results, conclusions and recommendations. This volume contains an appendix of search strategies utilized.

Volume II ~~- Abstract Data Base -~~ contains the ACE Data Base arranged into eleven areas of R&D effort as follows:

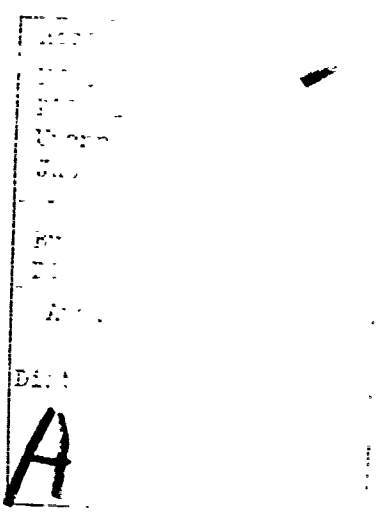
- Fuels —
  - Synthetic;
  - Liquid Hydrogen;
  - Other;
- Propulsion —
  - Gas Turbine;
  - Nuclear;
  - Advanced;
- Aerodynamics;
- Structures and Materials;
- Flight Performance Management;
- Advanced & Unconventional Systems; and
- Energy Efficient Operation.

# APPENDIX B
# ABSTRACT DATA BASE

B.1 FUELS TECHNOLOGY

B.1.1 SYNTHETIC FUELS

B.1.1.1 NAVY FUNDED



B.1.1.1.1 74A39738# May 1974
U.S. Naval Air Propulsion Test Center, Trenton, N.J.
Maggitti, L. Jr.
Title: Development of Alternate Sources of JP-5 Fuel - Domestic Nonpetroleum Resources

ABSTRACT

An investigation was conducted to explore the possibilities for obtaining a JP-5 type fuel for naval aircraft from nonpetroleum materials available in sufficient quantities in the U.S. Questions of Navy fuel usage are considered along with gas turbine engine fuel consumption trends. Attention is given to the possibility to obtain the jet fuel from oil shale and from coal. (Paper: National Conference on Environmental Effects on Aircraft and Propulsion Systems, 11th, Trenton, N.J., May 21-23, 1974, Proceedings.)

.....

B.1.1.1.2 79N14235# Jun 1978
Naval Air Systems Command, Washington, D.C.
Unknown
Title: Naval Air Systems Command - Naval Research Laboratory Workshop on Basic Research Needs for Synthetic Hdrocarbon Jet Aircraft Fuels

ABSTRACT

The workshop emphasized the technical aspects of synthetic jet fuels. The purpose was to examine what is known about synfuels, highlight current research programs, and suggest areas of basic research which are important to the future use of synthetic hydrocarbon fuels in jet aircraft.

.....

B.1.1.1.3 AD-A022 081 Jan 75
Tetra Tech Inc. Arlington, Va.
Tomlinson, Glen
Title: Summary of NATO Synthetic Fuel Alternatives

ABSTRACT

NATO countries have been forced to consider such alternative fossil fuel sources as coal, oil shale, and tar sands for their military forces. It presents a problem of technology how to realize and use effectively the synthetic product of these deposits. The military forces of NATO are particularly interested in the development of other sources and production methods for liquid fossil fuels. (Point Paper)

.....

B.1.1.1.4 AD-A023 435 Jan 76
Tetra Tech Inc., Arlington, Va.
Tomlinson, Glen
Title: Navy Energy Research and Development Quarterly Report

ABSTRACT

This report includes an overview of the Navy Energy R and D program. Fuel requirements for Naval ships, aircraft and shore installations are summarized. Emphasis is given to alternate sources of energy, synthetic fuels and energy conservation. (Report)

.....

B.1.1.1.5 ZQN-889800 10/77 to 9/83
Naval Air Propulsion Center, 1440 Pkwy. Ave.; Trenton, New Jersey 08628
Nowack, C. J.
Title: Synthetic and Petroleum Fuel Development

ABSTRACT

Conduct a laboratory program that will physically define the meaning of critical fuel properties as pertaining to performance of aircraft component hardware. This work includes tests of components with various fuels; studies of the effects of refining procedures on fuel properties; and tests of fuel properties that impact on aircraft fuel storage and use. (Plan)

.....

B.1.1.1.6 GQN-890105 5/78 to 8/79
Catholic University of America, School of Engineering and Architecture, 620 Michigan Ave., N.E., Washington, D.C. 20017
Moynihan, C. T.
Title: Hydrocarbon Low Temperature Viscosity

ABSTRACT

One problem with the jet fuels derived from alternative energy sources such as shale oil and coal is expected to be the deleterious effect of an N-alkane content higher than present from petroleum sources. This program will study the freezing point and viscosity behavior at low temperature of mixtures of kerosene jet fuel hydrocarbon mixtures as a function of temperature and composition. (Plan)

.....

B.1.1.1.7 79C0130973 1978
Naval Research Lab., Washington, D.C.
Hazlett, R.N.
Title: Properties and Composition of Jet Fuels Derived From Alternate Energy Sources. Part I. Background and N-Alkane Content

ABSTRACT

The critical properties of jet fuel JP-5 are described and compared with fuels made from oil shale, tar sands, and coal, whose critical properties are heat of combustion, freezing point/flash point, combustion properties, stability, and N-Alkane content. A though synthetic jet fuels can be made, refining processes and processing conditions must be modified. (Paper: Conf. on Composition of Transportation Synfuels: R and D Needs, Strategies and Actions, San Antonio, 11 Oct 78)

.....

B.1.1.1.8 ZQN-580087-5 7/74 to CONT
Naval Research Lab., 4555 Overlook Ave., S.W., Washington, D.C. 20375
Hazlett, R. N.
Title: Evaluation of Synthetic Fuels

ABSTRACT

To determine the basic chemical, physical and flammability properties of jet fuels derived from oil shale, tar sands, coal and heavier petroleum crudes. NRL is performing a comprehensive chemical, physical and flammability program to evaluate the characteristics of jet fuels. The NRL work will emphasize non-specification tests, composition/property relationships, and chemical analyses. Fire suppression techniques for substitute JP-5 will be evaluated in tests up to volumes 300 gallons of fuel. (Plan)

.....

B.1.1.1.9 ZQN-880122-2 10/77 to CONT
Naval Research Lab., 4555 Overlook Ave., S.W.; Washington, D.C. 20375
Hazlett, RM
Title: Chemical Energy Storage

ABSTRACT

The purpose of this research is to determine how N-Alkanes in the jet fuel range are formed in the thermal processes used to produce liquid fuels from shale oil, coal and tar sands. A further objective is to suggest variations of thermal processes or refining procedures which will result in a lower concentration of N-Alkanes, thus relieving the jet fuel freezing point problem. (Plan)

.....

B.1.1.1.10 GQN-890054-1 1/78 to 4/79
Exxon Research and Engineering Co., 1600 Linden Ave., Linden, New Jersey 07036
Frankenfeld, JW
Title: Alternate Fuels Nitrogen Chemistry

ABSTRACT

The objective of the program is to find the effect of the presence of nitrogen compounds in shale-derived alternate jet fuels on the storage stability of the fuel. (Plan)

.....

B.1.1.1.11 AD-A039 977/4ST Dec 69-Nov 76
Exxon Research and Engineering Co., Linden, NJ Government Research Lab (391338)
Taylor, William F.
Title: Development of High Stability Fuel. Executive Summary

ABSTRACT

Executive Summary of the work done on the Development of High Stability Fuel program which was carried out by the Government Research Laboratories of Exxon Research and Engineering Company for the Department of the Navy. The overall program consisted of an initial analytical study entitled, "Investigation and Analysis of Advanced Hydrocarbon Fluids," followed by an experimental effort entitled "Development of High Stability Fuel."

.....

B.1.1.1.12 79A12979 1977
Exxon Research and Engineering Co., Linden, NJ
Blazowski, WS
Title: Future Fuels in Gas Turbine Engines

ABSTRACT

Review of potential combustion problems of future synthetic fuels in gas turbine engines. Specifications, availability, cost, aircraft performance, and safety considered. (Paper :SQUID Workshop, Columbia, MD Sep 7-9, 1977)

.....

B.1.1.1.13 AD-A041 980/4ST Jun 77
Acurex Corp Mountain View Calif Aerotherm Div
Cohen, LM
Title: Alternate Petroleum Based Fuels for Naval Fleet Usage: Potential Availability, Cost, and System Impact

ABSTRACT

Study to determine whether there exists a large supply of fuel beyond that currently being procured for the Navy, which meets, or nearly meets, military specifications; determine whether any such comparable nonspecification fuel is less expensive than the currently approved product; and assess, using all available information, the viability of storing, handling, and burning comparable specification fuels in Naval systems, even if only on a limited basis. (Final Report)

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B.1.1.1.14 ZQN-796812 4/74 to 9/83
Naval Air Propulsion Center, 1440 Pkwy. Ave., Trenton, New Jersey 08628
Nowack C. F.
Title: Development of Alternate Sources of JP-5 Fuel

ABSTRACT

Obtain samples of JP-5 type fuels derived from coal, oil shale and tar sands and establish their properties, chemical and physical characteristics, and evaluate engine and component performance relative to petroleum JP-5 fuel. Establish relationships between synthetic fuel deficiencies and chemical composition of the fuel. (Plan)

.....

B.1.1.1.15 SSIE NO.: ZQN889801 1 10/77 to 9/83
Navy Naval air Propulsion Test Center, Fuels, Lubes and Power Dr Sys Gp, Trenton, New Jersey, 08628
Nowack, CJ
Title: Thermal Stability of Hydrocarbon Fuels

ABSTRACT

To determine the relationship between fuel properties and thermal stability of synthetic and petroleum jet fuels. Perform thermal degradation tests of fuel samples with controlled chemical composition using the jet fuel specification test procedure as well as actual aircraft hardware. Correlate the stability of the fuels with the chemical composition. (Plan)

.....

B.1.1.1.16 AD-A:061 050/1ST Oct 78
Purdue Univ Lafayette IN. Project Squid Headquarters
Bowman, Craig T.
Title: Alternative Hydrocarbon Fuels' Combustion and Chemical Kinetics

ABSTRACT

Alternative Fuel Availability and Anticipated Combustion Problems; Critical Processes in Combustion of Alternative Fuels; Pyrolysis and Oxidation Kinetics of Alternative Fuels; Pollutant Emissions Considerations for Fuel Combustion; and Summary and Conclusions. (Paper: Project SQUID Workshop, 7-9 Sep 77, Loyola College Conference Center, Columbia, MD)

.....

B.1.1.1.17 SSIE NO.: GQN975359 1979
Stanford University, School of Engineering, Dept. of Mechanical Engineering, Stanford, California, 94305
Bowman C. T.
Title: Combustion and Pollutant Emissions Characteristics of Coal-Derived Liquid Fuels

ABSTRACT

Research to investigate and measure key combustion and pollutant emission characteristics of hydrocarbon fuels representative of coal-derived liquid fuels. (Plan)

... .....

B.1.1.1.18 ZQN-880092-2 10/77 to N/A
Naval Research Lab. 4555 Overlook Ave. S.W., Washington, D.C.
Neihof R. A.
Title: Microbial Deteriotation of Synfuels

ABSTRACT

To assess the susceptibility of jet fuels derived from oil shale, tar sands and coal to infestation and deterioration by microorganisms. To identify fuel constituents contributing to microbial growth promotion and to examine ways of preventing such growt (Plan)

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B.1 FUELS TECHNOLOGY

B.1.1 SYNTHETIC FUELS

B.1.1.2 NON NAVY FUNDED

B.1.1.2.1 74A35496 June 1974
Unknown
Masefield, P.
Title: Fuel State - Expensive

ABSTRACT

There are real possibilities in the use of liquid hydrogen, although many problems remain, not least those of ground handling. Moreover, production of liquid hydrogen at present requires fossil fuels as the energy source. The whole purpose of using liquid hydrogen can be served only by the development of manufacturing cycles based on the use of nuclear, geothermal, tidal, solar, or hydroelectric power. To convert a petroleum-operating air-transport economy to a liquid-hydrogen operated air-transport economy would be vastly expensive. One other attractive nonfossil fuel would appear to be ethanol, which can be produced by solar energy from fermented cereal grain. It is not anticipated that oil supplies will run short in this century, and coal is even more plentiful. (Paper: Flight International, vol. 105, June 27, 1974)

.....

B.1.1.2.2 AIAA-80-0896 May 1980
NASA, Lewis Research Center, Cleveland, Ohio
Grobman, J.
Title: The Impact of Fuels on Aircraft Technology Through The Year 2000,

ABSTRACT

Broadening fuel properties could penalize the performance, durability, and reliability of the propulsion system unless actions are taken to develop the technology required to use broader property fuels. This paper describes research being conducted to (1) determine the potential range of properties for future jet fuels, (2) establish a data base of fuel property effects on propulsion system components, (3) evolve and evaluate advanced component technology that would permit the use of broader property fuels and (4) identify technical and economic trade-offs within the overall fuel production-air transportation system associated with variations in fuel properties. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000" May 6 - 8 1980, Baltimore, MD)

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B.1.1.2.3 AIAA: 80-0914 May 1980
NASA, Lewis Research Center, Cleveland, Ohio 44135
Weber, R.
Title: Aeropropulsion in Year 2000

ABSTRACT

Many advances can be anticipated in propulsion systems for aircraft in the next 20 years. This paper presents a sampling of probable future engine types such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports. This is followed by a brief review of related technology improvements in propellers, materials, noise suppression, etc. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8 1980, Baltimore, MD)

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B.1.1.2.4 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the Forum, Detroit, Michigan, October 15, 1975)

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B.1.1.2.5 79N33336 Nov 1978
Unknown
Taylor, W. F.
Title: Jet Fuel Thermal Stability

ABSTRACT

The thermal stability problem associated with the use of broadened-specification and nonpetroleum-derived turbine fuels are addressed. The state of the art is reviewed and the status of the research being conducted at various laboratories is presented. It is concluded that significant additional effort is required to cope with the fuel stability problems which will be associated with the potentially poorer quality fuels of the future such as broadened specification petroleum fuels or fuels produced from synthetic sources. (Proceedings: NASA Workshop, Cleveland, 1-2 Nov 1978)

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B.1.1.2.6 79A31908 Dec 1978
Royal Aeronautical Society and American Institute of Aeronautics and Astronautics
UNK
Title: Energy and Aerospace: Proceedings of the Anglo/American Conference, London, England, December 5 - 7, 1978

ABSTRACT

The energy research and development program of the U.S. is considered along with aspects of energy research and development on the basis of a UK view, prospects for reducing the fuel consumption of civil aircraft, the NASA aircraft energy efficiency program, aviation fuel from coal, commercial transports in the 1980s. (Conference Proceedings)

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B.1.1.2.7 78A35893 Jun 1977
Societe Nationale Industrielle Aerospatiale, Toulouse, France
Cormery, G.
Title: Supersonic Transport in Terms of Energy Savings

ABSTRACT

The utilization of petroleum-based fuel for civil aviation is considered within the framework of total energy consumption. Attention is given to developments in the United States and France, both currently and over the near-term future (through the 1980s). Various improvements in

engine and aerodynamic design are discussed, including use of composite materials, supercritical wings, high bypass engines, and improved engine geometries. (Paper: L°Aeronautique et l°Astronautique, no. 69, 1978, In French)

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B.1.1.2.8 79N13192# Oct 1978
Advisory Group for Aerospace Research and Development, Paris (France)
UNK
Title: Aircraft Engine Future Fuels and Energy Conservation

ABSTRACT

Current and forecasted world energy demands, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs. The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal, oil shale, and tar sands) and techniques for reducing energy consumption in refining processes are examined. Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems. An assessment is made as to what technology advancements are currently underway and what other advancements are needed with reference to engine components, engine systems, aircraft designs and operational procedures to help conserve fuel resources. (AGARD lectures in Munich and London, Oct 1978)

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B.1.1.2.9 75A36719 May 1975
Cranfield Institute of Technology, Cranfield, Beds., England
Goodger, E.M.
Title: Alternative Fuels for Aviation

ABSTRACT

Overall characteristics of alternative fuels, proposed to meet the desired technological improvements are discussed, together with the feasibility of using these possible replacements for petroleum products in the aviation industry. Low and high density fuels, hydride fuels, carbon containing fuels, vaporising fuels, aromatic mixtures, liquid methane, liquid hydrogen, nitrogen hydrides, alcohols, nuclear fuels, and various mixtures are analyzed for their performance, levels of volumetric and combined gravimetric energy densities, handling safety, pollution, thermal stability and capacity, and availability. (Paper in Aeronautical Journal, vol. 79, May 1975)

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B.1.1.2.10 78N11074*# Oct 1977
NASA, Lewis Research Center, Cleveland, Ohio
Grobman, J.S.
Title: Alternative Fuels

ABSTRACT

Potential problems related to the use of alternative aviation turbine fuels are discussed and both ongoing and required research into these fuels is described. This discussion is limited to aviation turbine fuels composed of liquid hydrocarbons. (Paper: Aircraft Eng. Emissions)

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B.1.1.2.11 78A23420# Feb 1978
Lockheed California Co., Burbank, CA
Hawkins, W.M.
Title: Where Aerospace Can Serve Afresh - Paths to Energy Independence

ABSTRACT

Feasibility of developing new energy technologies. Among the new technologies proposed are: using fusion explosions to generate superheated steam, nuclear-based conversion of seawater to hydrogen, methane production from plants and waste, ocean thermal energy conversion, and coal gasification. (Paper in Astronautics and Aeronautics, vol. 16, Feb 1978)

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B.1.1.2.12 AD-A080 748 Mar 78-Oct 79
Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH
Henderson, Robert E.
Title: Turbopropulsion Combustion Technology Assessment

ABSTRACT

General overview of the state-of-combustion-technology today; some general projections and trends for the future. State-of-the-art review of the five special areas of interest covered during the assessment -- main burners, afterburners, combustion modeling, structural and mechanical design, and alternative fuels. Advanced technology trends and projected technology needs. A five-year technology plan is outlined. (Summary Report)

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B.1.1.2.13 AD-A067 709/6ST Jun-Nov 76
Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH
Jackson, Thomas A.
Title: Fuel Hydrogen Content as an Indicator of Radiative Heat Transfer in an Aircraft Gas Turbine Combustor

ABSTRACT

Eleven fuels representing a wide range of hydrogen content were studied using a T56 single can combustor rig. Test fuels included single and double ring aromatic types as well as paraffins blended with each other and with JP-4. Fuel mixtures with hydrogen contents ranging from 9.9 to 15.9 per cent by weight were examined. (Final Report)

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B.1.1.2.14 76A24265 Mar 1976
Deutsche Forschungs- und Versuchsanstalt fuer Luft und Raumfahrt, Institut fuer Flugtreib- und Schmierstoffe, Munich, West Germany
Jantzen, E.
Title: Aviation Fuels and Lubricants -- Review

ABSTRACT

Review of investigations concerned with the availability of currently used aviation fuels and possibilities for their replacement. The use of liquid hydrogen as fuel appears, in principle, to be feasible. A number of difficulties have to be overcome. An intermediate employment of liquid methane is considered. Attention also given to studies regarding the use of synthetic hydrocarbons obtained from coal or oil shale products. (Article in VDI-Z, vol. 118, no. 5, Mar 1976, in German)

.....

B.1.1.2.15 75A44769# Mar 1974
Union Carbide Corp., New York, NY
Johnson, J E.
Title: An Economic Perspective on Hydrogen Fuel

ABSTRACT

Economic aspects of the production of different energy carriers are reviewed. Synthetic kerosene, hydrogen, methane, ammonia, and methanol are considered major factors. Discussed: (1) the capital investment required to convert fuel to energy; and (2) the total resources consumed

in accomplishing a given task efficiently. (Paper in Hydrogen Energy; Proceedings of the Hydrogen Economy Miami Energy Conference, Miami Beach, FL March 18-20, 1974, Part A)

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B.1.1.2.16 79N13193# Sep 1978
Imperial Coll. of Science and Technology, London, England, Dept. of Mechanical Engineering
Macfarlane, J.J.
Title: Future Fuels for Aviation

ABSTRACT

Background of the current aviation gas turbine fuel specification is described. The prospects for petroleum based aviation fuel are evaluated. The long term sources of aviation fuel are described and the problem areas enumerated. The need for a research program on alternative fuels is demonstrated. Potential contribution of fundamental research in the alternative aviation fuels program is outlined. (Paper: in AGARD Aircraft Eng. Future Fuels and Energy Conserv.)

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B.1.1.2.17 79A49376 Jun 1978
Unknown
Newman, M.
Title: Utilization of Alternative Fuels for Transportation; Proceedings of the Symposium, University of Santa Clara, Santa Clara, CA, June 19-23, 1978)

ABSTRACT

Overview of alternative fuel development deals with such issues as energy supply and fuel manufacturing/processing and storage and distribution. Attention is given to fuels for vehicles and aircraft. (Paper in Symposium sponsored by the U.S. Department of Energy New York, American Insitute of Aeronautics and Astronautics, Inc.)

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B.1.1.2.18 75N16980 1974
Pinkel, I. Irving, Fairview Park, Ohio
Pinkel, I.I.
Title: Alternative Fuels for Aviation

ABSTRACT

The status of energy programs to provide hydrocarbon fuels from new sources is examined. Experience in the United States with non-hydrocarbon fuels for turbine powered aircraft is analyzed. The various alternate sources of hydrocarbon fuels are defined. The use of metals and metal slurries as turbine fuels is proposed. The advantages and disadvantages of liquid hydrogen as an aircraft fuel are discussed. A specific example of an aircraft operating on liquid hydrogen is described. (Paper in AGARD The 1974 AGARD Ann. Meeting)

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B.1.1.2.19 AD-A042 272 Apr 75-Sep 76
Institute for Defense Analyses, Arlington, VA, Science and Technology Div.
Riddell, F.R.
Title: DoD Energy R and D. Part II. Military Fuel Options. Performance and R and D Implications

ABSTRACT

Questions addressed and conclusions reached in study are: (1) What range of multifuel capability may be desirable in military engines to relieve possible fuel supply problems. Conclusion is that it would be advantageous for military aircraft to be able to use all types of jet fuels. (2) What liquid hydrocarbon fuel options may be considered without incurring major performance degradation or severe maintenance problems. The conclusion is that with appropriate modifications to fuel supply and starting systems, the range of fuels defined in (1) could be used. However, R and D is needed. Fuels from syncrudes should be included in this R and D work. (Final Report)

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B.1.1.2.20 78N24369*# Oct 1978
NASA, Lewis Research Center, Cleveland, Ohio
Rudey, R. A.
Title: Impact of Future Fuel Properties on Aircraft Engines and Fuel Systems

ABSTRACT

Paper describes and discusses the propulsion system problems that will most likely be encountered if the specifications of hydrocarbon based jet fuels must undergo significant changes in the future and, correspondingly, the advances in technology that will be required to minimize the adverse impact of these problems. (Paper: Lecture Ser. 96, Paris, Munich, and London 12-20 Oct. 1978; sponsored by AGARD)

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B.1.1.2.21 78A31308# Oct 1977
Imperial Oil Enterprises, Ltd., Sarnia, Ontario, Canada
Rupar, C. B.
Title: Aviation Fuels - A Supplier's Perspective

ABSTRACT

Current availability of aviation kerosene is limited by the freeze point, flash point and aromatics content. In the future these constraints will become more critical as increasing volumes of synthetic liquids are produced to supplement natural petroleum. Ideally, to maximize security of supply and to control cost the next generation of aircraft should be designed to operate safely and efficiently on fuels with a wider range of properties. (Paper: Canada Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977, Proceedings.)

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B.1.1.2.22 N79-33205/2 Aug 79
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Taylor, J. R.
Title: Analytical Evaluation of the Impact of Broad Specification Fuels on High Bypass Turbofan Engine Combustors

ABSTRACT

Six conceptual combustor designs for the CF6-50 high bypass turbofan engine and six conceptual combustor designs for the NASA/GE E3 high bypass turbofan engine were analyzed to provide an assessment of the major problems anticipated in using broad specification fuels. Designs were

analyzed to estimate combustor performance, durability, and pollutant emissions when using commercial Jet A aviation fuel and when using experimental referee board specification fuel. Results indicate that lean burning, low emissions double annular combustor concepts can accommodate a wide range of fuel properties without a serious deterioration of performance or durability. However, rich burning, single annular concepts would be les tolerant to a relaxation of fuel properties. (Final Report)

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B.1.1.2.23 79A19687# Jan 1979
Avco Corp., Avco Lycoming Div., Stratford, Conn., Purdue University, West Lafayette, Ind.
Schmidt, D. A.
Title: A Characteristic Time Correlation for Combustion Inefficiency from alternative Fuels

ABSTRACT

Gas turbine engines in helicopters should be capable of at least emergency service with any fuel. Long term operation of aircraft will involve alternative fuels from non petroleum sources. Non aviation specification fuels, however, affect engine performance and in particular combustion efficiency. A characteristic time model correlation is examined with fuels representative of future alternatives with emphasis on viscosity and volatility effects upon efficiency. Progress made to date with inclusion of heterogeneous effects in characteristic time correlations is detailed, and further requisite research is suggested. (Paper: American Institute of Aeronautics and Astronatuics, Aerospace Sciences Meeting, 17th, New Orleans, La., Jan. 15-17, 1979, Army sponsored research.)

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B.1.1.2.24 77A36434 Apr 1977
ERDA, Washington D.C.
Seamans, R. C., Jr.
Title: Energy and Aerospace (Sixty-fifth Wilbur and Orville Wright Memorial Lecture) Aerospace Contributions to Energy Conservation

ABSTRACT

Some ways that aerospace science can contribute to conserving or obtaining energy are discussed. Developments leading to increased fuel efficiency and the possibility of using alternative fuels for aviation are considered, as is the use of fuel-efficient, lighter-than-air vehicles for transporting heavy cargo. (Paper: Aeronautical Journal, Vol 81, Apr,

1977.)

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B.1.1.2.25 77N15212# Sept 1976
Committee on Aeronautical and Space Sciences (U.S. Senate)
Unknown
Title: Alternative Fuels For Aviation

ABSTRACT

Research and progress in the developments of alternative fuels for aviation are discussed. The impact of using nonoptimum synthetic hydrocarbon based fuels on aeronautical structures and the cost of commercial airfares is explored. (Paper: GPO Hearings before Subcomm. on Aerospace Technol. and Natl. Needs of Comm. on Aeronaut, and Space Sci., 94th Congr., 2d Sess., 27-28 Sep. 1976.)

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B.1.1.2.26 EI790314064 Sep 1978
Boeing Commercial Aircraft Co., Seattle, Wash
Miller, M. P.
Title: Transportation and The U.S. Petroleum Resource: An Aviation Perspective

ABSTRACT

This paper provides an overview of several facets of commercial aviation fuel consumption: the merits of its public services, the conservation measures taken to date, the consequences of future shortages, energy conservation strategies, modal efficiency comparisons, and alternate fuels considerations. (Paper: J Energy V 2 N 5 Sep-Oct 1978.)

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B.1.1.2.27 78N29063*# 1978
NASA, Langley Research Center, Langley Station, Va
Witcofski, R. D.
Title: Progress on Coal Derived Fuels For Aviation Systems

ABSTRACT

The results of engineering studies of coal derived aviation fuels and their potential application to the air transportation system are presented. Synthetic aviation kerosene (SYN. JET-A), liquid methane (LCH4), and liquid hydrogen (LH2) appear to be the most promising coal derived fuels. Aircraft configurations fueled with LH2, their fuel

systems, and their ground requirements at the airport are identified. Energy efficiency, transportation hazards, and costs are among the factors considered. It is indicated that LCH4 is the most energy efficient to produce, and provides the most efficient utilization of coal resources and the least expensive ticket as well. (Paper: CTOL Transport Technol., 1978.)

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B.1.1.2.28 N76-29218*# 24 May 1976
NASA, Langley Research Center, Langley Station, Va.
Schrader, Owen E.
Title: Application of Advanced Technology to Future Long Range Aircraft

ABSTRACT

Assessment of three separate programs that have incorporated advanced technology into the design of long range aircraft. The first centers around the use of a span loaded cargo aircraft with the payload distributed along the wing. The second is the application of laminar flow control to the aircraft to reduce the aerodynamic drag. The last program evaluates the production of alternate aircraft fuels from coal and the use of liquid hydrogen as an aircraft fuel. (Paper: 35th Ann. Conf. of the Soc. of Allied Weight Engr. Inc., Philadelphia, 24-26 May 1976)

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B.1.1.2.29 77A47271# Sept 1977
Rand Corp., Washington, D.C.
Mikolowsky, W. T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

Study evaluating very large airplanes (VLA's) in the context of the most attractive alternative fuel for these airplanes. The chemical fuel alternatives considered are liquid hydrogen, liquid methane, and synthetic JP, each of which can be readily synthesized from coal. The nuclear fueled VLA was a fourth candidate aircraft. Concluded that overall conventional hydrocarbon jet fuel remains the most attractive fuel for military aircraft. Nuclear propulsion is attractive only for station keeping missions requiring large station radii. (Paper: Astronautics and Aeronautics, Vol 15, Sept 1977)

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B.1.1.2.30 77N33154# Dec 1976
Rand Corp., Santa Monica, Calif.
Mikolowsky, W. T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels: Executive Summary

ABSTRACT

This report summarizes the military utility of very large airplanes (over 1 million pounds gross weight) and examines several alternative fuels that could be used by such airplanes. (Exec Summary Report)

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B.1.1.2.31 76A45397# Sept 1976
Rand Corp., Washington, D.C.
Mikolowsky, W. T.
Title: An Evaluation of Very Large Airplanees and Alternative Fuels

ABSTRACT

The paper examines the potential of very large airplanes (VLA) in the context of Air Force missions. Synthetic jet fuel, liquid methane, liquid hydrogen, and nuclear propulsion are the fuel alternatives selected for detailed analysis. It is shown that for most military applications, VLA with gross weight exceeding one million pounds promise to be superior to contemporary vehicles in terms of cost and energy effectiveness. The conventional jet fuel (made from coal, oil shale or crude oil) appears to be the most effective at least up to year 2000. Nuclear propulsion is attractive only for station keeping missions requiring larger station radii (greater than about 4000 nautical miles). (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Dallas, Tex., Sept 27-29, 1976)

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B.1.1.2.32 SSIE: GQF 35480 7 6//2 to 7/80
University of Southern California, School of Engineering, Dept. of Mechanical Engineering, 3551 University Ave., Los Angeles, California, 90007
Choudhury, P. R.
Title: Turbulent Vortex Flame Stability and Spreading With Gas Jets and Spray Control Homogeneous Ignition of Fuel-Air Explosions

ABSTRACT

Provide additional understanding and realistic analytical modeling of the transient and steady-state behavior of turbulent reactive flow fields and of spontaneous reactive additives on programmed homogeneous ignition in Vortex combustion and fuel air clouds, and will contribute to establishing realistic guidelines for developing efficient, stable advanced air breathing combustors and determining the feasibility of possible new single event fuel air explosive devices, and in the application of broad range alternative fuels such as those derived from shale and coal. (Plan)

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B.1.1.2.33 78A43358*# July 1978
NASA, Langley Research Center, Langley Station, Va
Conner, D. W.
Title: CTOL Concepts and Technology Development

ABSTRACT

Various developments in the Aircraft Energy Efficiency (ACEE) program are discussed. Terminal area operations are considered with emphasis on the Terminal Configured Vehicle program. Consideration is also given to aircraft systems studies and economics (including noise reduction programs), coal derived fuels for aviation systems (including LH2 fueled aircraft), and transport aircraft concepts (including laminar flow control). (Paper: Astronautics and Aeronautics, Vol 16, July-Aug 1978)

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B.1.1.2.34 79A12376 Oct 1977
Western Michigan University, Kalamazoo, Mich.
Behm, H. D.
Title: National Conference on Energy Conservation in General Aviation, 1st, Kalamazoo, Mich, October 10, 11, 1977, Proceedings

ABSTRACT

Topics discussed include alternative aviation turbine fuels, economy in flight operations, and efficiency through angle of attack monitoring. (Proceedings)

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B.1.1.2.35 N78-13056/4ST Sep 77
NASA, Lewis Research Center, Cleveland, Ohio
Butze, H. F.
Title: Effect of Fuel Properties on Performance of Single Aircraft Turbojet Combustor at Simulated Idle, Cruise, and Takeoff Conditions

ABSTRACT

The performance of a single can JT8D combustor was investigated with a number of fuels exhibiting wide variations in chemical composition and volatility. Performance parameters investigated were combustion efficiency, emissions of CO, unburned hydrocarbons and nitrogen oxides, as well as liner temperatues and smoke. The most pronounced effects of changes in fuel composition were observed at simulated cruise and takeofff conditions, where smoke and liner temperatures increased significantly as the hydrogen content of the fuel decreased. At the simulated idle condition, emissions of CO and unburned hydrocarbons increased slightly and, accordingly, combustion efficiencies decreased slightly as the hydrogen content of the fuels decreased. (Report)

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B.1.1.2.36 79A49381# Jun 1978
Pan American World Airways, Inc., New York, N.Y.
Borger, J. G.
Title: Alternative Fuels In Aviation

ABSTRACT

The state of the art and expected future advances of alternative fuels in aviation are discussed. Consideration is given to uses of liquid hydrogen and methane, broadening of turbine fuel specifications, increased aromatics, decreased flashpoint, increased freeze point, thermal stability, synthetic fuels, and the refinery process. It is noted that major fuel efficiency improvements resulting from the NASA ACEE program probably will not appear before the late 1980s. (Paper: Utilization of Alternative Fuels for Transportation; Proceedings of the Symposium, Santa Clara, Calif, June 19-23, 1978.)

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B.1.1.2.37 AD-A060 322 Jan 75 Aug 77
Dayton Univ Ohio Research Inst
Berner, William E.
Title: Behavior of Nonmetallic Materials in Shale Oil Derived Jet Fuels and in High Aromatic and High Sulfur Petroleum Fuels

ABSTRACT

The increased pressure on decreasing fuel supplies has prompted the Air Force to examine fuels previously considered unacceptable. Fuels derived from shale oil and fuels high in sulfur and mercaptan sulfur were among those considered unacceptable. The objective of this program was to evaluate nonmetallic aircraft materials relative to increased levels of aromatics, sulfur, and mercaptan sulfur. Aircraft materials that are normally in contact or exposed to fuels were evaluated in ten fuel formulations. (Final Report)

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B.1.1.2.38 79N13194 Unknown
Shell Research Ltd., Chester (England)
Lewis, A.
Title: Future Aviation Fuels - Fuel Suppliers Views

ABSTRACT

Developments in the potential future availability of aviation fuels from petroleum crude oils, shale oils, and coal are reviewed on the basis of published data. Much of the data were derived from statistics of the Organization for Economic Cooperation and Development and the Workshop on Alternative Energy Strategies. (Article: AGARD Aircraft Eng. Future Fuels and Energy Conserv.)

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B.1.1.2.39 78A15021 1977
ONERA, Chatillon-sous-Bagneaux, Hauts-de-Seine, France
Barrere, M.
Title: Future fuels for Aviation

ABSTRACT

Review of global energy consumption. Fuel characteristics discussed noting physical and chemical effects on engine operation. Suggestions made regarding development of new fuel sources such as the potential combination of oil-derived and synthetic fuels, and the creation of wholly synthetic fuels, perhaps based on methane and hydrogen. (Paper in

L'Aeronautique et L'Astronautique, No. 661977)(in French)

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B.1.1.2.40 76N19295# Jan 1976
Pinkel, I. Irving, Consultant, Fairview Park, Ohio
Pinkel, I. 1.
Title: Future Fuels for Aviation

ABSTRACT

The fuel supply outlook within the NATO nations is considered. Hydrocarbon fuels, alternate fuels as well as specification changes for fuels and changes in aircraft design and operation are discussed. Recommendations for future programs are included.

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B.1.1.2.41 AD-A055 024/4ST Jun 78
Defense Intelligence Agency, Washington, DC
Busi, James D.
Title: Hydrogen Technology - Foreign

ABSTRACT

Survey of hydrogen and synthetic fuel technology research in foreign countries (Western and Communist) (Report)

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B.1.1.2.42 77A23718 Unknown
NASA, Langley Research Center, Langley Station, VA
Witcofski, R.D.
Title: The Thermal Efficiency and Cost of Producing Hydrogen and Other Synthetic Aircraft Fuels from Coal

ABSTRACT

A comparison is made of the cost and thermal efficiency of producing liquid hydrogen, liquid methane and synthetic aviation kerosene from coal. These results are combined with estimates of the cost and energy losses associated with transporting, storing, and transferring the fuels to aircraft. The results of hydrogen-fueled and kerosene-fueled aircraft performance studies are utilized to compare the economic viability and efficiency of coal resource utilization of synthetic aviation fuels. (Paper: Energy Research and Development Administration, World Hydrogen Energy Conference, 1st, Miami Beach, Florida, Mar 1-3, 1976)

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B.1.1.2.43 AD-A060 477/7st Sep 78
Advisory Group for Aerospace Research and Development, Neuilly-sur-Seine, France
Unknown
Title: Aircraft Engine Future Fuels and Energy Conservation

ABSTRACT

Survey/forecast of aviation fuel types, sources, world usage, NATO needs, refining processes, chemistry, combustion, and effect on engines. Includes future hydrocarbon fuels (coal, oil shale, and tar sand derived). (Lecture Series)

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B.1.1.2.44 SSIE No.: GQF 49360 3 6/77 to 10/79
Louisiana State University, Agricultural and Mechanical College School of Engineering, Dept. of Mechanical Engineering, University Station, Baton Rouge, Louisiana, 70803
Matula, R.A.
Title: Combustion Kinetics of Selected Aromatic Hydrocarbons

ABSTRACT

This research will study experimentally and analytically the mechanisms and rate constraints of high temperature thermal decomposition and oxidation of prototypical hydrocarbon components of alternate fuels. The results of this work will be used to optimize the performance and minimize smoke formation in jet combustors. (Plan)

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B.1.1.2.45 77N14271 Feb 76
RAND Corp., Santa Monica, CA
Stanley, W.L.
Title: Some Cost, Energy, Environmental, and Resource Implications of Synthetic Fuels Produced from Coal for Military Aircraft

ABSTRACT

This paper examines the most promising energy resource alternative to crude oil and the most attractive aviation fuels derivable from the resource alternatives, with emphasis on coal-based aviation fuels. The findings suggest that coal and oil shale are the most promising energy

resource alternatives. A synthetic jet fuel similar to jet fuels in use today appears to be the most attractive aviation fuel derivable from coal, primarily because its production requires lower energy expenditures and results in a less costly fuel product than the other two major alternatives, liquid hydrogen and liquid methane. (Report)

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B.1.1.2.46 SSIE: GQF 46870 2 1/77 to 1/81
Aerochem Research Lab. Inc., P.O. Box 12, Princeton, New Jersey 0[illegible] 0
Calcote, [illegible].
Title: Ionic Mechanisms of Carbon Formation in Flames

ABSTRACT

Study in progress will develop models of soot formation in air-breathing engines not now available, using conventional hydrocarbon and synthetic fuels derived from coal, shale oil, and sand tars. (Plan)

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B.1.1.2.47 AD-A039 597/OST Dec 76
RAND Corp., Santa Monica, CA
Gebman, J.R.
Title: The Potential Role of Technological Modifications and Alternative Fuels in Alleviating Air Force Energy Problems

ABSTRACT

This report examines short- and long-term measures to reduce the consumption of petroleum jet fuels by the Air Force. Engine retrofits and aerodynamic modifications to existing aircraft can save significant quantities of jet fuel. Synthetic JP fuels derived from oil shale or coal appear to be most attractive. (Report)

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B.1.1.2.48 SSIE: GQF-462710-1 1/79 to 5/81
Suntech Inc., Box 1135, Marcus Hook, PA 19061
Schneider, A.
Title: A Program Leading to Specifications for Aviation Turbine Fuel Produced from Whole Crude Shale Oil

ABSTRACT

The objectives of this program are - (1) To optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel. (2) To determine the trade-offs between jet fuel yield, jet fuel properties and processing costs. (Plan)

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B.1.1.2.49 SSIE: ZQF-462070-2 5/77 to 12/81
U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., Wright Patterson A.F.
B., Dayton, Ohio 45433
Hayes, P.C.
Title: Fuel Evaluation and Development

ABSTRACT

State-of-the-art laboratory techniques will be used for characterizing synthetic fuels as well as distillate fuels produced from petroleum, coal, and shale oil. Evaluation techniques for characterizing fuels will be developed or improved as needed. Selected materials will be characterized and submitted to other organizations for testing. (Plan)

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B.1.1.2.50 SSIE: GQF-456950-3 6/74 to N/A
Exxon Research and Engineering Co., 1600 Linden Ave., Linden, NJ 07036
Shaw, H.
Title: Evaluation of Methods to Produce Aviation Turbine Fuels from Synthetic Crude Oils

ABSTRACT

The objective of Phase I is to determine which raw materials and processes will provide refinery feedstocks most amenable to production of finished aviation turbine fuel. Raw materials will include coal and oil shale and their individual sources. The objective of Phase II is to provide an experimental base in support of production of aviation turbine fuel from synthetic crude oil. Phase III will provide an overall

assessment of material, equipment and processing requirements for producing the high yields of aviation turbine fuels from coal and oil shale. (Plan)

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B.1.1.2.51 SSIE: CQF-463880-1 1/79 to 5/81
Signal Co. Inc., 10 U O P Plaza, Des Plaines, Illinois 60016
Braun, A.O.
Title: A Program Leading to Specifications for Aviation Turbine Fuel Produced from Whole Crude Shale Oil

ABSTRACT

Optimize procedures for processing of shale oil into military fuels while maximizing the yield of aviation turbine fuel; determine tradeoffs between jet fuel yield, jet fuel properties, and processing costs. Program includes: (1) Process variable analysis, (2) Analysis of laboratory samples, (3) Production of component test samples, and (4) Overall economic optimization by computer model. (Plan)

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B.1.1.2.52 AD-A053 106/1ST Apr 76 - Apr 77
Exxon Research and Engineering Co., Linden, NJ, Government Research Lab.
Taylor, William F.
Title: Evaluation of Methods to Produce Aviation Turbine Fuels from Synthetic Crude Oils - Phase 3. Volume III

ABSTRACT

An engineering planning study was made of the effect of processing shale oil in a refinery processing both shale oil and petroleum to a full product slate including jet fuel. The results and conclusions of the Phase 1 state-of-the-art assessment and Phase 2 pilot plant experimental study were further investigated. (Final Report)

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B.1.1.2.53 78A20781 Jan 1978
USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio
Churchill, A.V.
Title: Future Aviation Turbine Fuels

ABSTRACT

Discusses an Air Force program which is being conducted to establish the properties of an aviation turbine fuel which will result in adequate costs. Results of recent processing studies on alternative hydrocarbon sources from coal and shale oil are presented, together with combustor studies directed to determining the effects of property variations on combustor performance, durability and level of harmful emissions. Also, results of a recent survey are given showing projected increases in property changes. A projection of the chemical and physical properties of the future Air Force aviation turbine fuel is presented. (Paper: AIAA 16th Aerospace Sciences Meeting, Huntsville, Ala., Jan 16-18, 1978)

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B.1.1.2.54 SSIE: GQA-163627-1 10/78 to CONT
Southwest Research Inst., 8500 Culebra Rd., P.O. Drawer 28510, San Antonio, TX 78228
Wimer, W.W.
Title: High Energy Fuel

ABSTRACT

Fuel-formulation and single-cylinder engine studies are being conducted to determine feasibility of using a carbonaceous fuel system for battlefield use. High-volumetric-energy conventional type liquid fuels and carbon/carrier-fluid pastes and slurries are being examined for energy effectiveness and overall fire safety potential. (Plan)

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B.1.1.2.55 79A25900 Nov 1978
USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio
Angello, L.C.
Title: Shale Oil - The Answer to the Jet Fuel Availability Question

ABSTRACT

Description of Air Force program since 1974 to derive synthetic JP4 fuel. Shale oil compared to coal as source. Combustion studies presented. Future specifications for AF aviation fuel presented. (Paper: SAE Aerospace Meeting, San Diego, Nov 27-30, 1978)

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B.1.1.2.56 N78-24370/6ST 1978
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Rudey, R.A.
Title: Characteristics and Combustion of Future Hydrocarbon Fuels

ABSTRACT

As available petroleum is depleted, the use of synthetic crude oils (those derived from coal and oil shale) may be required. The principal properties of these syncrudes and the fuels that can be derived from them are described. In addition to the changes in the supply of crude oil, increasing competition for middle-distillate fuels may require that specifications be broadened in future fuels. The impact that the resultant potential changes in fuel properties may have on combustion and thermal stability characteristics is illustrated and discussed in terms of ignition, soot formation, carbon deposition flame radiation, and emissions. (Report )

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B.1.1.2.57 79A10824 Apr 1978
MIT, Cambridge, Mass.
Longwell, J.P.
Title: Alternative Aircraft Fuels

ABSTRACT

Assess the suitability of jet fuels made from oil shale and coal and to develop a data base which will allow optimization of future fuel characteristics, taking energy efficiency of manufacture and the tradeoffs in aircraft and engine design into account. The properties of future aviation fuels are examined and proposed solutions to problems of alternative fuels are discussed. Attention is given to the refining of jet fuel to current specifications, the control of fuel thermal stability, and combustor technology for use of broad specification fuels. (Paper: American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, London, England, Apr 9 - 13, 1978)

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B.1.1.2.58 78W70026 Unknown
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Petrash, D.A.
Title: Fuels Research

ABSTRACT

The potential properties of future aviation turbine fuels derived from nonpetroleum sources such as oil shale and coal will be determined by synthesis and characterization techniques. Coordination with other government agencies, such as the USN, ERDA, EPA, and with industry will also be maintained. (Plan. See also 80W70028.)

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B.1.1.2.59 N79-32637/7 Sep 1979
National Aeronautics and Space Administration, Langley Research Center, Hampton, VA
Witcofski, R.D.
Title: Comparison of Alternate Fuels for Aircraft

ABSTRACT

Liquid hydrogen, liquid methane, and synthetic aviation kerosene were assessed as alternate fuels for aircraft in terms of cost, capital requirements, and energy resource utilization. Fuel transmission and airport storage and distribution facilities are considered. Environmental emissions and safety aspects of fuel selection are discussed and detailed descriptions of various fuel production and liquefaction processes are given. Technological deficiencies are identified. (Paper: Presented at the International Dglr/Dflr Symp. On Hydrogen in Air Transportation, Stuttgart, Germany, 11-14 Sep 1979)

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B.1.1.2.60 77N28322 1977
NASA, Langley Research Center, Langley Station, VA
Witcofski, R.D.
Title: Alternate Aircraft Fuels: Prospects and Operational Implications

ABSTRACT

The potential use of coal-derived aviation fuels was assessed. The studies addressed the prices and thermal efficiencies associated with the production of coal-derived aviation kerosene, liquid methane and liquid hydrogen and the air terminal requirements and subsonic transport

performance when utilizing liquid hydrogen. The fuel production studies indicated that liquid methane can be produced at a lower price and with a higher thermal efficiency than aviation kerosene or liquid hydrogen. Ground facilities of liquefaction, storage, distribution and refueling of liquid hydrogen fueled aircraft at airports appear technically feasible. The aircraft studies indicate modest onboard energy savings for hydrogen compared to conventional fuels. Liquid hydrogen was found to be superior to both aviation kerosene and liquid methane from the standpoint of aircraft engine emissions. (Report)

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B.1.1.2.61 N78-25545/2ST Unknown
NASA, Langley Research Center, Langley Station, VA
Witcofski, R.D.
Title: Progress on Coal-Derived Fuels for Aviation Systems

ABSTRACT

Synthetic aviation kerosene (Syn. Jet A), liquid methane (LCH4), and liquid hydrogen (LH2) appear to be the most promising coal-derived fuels. Liquid hydrogen aircraft configurations, their fuel systems, and their ground requirements at the airport are identified. For long haul use, aircraft fueled with coal derived LH2 would consume 9 percent less coal resources than would aircraft fueled with coal derived Syn. Jet A. Distribution of hydrogen from the point of manufacture to airports may pose problems. Synthetic Jet A would appear to cause fewer concerns to the air transportation industry. Of the three candidate fuels, LCH4 is the most energy efficient to produce, and an aircraft fueled with coal derived LCH4 may provide both the most efficient utilization of coal resources and the least expensive ticket as well. (Paper: Presented at Ctol Transport Technol. Conf., Hampton, VA, 28 Feb - 3 Mar 1978)

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B.1.1.2.62 79A25899 Unknown
U.S. Army, Fuels and Lubricants Research Laboratory, San Antonio, TX
Naegeli, D.W.
Title: Effects of Fuel Properties on Soot Formation in Turbine Combustion

ABSTRACT

A combustor rig instrumented for measuring flame radiation, exhaust smoke, and gaseous emissions is used to study the sensitivity of combustor performance to the physical and chemical properties of fuels used in turbine combustion. These fuels include petroleum-base jet fuels, JP5

syncrudes, water-fuel emulsions, and hybrid aromatic/methanol solutions. (Paper: Society of Automotive Engineers Aerospace Meeting, San Diego, CA, Nov 27-30, 1978)

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B.1.1.2.63 DJ-143-1 6/76 to 2/79
Chevron Research Co., 576 Standard Ave., Richmond, CA 94802
Stangeland, B.
Title: Refining and Upgrading of Synfuels From Coal and Oil Shale

ABSTRACT

A study to upgrade syncrudes by selected refinement activities, and to estimate commercial plant operating conditions, investments, operating costs, yields, and product analyses. Provide an overall refinery plan, including an estimate of total investment and operating cost for all units needed to produce the desired transportation fuels. (Plan)

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B.1.1.2.64 DS-321 1978
U.S. Dept. of Energy Bartlesville Energy Research Center, P.O. Box 1398, Bartlesville, Oklahoma 74003
Coleman, H.J.
Title: Quality of Crude Oils and Products

ABSTRACT

Data base of characteristics of crude oil from U.S. fields, including synthetic oils. (Notice)

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B.1.1.2.65 DS-325 10/76 to 9/83
U.S. Department of Energy, Bartlesville Energy Research Center, P.O. Box 1398, Bartlesville, Oklahoma 74003
Whisman, M.L.
Title: Stability Characteristics of Hydrocarbon Fuels

ABSTRACT

The basic objective of this project is to determine the stability characteristics of representative liquid hydrocarbon fuels. The materials studied include gasolines, and jet fuels from both petroleum and synthetic crudes. A near term goal is to evaluate the storage and thermal stability of commercial fuels across the country to help eliminate waste and

inefficient utilization due to fuel deterioration. (Plan)

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B.1.1.2.66 80W70028 1980
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Grobman, J.
Title: Fuels Research

ABSTRACT

The potential properties of future aviation turbine fuels derived from nonpetroleum sources such as oil shale and coal will be determined by synthesis and characterization techniques. The effects of these fuels, as well as petroleum based fuels synthesized to broader specifications than currently required, on the performance and durabililty of jet engine components and materials will be determined. Sufficient quantities of these fuels must be procured and/or simulated by blending of petroleum based fuels and will be used to conduct research tests required to evolve the technology that may be needed to use these fuels in current and future jet aircraft engines. A joint program has been developed with the AFAPL and Lewis. (Plan)

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B.1.1.2.67 N78-75465/2ST Jun 76
Institute of Gas Technology, Chicago, IL
Tsaros, C.L.
Title: A Study of the Conversion of Coal to Hydrogen, Methane, and Liquid Fuels for Aircraft

ABSTRACT

This study addresses the conversion of coal to hydrogen, methane, and synthetic aviation kerosene, for use as alternate aviation fuels. Thermal efficiencies are derived for several fuels and production processes. Process economics are analyzed for all processes except the Koppers-Totzek and CO2 Acceptor Processes.

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B.1.1.2.68 77N18105 1977
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Grobman, J.
Title: Alternative Aircraft Fuels Technology

ABSTRACT

NASA is studying the characteristics of future aircraft fuels produced from either petroleum or nonpetroleum sources such as oil shale or coal. These future hydrocarbon based fuels may have chemical and physical properties that are different from present aviation turbine fuels. This research is aimed at determining what those characteristics may be, how present aircraft and engine components and materials would be affected by fuel specification changes, and what changes in both aircraft and engine design would be required. (Paper: In Aircraft Safety and Operating Problems)

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B.1.1.2.69 78N26223 Unknown
National Aeronautics and Space Administration, Washington, DC
Hunter, W.H.
Title: Aviation Fuels Beyond the 1980°s --- Liquified Gases and Synthetic Fuels

ABSTRACT

The competitive use and effect of coal-derived synthetic JET A and cryogenic liquid methane (LCH4) and liquid hydrogen (LH2) fuels on the design, mass and operation of large subsonic, supersonic and hypersonic transport aircraft are analyzed. Overall energy and cost efficiency comparisons are presented from studies of JET A and LH2 fuels usage in subsonic and supersonic transports. The probable concerns of the public and the aviation industry over the use of the coal-derived fuels are discussed. The possibility that space-flight-vehicle-derived technology may be applied to special purpose passenger transports is considered. The likelihood that petroleum-derived fuels similar to JET A will continue in major use in aviation for the foreseeable future is predicted. (Paper: Symp. on Aviation Fuels in the 1980°s, Melbourne, 26-27 June 1978)

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B.1.1.2.70 AD-A066 983/8ST Dec 77 - Oct 78
Rockwell International Los Angeles CA, Los Angeles Div.
Robinson, Douglas A.
Title: The Impact of Alternate Fuels on Aircraft Configuration Characteristics

ABSTRACT

Study the effect of alternate fuel usage for three classifications of advanced technology vehicles for a post-2000 time period. Alternate fuel design vehicles offer 35 to 45 percent weight reduction. Life-cycle cost savings estimated as function of fuel cost showed fuels 10 to 15 times the basepoint resulted in breakeven LCC with the more exotic fuels. (Final Report)

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B.1.1.2.71 AD-B039 187L May 79
Air Command and Staff Coll Maxwell AFB Ala
Baker, Vincent T.
Title: Alternate Fuel Sources for Future USAF Aircraft

ABSTRACT

Study of ability of synfuel (coal or shale oil derived), liquid hydrogen, and nuclear energy to perform airlift and station-keeping AF missions. Synfuel and liquid hydrogen are attractive; nuclear power considered unacceptable. (Report)

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B.1.1.2.72 78A16637 1977
Exxon Research and Engineering Co., Linden, NJ
Longwell, J.P.
Title: Synthetic Fuels and Combustion

ABSTRACT

Emphasis is placed on conversion of coal to liquid fuels for transportation use. Transportation fuel requirements and solution to combustion problems in automotive systems are discussed. Future work should focus on improvement in the ability of aircraft engines to burn highly aromatic fuels with a wide boiling range and on research into the chemistry of soot formation and burnout along with the mechanics of reactive flows involving high-molecular-weight liquids and vapors and soot. (Article: Progress in Energy and Combustion Science, Vol. 3 No. 2, 1977)

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B.1.1.2.73 75A45519 1975
Khimiia i Tekhnol. Topliv i Masel, No. 8
Kuznetsov, V.G.
Title: The Determination of Sulfur-Containing Additives in Synthetic Aviation Oils

ABSTRACT

A speedy, accurate method for determining the quantity of sulfur-containing additives in synthetic aviation fuels. (Article)

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B.1.1.2.74 77A48159 Aug 1976
Exxon Research and Engineering Co., Linden, NJ
Longwell, J.P.
Title: Synthetic Fuels and Combustion

ABSTRACT

The manufacture of synthetic fuels from coal involves a significant increase in the hydrogen-to-carbon ratio from the comparatively low value of the ratio found in coal. The relative fuel/engine system efficiency for both air and ground transportation is expected to be strongly influenced by the ability of an engine to burn low hydrogen-to-carbon ratio aromatic fuels without formation of carbon particulates, engine deposits, or maintenance problems. Improvement in the ability of aircraft engines to burn highly aromatic, wide boiling range fuels offers the possibility of advances in economics and fuel conservation in air transportation. (Paper: 16th International Symp. on Combustion, Cambridge, Mass., Aug 15-20, 1976)

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B.1.1.2.75 78A18669 1977
Direction Generale de l'Aviation Civile, Paris, France
Troadec, J.P.
Title: Current and Future Fuels for Transport Aircraft

ABSTRACT

Some of the basic characteristics of liquid hydrogen and methane as aircraft fuels are compared with the characteristics of the current Jet A and synthetic Jet A fuels. Liquid hydrogen's advantages include an elevated ratio of calorific value to mass, its nonpolluting combustion, and the fact that it can be obtained nearly everywhere without large

transportation costs. Its disadvantages include the storage problem, the safety question, and its cost. Liquid methane has smaller production cost and requires less energy for production than liquid hydrogen. (Article: France Transports - Aviation Civile, Fall 1977, In French)

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B.1.1.2.76 77A21623 Dec 1976
Mobil Research and Development Corp., Paulsboro, NJ
Callen, R.
B.
Title: Upgrading Coal Liquids to Gas Turbine Fuels I- Analytical Characterization of Coal Liquids

ABSTRACT

The physical properties and chemical compositions of three coal liquids (SRC, H-Coal, and Synthoil) were determined. Improvement in certain physical and chemical properties will be required to upgrade coal liquids for use as gas turbine fuels. (Article: Industrial and Engineering Chemistry, Product Research and Development, Vol. 15, Dec 1976)

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B.1.1.2.77 DJ-124-1 6/75 to 6/78
Montana State University School of Engineering, Bozeman, Montana 59715
Berg, L.
Title: Research in the Conversion of Coal to Clean Distillate Fuels

ABSTRACT

Research in the conversion of coal to jet fuel. (Notice)

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B.1.1.2.78 DJ-710-1 5/72 to 5/78
Southwest Research Inst. , 8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas 78228
Bowden, J.N.
Title: Stability Characteristics of Hydrocarbon Fuels from Alternate Sources

ABSTRACT

Research to determine the storage characteristics of representative liquid fuels derived from coal, oil shale and tar sands. (Plan)

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B.1.1.2.79 N79-29354/4ST 17 Mar 78
California Univ., Los Angeles. School of Engineering and Applied Science
English, J.M.
Title: Forecast of Future Aviation Fuels. Part 1: Scenarios

ABSTRACT

A preliminary set of scenarios is described for depicting the air transport industry as it grows and changes, up to the year 2025. This provides the background for predicting the needs for future aviation fuels to meet the requirements of the industry as new basic sources, such as oil shale and coal, are utilized. Five scenarios are written to encompass a range of futures from a serious resource-constrained economy to a continuous and optimistic economic growth. (Progress Report)

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B.1.1.2.80 ZQF-457580-3 7/74 to 7/80
Air Force Aero Propulsion Lab., Wright Patterson A.F. B.; Dayton, Ohio 45433
Delaney, C.L.
Title: Evaluation of Special Aviation Turbine Fuels Produced from Petroleum, Coal and Oil Shale

ABSTRACT

Quantitatively determine both the individual and collective impact of specification properties on grade JP-4 yield. Evaluate the effect of extending the range of availability- related properties on aircraft performance and materials. Evaluate fuel produced from coal and oil shale crude oils as these crude oils become available from commercial sources. (Plan)

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B.1.1.2.81 79N27321 1979
Jet Propulsion Lab., California Inst. of Tech., Pasadena
Kalfayan, S.H.
Title: Compatibility of elastomers in Alternate Jet Fuels

ABSTRACT

The compatibility of elastomeric compositions of known resistance to aircraft fuels was tested for potential use in Jet A type fuels obtainable from alternate sources, such as coal. The elastomeric compounds tested were based on butadiene-acrylonitrile rubber, a castable Thiokol polysulfide rubber, and a castable fluorosilicone rubber. Batches of various cross-link densities of these rubbers were made and their chemical stress relaxation behavior in fuel, air, and nitrogen, their swelling properties, and response to mechanical testing were determined. (Report)

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B.1.1.2.82 N79-31163/5 1978 Sep 79
Unknown
Cormery, G.
Title: Supersonic Transport Vis-a-Vis Energy Savings

ABSTRACT

Energy and economic saving modifications in supersonic transportation are studied. Modifications in the propulsion systems and in the aerodynamic configurations of the Concorde aircraft to reduce noise generation and increase fuel efficiency are discussed. The conversion of supersonic aircraft from fuel oils to synthetic fuels is examined. (Article: Translated from Aeron. Astronaut (Paris), v 69 n 2, 1978)

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B.1.1.2.83 ZQF-458210-1 7/75 to 7/79
Air Force Aero Propulsion Lab., Wright Patterson A.F.
B.; Dayton, Ohio 45433
Jackson, TA
Title: Alternate Fuels Combustion Investigations

ABSTRACT

Expanded-specification petroleum fuels and fuels from oil shale and coal are being considered for future use in Air Force aircraft. The objective of this effort is to examine and quantify the effects of appropriate fuel character changes on the engine combustion systems.

These findings will be used as a basis for decisions regarding - (a) the extent to which current systems can tolerate changes in fuel quality, (b) future modifications to combustion systems to allow use of reduced quality fuels, and (c) the trade-off of fuel processing cost versus the cost of modified combustor designs. (Plan)

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B.1 FUELS TECHNOLOGY

B.1.2 LIQUID HYDROGEN FUEL

B.1.2.1 NAVY FUNDED

B.1.2.1.1 AD-A036 936/3ST 1976
Office of Naval Research, London (England)
Soper, W.G.
Title: International Conference on Hydrogen and Its Prospects

ABSTRACT

Papers from the international conference "Hydrogen and its Prospects," Liege, Belgium, 15-18 1976, are reviewed for their contribution to future production and utilization of hydrogen as a fuel. Principal emphasis is placed upon the production of hydrogen by electrolysis and thermochemical decomposition of water, and upon the comparison of these processes with synthetic fuel production from fossil resources. Other topics discussed include hydrogen storage and its use as fuel in automobiles and aircraft.

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B.1.2.1.2 AD-A074 595 Nov 78 - Aug 79
Martin Marietta Aerospace Denver Colo, Denver Div
Marcy, William L.
Title: Propulsion Options for the HI Spot Long Endurance Drone Airship

ABSTRACT

Airbreathing, monofueled, stored energy, and solar rechargeable propulsion systems have been studied for the HI SPOT Long Endurance Drone Airship, providing constant level electrical power as well as variable aerodynamic thrust to maintain position in winds varying from 15 to 100 knots at high altitude. A hydrogen fueled, airbreathing engine is optimum for mission lengths up to 30 days or more. (Final Report)

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B.1 FUELS TECHNOLOGY

B.1.2 LIQUID HYDROGEN

B.1.2.2 NON NAVY FUNDED

B.1.2.2.1 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the Forum, Detroit, Michigan, October 15, 1975)

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B.1.2.2.2 74A34985 Apr 1974
Unknown
Kelly, D.L.
Title: Application of Hydrogen to Commercial Transports

ABSTRACT

A design analysis of the conversion of an in-production wide-bodied transport to hydrogen fuel is presented. Comparisons are drawn between storage of hydrogen in the fuselage and storage in wing-external tanks. Required structural modifications are defined and costed, and a preferred configuration is selected on the basis of direct operating cost. It is shown that a conversion of a jet fueled, wide-bodied transport to hydrogen fuel is technically and economically feasible, provided that it is preceded by a long-life tankage and insulation development. The preferred configuration has the hydrogen stored in pylon-mounted tanks above the wings. Flyaway cost of the hydrogen fueled conversion is 8 percent greater than that of the baseline jet fueled transport. (Paper: Society of Automotive Engineers, Air Transportation Meeting, Dallas, TX, Apr 30 - May 2, 1974)

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B.1.2.2.3 AD-A066 983/8ST Dec 77 - Oct 78
Rockwell International, Los Angeles, CA, Los Angeles Div.
Robinson, Douglas A,.
Title: The Impact of Alternate Fuels on Aircraft Configuration Characteristics

ABSTRACT

Study the effect of alternate fuel usage for three classifications of advanced technology vehicles for a post-2000 time period. Alternate fuel design vehicles offer 35 to 45 percent weight reduction. Life-cycle cost savings estimated as function of fuel cost showed fuels 10 to 15 times the basepoint resulted in breakeven LCC with the more exotic fuels. (Final Report)

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B.1.2.2.4 EI800100331 Sep 1979
Case Western Reserve Univ., Cleveland, Ohio
Reshotko, Eli
Title: Drag Reduction By Cooling In Hydrogen-Fueled Aircraft

ABSTRACT

Drag reductions are possible for cryo-fueled aircraft by using fuel to cool selected aerodynamic surfaces on its way to the engines. Calculations for hydrogen-fueled transport show that drag reductions in cruise of about 20% are within reason. Hydrogen fueled aircraft employing surface cooling is attractive as an energy conservative aircraft and warrants more detailed study. (Paper: Journal of Aircraft Vol 16, No. 9, Sept 1979)

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B.1.2.2.5 N77-15045/6ST 1976
NASA, Langley Research Center, Langley Station, VA
Guy, R.W.
Title: Thermal Design and Analysis of a Hydrogen-Burning Wind Tunnel Model of an Airframe-Integrated Scramjet

ABSTRACT

An aerodynamic model of a hydrogen burning, airframe integrated scramjet engine has been designed, fabricated, and instrumented. This model is to be tested in an electric arc heated wind tunnel. (Report)

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B.1.2.2.6 75A43968 1975
Unknown
Grey, J.
Title: Future Engines and Fuels --- Advanced Cycles, Fuels and Nuclear Propulsion

ABSTRACT

The variable-cycle engine and the supersonic-combustion ramjet (for hypersonic aircraft) are discussed, with emphasis on the first topic. Flexible variable-cycle engines could power high-thrust STOL operations and low-noise takeoffs and landings while still permitting high-speed economical cruise; others could permit a single airplane to fly efficiently at both subsonic and supersonic speeds. The supersonic-combustion ramjet will find application farther in the future than the variable-cycle engine; it is the only envisoned air-breathing engine which could operate effectively above Mach 5. The use of hydrogen as a fuel and the need for rejuvenation of the nuclear aviation power development effort are also discussed. (Article: Exxon Air World, v 27, n 4, 1975)

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B.1.2.2.7 77N15212# Sept 1976
Committee on Aeronautical and Space Sciences (U.S. Senate)
Unknown
Title: Alternate Fuels For Aviation

ABSTRACT

Research and progress in the development of alternative fuels for aviation are discussed. The impact of using nonoptimum synthetic hydrocarbon based fuels on aeronautical structures and the cost of commercial airfares is explored. (Paper: GPO Hearings before Subcomm. on Aerospace Technol. and Natl. Needs of Comm. on Aeronaut. and Space Sci., 94th Congr. 2d Sess., 27-28 Sep. 1976)

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B.1.2.2.8 N78-75465/2ST Jun 76
Institute of Gas Technology, Chicago, IL
Tsaros, C.L.
Title: A Study of the Conversion of Coal to Hydrogen, Methane, and Liquid Fuels for Aircraft

ABSTRACT

This study addresses the conversion of coal to hydrogen, methane, and synthetic aviation kerosene, for use as alternate aviation fuels. Thermal efficiencies are derived for several fuels and production processes. Process economics are analyzed for all processes except the Koppers-Totzek and CO2 Acceptor Processes.

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B.1.2.2.9 N78-31085/1ST Jul 78
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Study of Fuel Systems for LH2-Fueled Subsonic Transport Aircraft, Volume 1

ABSTRACT

Engine concepts examined for use with hydrogen fuel in aircraft. Candidate tank structure and cryogenic insulation systems evaluated. Designs of aircraft fuel system (pumps, lines, valves, regulators, and heat exchangers) received attention. Designs of boost pumps mounted in the LH2 tanks, and high pressure pump mounted on the engine were defined. Aircraft compared with conventionally fueled counterpart. (Final Report)

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B.1.2.2.10 N76-29218/4ST 24 May 1976
NASA, Langley Research Center, Langley Station, VA
Schrader, Owen R.
Title: Application of Advanced Technology to Future Long-Range Aircraft

ABSTRACT

Assessment of three separate programs that have incorporated advanced technology into the design of long-range aircraft. The first centers around the use of span-loaded cargo aircraft with the payload distributed along the wing. The second is the application of laminar flow contro. to tne aircraft to reduce the aerodynamic drag. The last program evaluates the production of alternate aircraft fuels from coal and the use of liquid hydrogen as an aircraft fuel. (Paper in 35th Ann. Conf. of the Soc. of

Allied Weight Engr. Inc., Phila., PA 24-26 May 1976)

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B.1.2.2.11 79A49376 Jun 1978
Unknown
Newman, M.
title: Utilization of Alternative Fuels for Transportation; Proceedings of the Symposium, University of Santa Clara, Santa Clara, CA, June 19 - 23, 1978

ABSTRACT

Overview of alternative fuel development deals with such issues as energy supply and fuel manufacturing/processing and storage and distribution. Attention is given to fuels for vehicles and aircraft. (Paper in Symposium sponsored by the U.S. Dept. of Energy, New York, American Institute of Aeronautics and Astronautics, Inc. 1979)

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B.1.2.2.12 75N16980 1974
Pinkel, I. Irving, Fairview Park, Ohio
Pinkel, I.I.
Title: Alternative Fuels for Aviation

ABSTRACT

The status of energy programs to provide hydrocarbon fuels from new sources is examined. Experience in the United States with non-hydrocarbon fuels for turbine powered aircraft is analyzed. The various alternate sources of hydrocarbon fuels are defined. The use of metals and metal slurries as turbine fuels is propose.. The advantages and disadvantages of liquid hydrogen as an aircraft fuel are discussed. A specific example of an aircraft operating on liquid hydrogen is described. (Paper in AGARD The 1974 AGARD Ann. Meeting)

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B.1.2.2.13 75A44769# Mar 1974
Union Carbide Corp., New York, NY
Johnson, J.E.
Title: An Economic Perspective on Hydrogen Fuel

ABSTRACT

Economic aspects of the production of different energy carriers are reviewed. Synthetic kerosene, hydrogen, methane, ammonia, and methanol are considered. Major factors discussed: (1) the capital investment required to convert fuel to energy; and (2) the total resources consumed in accomplishing a given task efficiently. (Paper in Hydrogen energy; Proceedings of the Hydrogen Economy Miami Energy Conference, Miami Beach, FL, March 18-20, 1974)

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B.1.2.2.14 76A24265 Mar 1976
Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Flugtreib- und Schmierstoffe, Munich, West Germany
Jantzen, E.
Title: Aviation Fuels and Lubricants --- Review

ABSTRACT

Review of investigations concerned with the availability of currently used aviation fuels and possibilities for their replacement. The use of liquid hydrogen as fuel appears, in principle, to be feasible. A number of difficulties have to be overcome. An intermediate employment of liquid methane is considered. Attention also given to studies regarding the use of synthetic hydrocarbons obtained from coal or oil shale products. (Article in VDI-Z, vol. 118, no. 5, Mar 1976, In German)

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B.1.2.2.15 76N20626* 31 Mar, 1975
New Mexico Univ., Albuquerque
Unknown
Title: Quarterly Literature Review of Hydrogen Energy: A Bibliography with Abstracts First Quarter, 1975

ABSTRACT

A continuing bibliographic summary with abstracts of research and projection on the subject of hydrogen as a secondary fuel and as an energy carrier is presented. Cross indexes are included. Topics covered include production, utilization, and safety.

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B.1.2.2.16 79N13026*# Jan 1977
General Dynamics Convair, San Diego, Calif.
Oman, B. H.
Title: Vehicle Design Evaluation Program (VDEP).

ABSTRACT

The NASA Langley Research Center vehicle design evaluation program (VDEP-2) was expanded by incorporating into the program a capability to conduct preliminary design studies on subsonic commercial transport type aircraft using both JP and such alternate fuels as hydrogen and methane. (Report)

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B.1.2.2.17 76A45242 Mar 1976
Institute of Gas Technology, Chicago, Ill.
Pangborn, J. B.
Title: Hydrogen Energy Technology Update 1976

ABSTRACT

Hydrogen production techniques are discussed including thermochemical hydrogen production, hydrogen from the reaction of coal and steam, water electrolysis, and photosynthetic and photochemical hydrogen production. Hydrogen storage transmission, distribution, and materials compatibility with hydrogen in storage and transmission systems are also considered. Hydrogen utilization is examined with attention given to automotive, aircraft and industrial applications.

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B.1.2.2.18 80A23179 1978
Michigan, University, Dearborn, Mich.
Varde, K. S.
Title: Hydrogen Fuel in Air Transportation and its Effects Around Airports

ABSTRACT

Based on the characteristics of hydrogen fuel a model analysis is conducted to predict the pollution that might be generated from a hydrogen fueled aircraft. Specific consideration is given when the aircraft is idling at the terminal and during full power conditions. The kinetic model predicts the dominant pollutant to be the oxides of nitrogen with other related species being in very small quantities. (Paper: Hydrogen

Energy System; Proceedings of the Second World Hydrogen Energy Conference, Zurich, Switzerland, August 21-24, 1978 Volume 4)

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B.1.2.2.19 77N21626# Mar 1976
Miami Univ., Coral Gables, Fla. (Clean Energy Research Inst.)
Veziroglu, T. N.
Title: First World Hydrogen Energy Conference Proceedings, Volume 3

ABSTRACT

The use of hydrogen energy and its impact on the economy are discussed. The thermodynamic characteristics and efficiency of hydrogen and liquid hydrogen fuels in aircraft are investigated.

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B.1.2.2.20 77A14563 Nov 1976
Chatillon-sous-Bagneux, Hauts de Seine, France
Wanner, J. C.
Title: Air Transportation and Fuel Consumption

ABSTRACT

Various options in present technology for reducing fuel consumption are examined. Improvements in thermodynamic efficiency by altering specific fuel consumption and bypass ratio, and two ways of raising the temperature upstream of the turbine, are considered. Advantages of the delta sweepback wing and supercritical airfoils are outlined in addition to possible weight reduction through the use of new advanced materials (more Ti, less steel, more composites) and optimized dimensional design of aircraft by finite element methods. Control configured vehicle approaches to aeronautical design are outlined briefly, and outlook for reliance on liquid hydrogen as fuel is sketched. (Paper: Sciences et Techniques, Nov. 1976, in French)

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B.1.2.2.21 N77-10033/7ST Sept 1976
Boeing Commercial Airplane Co., Seattle, Wash Dept. of
Preliminary Design
Unknown
Title: An Exploratory Study to Determine The Integrated Technological Air Transportation System Ground Requirements of Liquid Hydrogen Fueled Subsonic Long Haul Civil Air Transports

ABSTRACT

A baseline air terminal concept was developed which permitted airlines and the airport to operate JP or LH2 fueled aircraft at common terminal gates. The concept included installation of a hydrogen liquefaction and storage facility on airport property as well as the fuel distribution system. The capital investment and hydrogen related operating costs to the airlines were estimated. (Final Report)

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B.1.2.2.22 N73-22711*# 1972
NASA, Lewis Research Center, Cleveland, Ohio
Whitlow, John B., Jr.
Title: Preliminary Appraisal of Hydrogen and Methane Fuel in a Mach 2.7 Supersonic Transport

ABSTRACT

The higher heating value of hydrogen relative to JP fuel is estimated to reduce fuel weight by three fold and gross weight by 40 percent for comparable designed airplanes of equal payload and range. At current fuel prices, the DOC of a hydrogen airplane would be much higher than that of a JP airplane. A methane airplane could offer an 8.5 percent lower DOC than JP. Future shortages may escalate the prices of both JP and methane, whereas the price of hydrogen manufactured hydrolytically could be reduced from present levels. If in the future all three fuels are postulated to have equal costs per unit of energy, the DOC for hydrogen could be a much as 20 percent below that for JP on the reference 4000 nautical mile mission. Longer ranges would improve the advantage of hydrogen. (Report)

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B.1.2.2.23 75A36719 May 1975
Cranfield Institute of Technology, Cranfield, Beds., England
Goodger, E. M.
Title: Alternative Fuels for Aviation

ABSTRACT

Overall characteristics of alternative fuels, proposed to meet the desired technological improvements are discussed, together with the feasibility of using these possible replacements for petroleum products in the aviation industry. Low and high density fuels, hydride fuels, carbon containing fuels vaporising and/or endothermically reacting fuels, hydrocarbon fuels, aromatic mixtures, liquid methane, liquid hydrogen, nitrogen hydrides, alcohols, nuclear fuels, and various mixtures are analyzed for their performance, levels of volumetric and combined gravimetric energy densities, handling safety, pollution, thermal stability and capacity, and availability. (Paper: Aeronautical Journal, Vol, 79, May 1975)

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B.1.2.2.24 78A23420# Feb 1978
Lockheed California Co., Burbank, Calif.
Hawkins, W. M.
Title: Where Aerospace Can Serve Afresh - Paths to Energy Independence

ABSTRACT

Feasibility of developing new energy technologies. Among the new technologies proposed are: using fusion explosions to generate superheated steam, nuclear based conversion of seawater to hydrogen, methane production from plants and waste, ocean thermal energy conversion and coal gasification. (Paper: Astronautics and Aeronautics, Vol 16, Feb 1978)

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B.1.2.2.25 79A49381# Jun 1978
Pan American World Airways, Inc., New York, N.Y.
Borger, J. G.
Title: Alternative Fuels in Aviation

ABSTRACT

The state of the art and expected future advances of alternative fuels in aviation are discussed. Consideration is given to uses of liquid hydrogen and methane, broadening of turbine fuel specifications, increased aromatics, decreased flashpoint, increased freeze point, thermal

stability, synthetic fuels, and the refinery process. It is noted that major fuel efficiency improvements resulting from the NASA ACEE program probably will not appear before the late 1980s. (Paper: Utilization of Alternative fuels for transportation; Proceedings of the Symposium, Santa Clara, Calif., June 19-23, 1978.)

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B.1.2.2.26 76A5397# Sept 1976
Rand Corp., Washington, D.C.
Mikolowsky, W. T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels

ABSTRACT

The paper examines the potential of very large airplanes (VLA) in the context of Air Force missions. Synthetic jet fuel, liquid methane, liquid hydrogen, and nuclear propulsion are the fuel alternatives selected for detailed analysis. It is shown that for most military applications, VLA with gross weight exceeding one million pounds promise to be superior to contemporary vehicles in terms of cost and energy effectiveness. The conventional jet fuel (made from coal, oil shale or crude oil) appears to be the the most effective, at least up to year 2000. Nuclear propulsion is attractive only for station keeping missions requiring larger station radii (greater than about 4000 nautical miles). (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Dallas, Tex., Sept. 27-29, 1976.)

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B.1.2.2.27 77A47271# Sept 1977
Rand Corp., Washington, D.C.
Mikolowsky, W. T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

Study evaluating very large airplanes (VLA°s) in the context of Air Force missions and the most attractive alternative fuel for these airplanes. The chemical fuel alternatives considered are liquid hydrogen, liquid methane, and synthetic JP, each of which can be readily synthesized from coal. The nuclear fueled VLA was a fourth candidate aircraft. Concluded that overall conventional hydrocarbon jet fuel remains the most attractive fuel for military aircraft. Nuclear propulsion is attractive only for station keeping missions requiring large station radii. (Paper: Astronautics and Aeronautics, Vol. 15, Sept. 1977)

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B.1.2.2.28 77N33154# Dec 1976
Rand Corp., Santa Monica, Calif.
Mikolowsky, W. T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels: Executive Summary

ABSTRACT

This report summarizes the military utility of very large airplanes (over 1 million pounds gross weight) and examines several alternative fuels that could be used by such airplanes. (Executive Summary Report)

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B.1.2.2.29 78N29063*# 1978
NASA, Langley Research Center, Langley Station, Va
Witcofski, R. D.
Title: Progress on Coal Derived Fuels for Aviation Systems

ABSTRACT

The results of engineering studies of coal derived aviation fuels and their potential application to the air transportation system are presented. Synthetic aviation kerosene (SYN JET-A) liquid methane (LCH4) and liquid hydrogen (LH2) appear to be the most promising coal derived fuels. Aircraft configurations fueled with LH2, their fuel systems, and their ground requirements at the airport are identified. Energy efficiency, transportation hazards, and costs are among the factors considered. It is indicated that LCH4 is the most energy efficient to produce, and provides the most efficient utilization of coal resources and the least expensive ticket as well. (Paper: CTOL Transport Technol., 1978)

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B.1.2.2.30 78N28051# Sep 1977
RAND Corp., Santa Monica, CA
Mikolowsky, W.T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

The specific objectives of this work were: Evaluate very large airplanes (VLAs) in the context of existing and possible future Air Force missions, and determine the most attractive alternative fuel for airplanes

of this type. (Report)

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B.1.2.2.31 80A37335# Sep 1979
Unknown
Braun, M.
Title: Description of Processes for Producing Hydrogen by Advanced Electrolysis

ABSTRACT

A review of water electrolysis technology is presented. Electrolysis is not inferior to thermochemical methods for producing hydrogen from nonfossil heat sources on a large scale since the efficiency of both processes is limited to the same value by the second law of thermodynamics. The two types of electrolysis systems, aqueous alkaline electrolysis at elevated temperatures and pressure and the use of a cation exchange membrane, offer the possibility of reaching a cell voltage of about 1.7v at the plant investment cost of about 100 dollars/kw within the next 8 years. (Paper in Hydrogen in Air Transportation: Proceedings of the International Symposium, Stuttgart, West Germany, September 11-14 1979.)

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B.1.2.2.32 AD-603 150 Nov 62-Nov 63
Air Products and Chemicals Inc., Allentown, PA
Biskis, E.C.
Title: Investigation of the Para-Ortho Shift of Hydrogen

ABSTRACT

Results of a program for the development of catalysts for the promotion of the low temperature para-ortho reaction of hydrogen. Program resulted in a catalyst with an activity 13.7 times greater on a weight basis than the best commercial material. Mechanism studies resulted in a model which successfully predicts the kinetic behavior over a wide range of flow rate, pressure, and catalyst particle size. (Final Report)

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B.1.2.2.33 78A18826 Nov 1976
Workshop sponsored by the Association des Ingenieurs Electriciens Sortis de l'Institut Electrotechnique Montefiore, Liege
Unknown
Title: International Workshop on Hydrogen and its Perspectives, Liege, Belgium

ABSTRACT

Techniques for obtaining hydrogen fuels are reviewed, and the use of hydrogen for aircraft fuel is discussed. Topics of the papers include: hydrogen generation, hydrogen fuel transport and storage systems (including those that use metal hydrides), a NASA study of the feasibility of adopting liquid hydrogen aircraft fuel, hydrogen as used in chemical processing, and the toxicological effects of hydrogen. (Proceedings in two volumes; in French, English and German.)

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B.1.2.2.34 74N20647 Sep 1973
Escher Technology Associates, St. Johns, Michigan
Escher, W.J.D.
Title: Prospects for Liquid Hydrogen Fueled Commercial Aircraft

ABSTRACT

The use of hydrogen as a fuel for aircraft propulsion is discussed. Liquid hydrogen as a potential future aviation fuel is considered to be the only practical chemical fuel producible from ultimate nonfossil energy primary sources. The facilities and processes for commercial production of hydrogen are reported. (Report)

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B.1.2.2.35 76N20625* 1974
New Mexico Univ., Albuquerque
Natarajan, M.
Title: Hydrogen Energy: A Bibliography with Abstracts. Annual Supplement, 1974

ABSTRACT

A bibliography with abstracts on research and projections on the subject of hydrogen as a secondary fuel and as an energy carrier is presented. References identified during the year 1974 are cited. Cross indexes are included. Topics covered include: production, utilization,

transmission, distribution, storage, and safety.

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B.1.2.2.36 76N20628* 30 Sep 1975
New Mexico Univ., Albuquerque
Unknown
Title: Quarterly Literature Review of Hydrogen Energy: A Bibliography with Abstracts. Third Quarter, 1975

ABSTRACT

A continuing bibliographic summary with abstracts of research and projection on the subject of hydrogen as a secondary fuel and as an energy carrier is presented. Cross indexes are included. Topics covered include production, utilization, and safety.

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B.1.2.2.37 76N20627* 30 Jun 1975
New Mexico Univ., Albuquerque
Unknown
Title: Quarterly Literature Review of Hydrogen Energy: A Bibliography with Abstracts. Second Quarter, 1975

ABSTRACT

A continuing bibliographic summary with abstracts of research and projection on the subject of hydrogen as a secondary fuel and as an energy carrier is presented. Cross indexes are included. Topics covered include production, utilization, and safety.

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B.1.2.2.38 77A29437* Nov 1976
Institute of Gas Technology, Chicago, Ill
Gregory, D. P.
Title: Prospects for Pipeline Delivery of Hydrogen as a Fuel and as a Chemical Feedstock

ABSTRACT

Hydrogen for storing and carrying energy is examined. Obtain hydrogen from water by three basically distinct routes: (1) electrical generation followed by electrolysis; (2) thermochemical decomposition; and (3) direct neutron or ultraviolet irradiation of hydrogen-bearing molecules. The hydrogen will be transmitted in long distance pipelines. (Paper: American Gas Association Monthly, Vol. 58, Nov. 1976.)

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B.1.2.2.39 75A43978# Aug 1973
Union Carbide Corp., New York, N.Y.
Johnson, J. E.
Title: The Economics of Liquid Hydrogen Supply for Air Transportation

ABSTRACT

An investigation is conducted for an early application of liquid hydrogen which could substantially contribute toward easing the fuel shortage. Near term benefits of liquid hydrogen would be greatest in aircraft operation. Analysis of economics of liquid hydrogen takes into account a conversion of coal to hydrogen and fission energy to hydrogen. It is concluded that a liquid hydrogen aviation fuel capability offers the best domestic alternate fuel strategy to counter overpricing and overdependence on imported hydrocarbon liquid fuel for air transportation. (Paper: Cryogenic Engineering Conference, Atlanta, Ga., August 8-10, 1973, Proceedings)

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B.1.2.2.40 75A22509 Feb 1975
Lockheed-Georgia Co., Marietta, Ga.
Lange, R.H.
Title: Design Concepts For Future Cargo Aircraft

ABSTRACT

This paper presents results of preliminary design studies of advanced technology cargo aircraft including novel distributed-payload Spanloader designs, hydrogen-fueled transports, nuclear-powered transports, and ram-wing vehicles. (Paper. 11th Ann. Meeting AIAA, Wash. D.C., Feb 24-26, 1975)

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B.1.2.2.41 77A31307# 1977
Lockheed-California Co., Burbank, Calif.
Hopps, R.H.
Title: Fuel Efficiency - Where We Are Heading in the Design of Future Jet Transports

ABSTRACT

Three potential technologies for the 1990s are discussed: laminar flow control, advanced turboprops and liquid hydrogen. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977 Proceedings)

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B.1.2.2.42 79N18057*# Feb 1979
Union Carbide Corp., Tonawanda, N.Y.
Baker, C.R.
Title: Study of Hydrogen Recovery System for Gas Vented While Refueling Liquid-Hydrogen Fueled Aircraft

ABSTRACT

Methods of capturing and reliquefying the cold hydrogen vapor produced during the fueling of aircraft designed to utilize liquid hydrogen fuel were investigated. An assessment of the most practical, economic, and energy-efficient of the hydrogen recovery methods is provided. (Report)

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B.1.2.2.43 78A43358*# July 1978
National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
Conner, D.W.
Title: CTOL Concepts and Technology Development

ABSTRACT

Various developments in the Aircraft Energy Efficiency (ACEE) program are discussed. Terminal-area operations are considered with emphasis on the Terminal Configured Vehicle program. Consideration is also given to aircraft systems studies and economics (including noise reduction programs). Coal-derived fuels for aviation systems (including LH2-fueled aircraft), and transport-aircraft concepts (including laminar flow control). (Paper : Astronautics and Aeronutics, Vol. 16, July-Aug. 1978.)

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B.1.2.2.44 78A38055 1977
Stanford Research Institute, Menlo Park, Cal.
Dickson, E.M.
Title: The Hydrogen Energy Economy: A Realistic Appraisal of Prospects and Impacts

ABSTRACT

Conclusions and recommendations related to the use of hydrogen, the transition to hydrogen, the future of hydrogen, and recommendations for research and development. Aspects of hydrogen production, storage, distribution, the end-uses, hydrogen safety, energy end-use alternatives to hydrogen, costs and economic relationships to other fuels, and the consequences of a hydrogen economy for commercial aviation. (Book)

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B.1.2.2.45 75A42282# Mar 1975
Lockheed-California Co., Burbank, Calif.
Brewer, G.D
Title: Aviation Use of Liquid Hydrogen Fuel - Prospects and Problems

ABSTRACT

Results of studies performed to investigate the feasibility, practicability, and potential advantages/disadvantages of using liquid hydrogen as fuel in both subsonic and supersonic commercial transport aircraft for initial operation in the 1990-2000 time period are discussed. A program to develop needed technologies is outlined. (Paper: Hydrogen Energy Fundamentals: Proceedings of the Symposium -Course, Miami Beach, Fla., March 3-5, 1975)

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B.1.2.2.46 74A29452# May 1974
Lockheed-California Co., Burbank, Calif.
Brewer, G.D.
Title: The Case For Hydrogen-Fueled Transport Aircraft

ABSTRACT

Hydrogen is shown to offer significant advantages as an energy medium in a society which can no longer depend on the availability of petroleum and natural gas. For the near term requirements, liquid hydrogen can be manufactured from coal and lignite. In the longer term, power from

nuclear power plants or solar collectors can generate large quantities of hydrogen by electrolysis or by thermochemical splitting of water. (Paper: Astronautics and Aeronautics, Vol. 12, May 1974)

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B.1.2.2.47 79A45576 Jul 1978
Institute of Gas Technology
Unknown
Title: Hydrogen for Energy Distribution; Proceedings of the Symposium, Chicago, Ill., July 24-28, 1978

ABSTRACT

The symposium focused on hydrogen as an energy carrier analogous to electricity, covering its status today in the captive and merchant hydrogen industry to future uses, such as hydrogen-fueled transportation systems. Specifically, papers covered hydrogen in the U.S. energy picture, international developments in hydrogen technologies, demand and supply as a chemical feedstock in U.S., modern ammonia synthesis, use of hydrogen, economics of small user hydrogen, developmental hydrogen via coal gasification processes, alkaline electrolysis, water electrolysis using polymer electrolytes, hydrogen via thermochemical and other advanced water-splitting technologies, transmission of gaseous hydrogen, and liquid hydrogen fueled commercial aircraft.

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B.1.2.2.48 EI750209952 Jan 1975
Jan 1975
Escher, William J.D.
Title: Hydrogen: Make-Sense Fuel for an American Supersonic Transport

ABSTRACT

Article reviewing desirable features of hydrogen as an aircraft fuel. Considers availability, pollution, performance, economics, etc. (Article: J. Aircr. v 12 n 1, Jan 1975)

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B.1.2.2.49 NTIS/PS-79/0779/3ST Aug 79
National Technical Information Service, Springfield, VA
Hundemann, Audrey S.
Title: Hydrogen Use as a Fuel (Citations from the NTIS Data Base)

ABSTRACT

Federally-funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. This updated bibliography contains 186 abstracts, 24 of which are new entries to the previous edition.

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B.1.2.2.50 75A47081 1975
1975
Escher, W.J.D.
Title: Liquid Hydrogen - Future Aircraft Fuel; Background Payoff, and Cryogenic Engineering Challenge

ABSTRACT

The paper reviews past experience with hydrogen aircraft and engines and examines the issue of the potential technical impact of liquid hydrogen fuel on future commercial aircraft design. The engineering aspects of liquid hydrogen compared to conventional hydrocarbon aircraft fuel are studied, and several conceptual designs created by the aircraft industry which reflect approaches for integrating hydrogen fuel into the aircraft are presented. (Article: Advances in Cryogenic Engineering, Volume 20, New York,Plenum Press, 1975)

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B.1.2.2.51 NTISUB/C/023 1977
New Mexico Univ., Albuquerque, Technology Application Center
Unknown
Title: Hydrogen Energy - A Bibliography With Abstracts

ABSTRACT

A quarterly bibliographic series that contains citations and abstracts from over 7000 different sources devoted to hydrogen as a synthetic fuel or "energy carrier." Foreign and domestic publications are cited, abstracted and indexed. A current and historic file of documents containing essentially all articles and publications referenced in the series is maintained at the Technology Application Center.

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B.1.2.2.52 N76-24726/1ST Apr 75
Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany), Inst. fuer Chemische Raketenantriebe
Nitsch, J.
Title: Production and Utilization of Alternative Secondary Energy Carriers

ABSTRACT

Primary activities considered are: investigation of combined thermochemical-electrolytical cycling processes, storage of hydrogen in low temperature absorbers and hydrogen-oxygen fed cycling process for energy storage and peak current generation. Supplementary activites are: the hydrogen aircraft, investigations of the liquid hydrogen tank/engine in an automobile, and safety investigations with hydrogen. Planned research in the fields of alcohols and mineral oil processing is mentioned. (Report, in German)

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B.1.2.2.53 NTIS: LA-UR-79-1416 1979
Los Alamos Scientific Lab., NM
Edeskuty, F.J.
Title: Safety of Liquid Hydrogen in Air Transportation

ABSTRACT

Discussion of safety problems in use of cryogenic hydrogen as air transportation fuel. (Report)

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B.1.2.2.54 NTIS: COO-2675-4 1976 - September
General Electric Co., Wilmington, Mass., Aircraft Equipment Div.
Unknown
Title: SPE Water Electrolysis Technology Development for Large Scale Hydrogen Production - Progress Report No. 4

ABSTRACT

Detailed engineering report on tests of materials in cells for hydrogen production by electrolysis. (Progress Report)

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B.1.2.2.55 73A35469 Mar 1973
NASA, Lewis Research Center, Aerospace Safety Research and Data Institute, Cleveland, Ohio
Weiss, S.
Title: The Use of Hydrogen for Aircraft Propulsion in View of the Fuel Crisis

ABSTRACT

Cost studies show LH2 to be more expensive than presently used fuels with potential performance benefits. Accompanying these benefits, however, are many new problems associated with aircraft design and operations: for example, problems related to fuel system design and the handling of LH2 during ground servicing. Some of the factors influencing LH2 fuel tank design, pumping, heat exchange, and flow regulation are discussed. (Paper: NASA Research and Technology Advisory Committee on Aeronautical Operating Systems, Meeting, Ames Research Center, Moffett Field, CA, Mar 7, 8, 1973)

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B.1.2.2.56 N75-10945/4ST Oct 74
NASA, Lewis Research Center, Cleveland, Ohio
Civinskas, K.C.
Title: A Comparison of Optimum Jp and LH2 Turbofan Engines Designed for Two Subsonic Transport Missions

ABSTRACT

The use of liquid hydrogen fuel instead of JP fuel for two subsonic commercial transports was examined. The following determinations which are important to meeting noise reduction requirements were calculated: (1) take off gross weight, (2) energy consumption, and (3) direct operating costs. The optimum engine cycles were found to be the same for both fuels. (Report)

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B.1.2.2.57 N78-11260/4ST Oct 77
NASA, Langley Research Center, Langley Station, VA
Momenthy, A.M.
Title: Liquid Hydrogen Flash Vaporizer

ABSTRACT

A method and device are disclosed for initially reducing the temperature of a stream of LH2 in a fuel distribution line. (Patent application)

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B.1.2.2.58 N78-10306/6ST Sep 77
NASA, Langley Research Center, Langley Station, VA
Korycinski, P.F.
Title: The Liquid Hydrogen Option for the Subsonic Transport: A Status Report

ABSTRACT

Continued subsonic air transport design studies include the option for a liquid hydrogen fuel system as an aircraft fuel conservation measure. Elements of this option discussed include: (1) economical production of hydrogen; (2) efficient liquefaction of hydrogen; (3) materials for long service life LH2 fuel tanks; (4) insulation materials; (5) LH2 fuel service and installations at major air terminals; (6) assessment of LH2 hazards; and (7) the engineering definition of an LH2 fuel system for a large subsonic passenger air transport.

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B.1.2.2.59 AD-483 957/7ST Apr 66
Air Force AERO Propulsion Lab, Wright-Patterson AFB, Ohio
Elrod, Charles, W.
Title: A Comparison of Subcooled Versus Liquid Hydrogen Requirements

ABSTRACT

This report presents information on the desirability of using subcooled or slush hydrogen in a number of general cases. Ground handling of subcooled hydrogen is considered as well as the on-board considerations. (Report)

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B.1.2.2.60 AD-A026 666/8ST Feb 76
Rand Corp., Washington, DC
Mikolowsky, William, T.
Title: The Potential of Liquid Hydrogen as a Military Aircraft Fuel

ABSTRACT

Liquid hydrogen does not appear to be attractive as a military aircraft fuel for the immediate future. In a wide variety of mission applications, liquid hydrogen is less cost-effective and less energy-effective than the available alternative. Indications are that synthetic jet-fuel is the most attractive alternative fuel for very large airplanes. At the least, this conclusion appears valid until coal reserves are substantially depleted. (Report)

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B.1.2.2.61 77A13544 Oct 1976
USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio
Lippert, J.R.
Title: Vulnerability of Advanced Aircraft Fuel to Ballistic and Simulated Lightning Threats

ABSTRACT

Initial survey tests reported herein compared the response of confined LH2 and JP-4 to ballistic impacts and lightning strikes. The internal arcing effect requires further investigation. (Article: International J. of Hydrogen Energy, v 1 Oct 20, 1976)

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B.1.2.2.62 75A44792 Mar 1974
United Aircraft Research Laboratories, East Hartford, Conn.
Lessard, R.D.
Title: Liquid Hydrogen as a Fuel for Future Commercial Aircraft

ABSTRACT

A realistic cost is established for liquid hydrogen delivered to the aircraft, and the question is evaluated of whether liquid hydrogen at this cost level would be competitive with conventional aircraft fuels. It is found that the least expensive commercial method for producing hydrogen is coal gasification. It does not appear that liquid hydrogen produced by any of the present or proposed processes could supplant conventional aircraft fuel in commercial aircraft before the year 2000. (Paper:

Hydrogen energy: Proceedings of the Hydrogen Economy Miami Energy Conference, Miami Beach, FL, March 18-20, 1974)

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B.1.2.2.63 NTIS: PB-266 607/1ST Feb 76
Stanford Research Inst., Menlo Park, CA
Dickson, Edward M.
Title: The Hydrogen Economy: A Preliminary Technology Assessment

ABSTRACT

This report addresses the question of the feasibility of the use of hydrogen as a fuel. Competition among fuels in the energy marketplace and the need to derive hydrogen from other energy sources will insure that hydrogen does not become less expensive than alternatives for a very long time. Transitions involving change in basic infrastructure technologies, systems, and institutions are discussed. (Final Report)

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B.1.2.2.64 75A44791 1974
NASA, Langley Research Center, Hampton, VA
Korycinski, P.F.
Title: Hydrogen for the Subsonic Transport --- Aircraft Design and Fuel Requirements

ABSTRACT

Relations between air travel and fuel requirements are examined. Alternate fuels considered in connection with problems related to a diminishing supply of petroleum include synthetic jet fuel, methane, and hydrogen. Aircraft designs for alternate fuels are discussed, giving attention to hydrogen-related technology already available and new developments which are needed. (Hydrogen Energy; Proceedings of the Hydrogen Economy Miami Energy Conference, Miami Beach, FL, March 18-20, 1974. Part B.)

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B.1.2.2.65 73A38373 Aug 1973
NASA, Langley Research Center, Hampton, VA
Kirkham, F.S.
Title: Energy Supply and Its Effect on Aircraft of the Future. II - Liquid- Hydrogen-Fueled Aircraft: Prospects and Design Issues

ABSTRACT

The performance of hydrogen-fueled commercial aircraft is examined in the subsonic, supersonic, and hypersonic speed regime and compared with JP-fueled systems. Hydrogen aircraft are shown to provide substantial improvements in range and payload fraction as well as to minimize or eliminate many environmental problems. The major elements of a development program required to make hydrogen-fueled aircraft a commercial reality are also outlined and the rationale for and characteristics of both a subsonic demonstrator and a high speed research airplane are described.

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B.1.2.2.66 77A48709 Sep 1977
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Alternate Fuels for Future Aircraft

ABSTRACT

Compares liquid hydrogen fueled aircraft with synthetic Jet A fueled aircraft. Economics of fuel production considered. (Paper: 12th Intersociety Energy Conversion Engineering Conference, Washington, DC, Aug 28 - Sep 2, 1977)

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B.1.2.2.67 78A41924 Jul 1978
Bell Aerospace Co., Buffalo, NY
Sharpe, E.L.
Title: Durability of Foam Insulation for LH2 Fuel Tanks of Future Subsonic Transports

ABSTRACT

A description is presented of an experimental study regarding the suitability of commercially available organic foams as cryogenic insulation for liquid hydrogen tanks under extensive thermal cycling typical of subsonic airline type operation. Fourteen commercially available organic foam insulations were tested. Two unreinforced

polyurethane foams survived over 4200 thermal cycles (representative of approximately 15 years of airline service) without evidence of structural deterioration. The polyurethane foam insulations also exhibited excellent thermal performance. (Paper: International Cryogenic Materials Conference on Nonmetallic Materials and Composites at Low Temperatures, Munich, West Germany, July 10, 11, 1978)

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B.1.2.2.68 AD-775 176/1 Nov 73
California Univ. Berkeley, Dept. of Mechanical Engineering
Austin, Arthur L.
Title: The Hydrogen Fuel Economy and Aircraft Propulsion

ABSTRACT

Hydrogen fuel for aircraft propulsion; economic discussion; significant impact well after 1990. (Progress Report)

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B.1.2.2.69 N77-10032/9ST Sep 1975 - Feb 1976
Lockheed-California Co.,Burbank
Brewer, G.D.
Title: LH2 Airport Requirements Study

ABSTRACT

Assessment of facilities and equipment required at airport so liquid hydrogen LH2 can be used as fuel in long range transport aircraft. Facility includes the liquefaction plant, LH2 storage capability, and LH2 fuel handling system. Requirements for ground support and maintenance for LH2 fueled aircraft analyzed. Estimate made of capital and operating costs expected for the facility. Recommendations made for design modifications to the reference aircraft reflecting analysis of airport fuel handling requirements. Program of technology development for air terminal related items. (Final Report)

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B.1.2.2.70 AD-A028 224 Mar - Jul 74
Dayton Univ. Ohio Research Inst.
Schalit, L.M.
Title: Military Applications of Liquid Hydrogen Fueled Aircraft

ABSTRACT

This report examines certain aspects of the military use of LH2 as an alternate fuel for use in large military aircraft. These aspects include availability, cost, implications for aircraft design, mission capability, safety, and fuel tank vulnerability in a military threat environment. It is concluded that vulnerability in a military threat environment is the major topic which requires further attention in a comprehensive manner. (Report)

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B.1.2.2.71 NTIS/PS-75/379/8ST 1964 - Apr 75
National Technical Information Service, Springfield, VA
Hundemann, Audrey S.
Title: Hydrogen Energy (A Bibliography with Abstracts)

ABSTRACT

Abstracts dealing with production, storage, and use of hydrogen are presented. Production methods include coal gasification, bio-solar conversion, and production from water.

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B.1.2.2.72 77A23718 Mar 1976
NASA, Langley Research Center, Langley Station, Va.
Witcofski, R. D.
Title: The Thermal Efficiency and Cost of Producing Hydrogen and Other Synthetic Aircraft Fuels From Coal

ABSTRACT

A comparison is made of the cost and thermal efficiency of producing liquid hydrogen, liquid methane and synthetic kerosene from coal. These results are combined with estimates of the cost and energy losses associated with transporting, storing, and transferring the fuels to aircraft. The results of hydrogen-fueled and kerosene-fueled aircraft performance studies are utilized to compare the economic viability and efficiency of coal resource utilization of synthetic aviation fuels. (Paper: Energy Research and Development Administration, World Hydrogen

Energy Conference, 1st, Miami Beach, Fla., Mar 1-3, 1976)

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B.1.2.2.73 N75-21154/OST Apr 75
NASA, Ames Research Center, Moffett Field, Calif.
Alexander, A.D.
Title: United States Transportation Fuel Economics (1975 - 1995)

ABSTRACT

Review/ evaluation of aviation fuels; JP, liquid methane, liquid hydrogen; economics, portable fuel-processing alternatives; guidance/strategy for NASA development of aviation/air transport research and technology. (Report)

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B.1.2.2.74 N72-32742 Sep 72
NASA, Ames Research Center, Moffett Field, Calif.
Alexander, A. D. III
Title: Economic Study of Future Aircraft Fuels (1970 - 2000)

ABSTRACT

Future aircraft fuels are evaluated in terms of fuel resource availability and pricing, processing methods, and economic projections over the period 1970 - 2000. Liquefied hydrogen, methane and propane are examined as potential turbine engine aircraft fuels relative to current JP fuel. (Report)

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B.1.2.2.75 AD:A055 024/4ST Jun 78
Defense Intelligence Agency, Washington, DC
Busi, James D.
Title: Hydrogen Technology - Foreign

ABSTRACT

Survey of hydrogen and synthetic fuel technology research in foreign countries (Western and Communist). (Report)

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B.1.2.2.76 N74-32432/8SL 1 Aug 74
NASA, Langley Research Center, Langley Station, VA
Snow, D.
B.
Title: A Study of Subsonic Transport Aircraft Configureations Using Hydrogen (H2) and Methane (CH4) as Fuel

ABSTRACT

The acceptability of alternate fuels for future commercial transport aircraft are discussed. Using both liquid hydrogen and methane, several aircraft configurations are developed and energy consumption, aircraft weights, range and payload are determined and compared to a conventional Boeing 747-100 aircraft. The results shown that liquid hydrogen can be used to reduce aircraft energy consumption and that methane offers no advantage over JP or hydrogen fuel. (Report)

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B.1.2.2.77 AD-B039 187L May 79
Air Command and Staff Coll, Maxwell AFB, ALA
Baker, Vincent T.
Title: Alternate Fuel Sources for Future USAF Aircraft

ABSTRACT

Study of ability of synfuel (coal or shale oil derived), liquid hydrogen, and nuclear energy to perform airlift and station- keeping AF missions. Synfuel and liquid hydrogen are attractive; nuclear power considered unacceptable. (Report)

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B.1.2.2.78 N79-32637/7 Sep 1979
NASA, Langley Research Center, Hampton, VA
Witcofski, R.D.
Title: Comparison of Alternate Fuels for Aircraft

ABSTRACT

Liquid hydrogen, liquid methane, and synthetic aviation kerosene were assessed as alternate fuels for aircraft in terms of cost, capital requirements, and energy resource utilization. Fuel transmission and airport storage and distribution facilities are considered. Environmental emissions and safety aspects of fuel selection are discussed and detailed descriptions of various fuel production and liquefaction processes are given. Technological deficiencies are identified. (Paper: Presented at

the International Dglr/Dflr Symp. On Hydrogen in Air Transportation, Stuttgart, Germany, 11-14 Sep 1979)

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B.1.2.2.79 79J0115972 1945-1959
NASA, Washington DC
Sloop, J.L.
Title: Liquid Hydrogen as a Propulsion Fuel, 1945-1959

ABSTRACT

A historical review, covering the period 1945-1959, is presented of the research of liquid hydrogen as potential propellant for aerospace vehicles. The following topics are covered: Air Force research on hydrogen; hydrogen-oxygen for a Navy satellite; hydrogen technology from thermonuclear research; NASA research on high-energy propellants and on hydrogen for high-altitude aircraft; the early US space program; early high-energy upper states; large engines and vehicles of 1958; and the Saturn vehicle of 1959.

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B.1.2.2.80 N78-22073/8St Jun 1977
NASA, Washington DC
Aiken, W.S.
Title: Alternate-Fueled Transport Aircraft Possibilities

ABSTRACT

(1) NASA's cryogenically fueled aircraft program; (2) LH2 subsonic and supersonic transport design possibilities (3) the fuel system and ground side problems associated with LH2 distribution; (4) a comparison of LCH4 with LH2; (5) the design possibilities for LCH4 fueled aircraft. (Paper: 13th Cong. Intern. Aeron., Paris, 2:3 Jun 1977)

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B.1.2.2.81 N75-10943/9ST Jul - Dec 1973
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Advanced Supersonic Technology Concept Study: Hydrogen Fueled Configuration

ABSTRACT

Conceptual designs of hydrogen fueled supersonic transport configurations developed and compared with equivalent Jet A-1 fueled vehicles to determine the economic and performance potential of liquid hydrogen as an alternate fuel. Evaluation of costs and environmental considerations. Technology development requirements presented. (Final Report)

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B.1.2.2.82 N79-33207/8 Jan 75
Lockheed-California Co, Burbank
Brewer, G.D.
Title: Study of the Application of Hydrogen Fuel to Long-Range Subsonic Transport Aircraft. Volume 1: Summary

ABSTRACT

Feasibility of using liquid hydrogen in long range, subsonic transport aircraft assessed. Comparisons of physical, performance, and economic parameters of the LH2 fueled designs with conventionally fueled aircraft. Design studies to determine characteristics for hydrogen related systems required on board the aircraft. Include material, structural, and thermodynamic requirements of cryogenic fuel tanks and fuel systems with the structural support and thermal protection systems. (Final Report)

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B.1.2.2.83 N76-19144/4ST Jul - Dec 1975
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Study of LH2 Fueled Subsonic Passenger Transport Aircraft

ABSTRACT

Liquid hydrogen as fuel in subsonic transport aircraft investigated to explore aircraft sizes. Both liquid hydrogen and conventionally fueled aircraft in each mission category compared on the basis of weight, size,

cost, energy utilization, and noise. (Final Report)

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B.1.2.2.84 N75-30163/0ST Jan 75
Lockheed- California Co., Burbank
Brewer, G.D.
Title: Study of the Application of Hydrogen Fuel to Long-Range Subsonic Transport Aircraft, Volume 2

ABSTRACT

Feasibility and potential advantages/disadvantages of liquid hydrogen in long range, subsonic transport aircraft studies. Liquid hydrogen and Jet A fueled aircraft compared on basis of weight, size energy utilization, cost, noise, emissions, safety, and operational characteristics. Program of technology development formulated. (Final Report)

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B.1.2.2.85 N78-31086/9ST Jul 78
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Study of Fuel Systems for LH2-Fueled Subsonic Transport Aircraft, Volume 2

ABSTRACT

Engine concepts examined for use with hydrogen fuel in aircraft. Candidate tank structure and cryogenic insulation systems evaluated. Designs of aircraft fuel system (pumps, lines, valves, regulators, and heat exchangers) received attention. Designs of boost pumps mounted in the LH2 tanks, and high pressure pump mounted on the engine were defined. Aircraft compared with conventionally fueled counterpart. (Final Report)

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B.1.2.2.86 75A40521 May 1975
General Dynamics Corp., St. Louis, MO
Carline, A.J.K.
Title: Future Hydrogen Fueled Commercial Transports

ABSTRACT

An examination of the problems inherent in the design of future subsonic liquid hydrogen fueled transports with analysis of economics of operations. (Paper: SAE Air Transportation Meeting, Hartford, CN, May 6-8, 1975)

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B.1.2.2.87 EI760743190 Mar 1976
NASA, Langley Research Center, Hampton, VA
Wieting, Allan R.
Title: Thermal-Structural Design/Analysis of an Airframe-Integrated Hydrogen-Cooled Scramjet

ABSTRACT

This paper presents the salient features of a preliminary thermal-structural design and analysis study of a hydrogen- fueled, regeneratively cooled, airframe-integrated scramjet. State-of-the-art analytical methods consisting of lumped system and finite-difference steady-state thermal analyses and a finite-element structural analysis were used. The results of the study indicated that this scramjet concept is viable from both a structural mass and cooling requirement standpoint. (Paper: J Aircr v 13 n 3 Mar 1976)

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B.1.2.2.88 73A43499 Sep 1973
NASA, Langley Research Center, Hampton, VA
Small, W.J.
Title: Potential of Hydrogen Fuel for Future Air Transportation Systems

ABSTRACT

Recent studies have shown that hydrogen fuel can yield spectacular improvements in aircraft performance in addition to its more widely discussed environmental advantages. The characteristics of subsonic, supersonic, and hypersonic transport aircraft using hydrogen fuel are discussed, and their performance and environmental impact are compared to that of similar aircraft using conventional fuel. (Paper: Intersociety Conference on Transportation, 2nd, Denver, Colo., Sept 23-27, 1973)

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B.1.2.2.89 75A47495 May 1975
Lockheed-California Co., Burbank, CA
Jensen, R.
Title: Liquid Hydrogen - Fuel of the Future --- for Aircraft

ABSTRACT

Liquid hydrogen is compared to petroleum-based fuels for propulsion of various types of vehicles. Aircraft design, performance and cost are considered. Fuel production and handling are discussed. (Paper: 34th Ann. Conf. Soc. of Allied Weight Engineers, Seattle, May 5-7, 1975)

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B.1 FUELS TECHNOLOGY

B.1.3 OTHER AVIATION FUELS

B.1.3.1 NAVY FUNDED

B.1.3.1.1 74A39738 May 1974
U.S. Naval Air Propulsion Test Center, Trenton, NJ
Maggitti, L., Jr.
Title: Development of Alternate Sources of JP-5 Fuel --- Domestic Nonpetroleum Resources

ABSTRACT

Limits in the U.S. and world-wide resources of petroleum make it desirable to exploit domestic nonpetroleum resources for applications now served by liquid petroleum derivatives. An investigation was conducted to explore the possibilities for obtaining a JP-5 type fuel for naval aircraft from nonpetroleum materials available in sufficient quantities in the U.S. Questions of Navy fuel usage are considered along with gas turbine engine fuel consumption trends. Attention is given to the possibility to obtain the jet fuel from oil shale and from coal. (Paper: Proceedings of National Conference on Environmental Effects on Aircraft and Propulsion Systems, 11th,Trenton, NJ, May 21-23, 1974)

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B.1.3.1.2 AD-A023 435 Jan 76
Tetra Tech Inc., Arlington VA
Tomlinson, Glen
Title: Navy Energy Research and Development Quarterly Report

ABSTRACT

This report includes an overview of the Navy Energy R and D program. Fuel requirements for Naval ships, aircraft and shore installations are summarized. Emphasis is given to alternate sources of energy, synthetic fuels and energy conservation. (Report)

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B.1.3.1.3 76R0022309 Oct 1974
Naval Weapons Center, China Lake, Calif.
Nielsen, A.T.
Title: New Class of High- Density Fuels

ABSTRACT

A new class of high-density fuels has been synthesized--the 7--(n.N-Dialkylamino)-1,3,5Triazaadamantanes (Diadam Fuels). Properties are discussed. (Report)

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B.1.3.1.4 SSIE: ZQN 796813 10/76 to 9/78
Naval Propulsion Test Center, Trenton, NJ 08628
Nowack, C.J.
Title: Feasibility of the Use of Diesel Fuel, Marine, as Aircraft Fuel

ABSTRACT

Determine the suitability or adaptability of diesel fuel, marine (DFM) for emergency use in aircraft gas turbine power plants. (Plan)

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B.1.3.1.5 SSIE: GQN 524574 8 10/61 to Cont
Purdue University, School of Engineering, Dept. of Mechanical Engineering, Executive Bldg., West Lafayette, Indiana 47907
Murthy, S.N.
Title: Research Supporting Jet Propulsion Technology (Project Squid)

ABSTRACT

In the project "principles of chemical propulsion and armaments," this task is a major effort in support of jet propulsion technology; it generates understanding and expansion of knowledge required for the development of jet devices used in Naval aircraft, missiles and space vehicles. The objectives of Squid are: (1) stimulate interests of scientists and engineers in solving Navy-related problems, (2) plan and support basic and applied research relating to jet propulsion, and (3) provide capability for conducting special studies, consulting and probing new avenues of relevant research. (Notice)

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B.1.3.1.6 AD-A-007353 1974
Georgia Inst. of Tech., Atlanta
Ashby, E.C.
Title: Complex Metal Hydrides. High Energy Fuel Components for Solid Propellant Rocket Motors. Annual Report, 1 January - 31 December 1974

ABSTRACT

During the contract period, work has continued on the preparation and structure elucidation of simple and complex metal hydrides of the main group elements. (Progress Report)

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B.1.3.1.7 SSIE: GQN 823133 8 3/68 to Cont
Georgia Inst. of Technology, School of Chemistry, 225 North Ave., NW, Atlanta Georgia 30332
Ashby, E.C.
Title: Synthesis and Characterization of New Complex Light Metal Hydrides

ABSTRACT

New or improved chemical rocket propellants are needed for the propulsion systems of Navy vehicles for tactical and surveillance missions in the atmosphere and nearby space. This task in seeking new hydrides as candidate ingredients for solid propellants may contribute significantly to the fuel portions of rocket propellants at higher energy levels. Study the stability of diethyl ether soluble aluminim hydride, discovered under this contract, and its use in the synthesis of other simple and complex metal hydrides. Continue the preparation and characterization of complex metal hydrides of copper and initiate studies on new complex hydrides of beryllium. (Plan)

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B.1 FUELS TECHNOLOGY

B.1.3 OTHER AVIATION FUELS

B.1.3.2 NON NAVY FUNDED

B.1.3.2.1 74A38898 Mar 1974
New York, American Institute of Aeronautics and Astronautics, Inc.
Grey, J.
Title: Aircraft Fuel Conservation: An AIAA View: Proceedings of a Workshop Conference, Reston, VA, March 13 - 15, 1974

ABSTRACT

Aspects of aircraft fuel conservation are reviewed and discussed, and measures are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Principal measures included: increasing load factors, achieved by revised rerouting and schedulilng and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical "winglet" located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuels currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics.

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B.1.3.2.2 74A35496 June 1974
Unknown
Masefield, P.
Title: Fuel State - Expensive

ABSTRACT

There are real possibilities in the use of liquid hydrogen, although many problems remain, not least those of ground handling. Moreover, production of liquid hydrogen at present requires fossil fuels as the energy source. The whole purpose of using liquid hydrogen can be served only by the development of manufacturing cycles based on the use of nuclear, geothermal, tidal, solar, or hydroelectric power. To convert a petroleum-operating air-transport economy to a liquid-hydrogen operated air-transport economy would be vastly expensive. One other attractive nonfossil fuel would appear to be ethanol, which can be produced by solar energy from fermented cereal grain. It is not anticipated that oil supplies will run short in this century, and coal is even more plentiful. (Paper: Flight International, vol. 105, June 27, 1974)

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B.1.3.2.3 AIAA-80-0896 May 1980
NASA, Lewis Research Center, Cleveland, Ohio
Grobman, J.
Title: The Impact of Fuels on Aircraft Technology Through The Year 2000,

ABSTRACT

Broadening fuel properties could penalize the performance, durability, and reliability of the propulsion system unless actions are taken to develop the technology required to use broader property fuels. This paper describes research being conducted to (1) determine the potential range of properties for future jet fuels, (2) establish a data base of fuel property effects on propulsion system components, (3) evolve and evaluate advanced component technology that would permit the use of broader property fuels and (4) identify technical and economic trade-offs within the overall fuel production-air transportation system associated with variations in fuel properties. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000" May 6 - 8 1980, Baltimore, MD)

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B.1.3.2.4 AIAA: 80-0914 May 1980
NASA, Lewis Research Center, Cleveland, Ohio 44135
Weber, R.
Title: Aeropropulsion in Year 2000

ABSTRACT

Many advances can be anticipated in propulsion systems for aircraft in the next 20 years. This paper presents a sampling of probable future engine types such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports. This is followed by a brief review of related technology improvements in propellers, materials, noise suppression, etc. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8 1980, Baltimore, MD)

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B.1.3.2.5 76A36606 May 1976
Unknown
Stern, J.
Title: Aircraft Propulsion - A Key to Fuel Conservation: An Aircraft Manufacturer's View

ABSTRACT

A range of possible approaches to fuel conservation is examined. The fuel contributions to direct operating costs, aircraft operations and maneuvers designed to conserve fuel, aircraft design variants, modifications, and refittings capable of aiding fuel conservation are discussed. Advantages of turbofan and turboprop derivatives of basic aircraft designs are examined. The RECAT (Reducing Energy Consumption of Commercial Air Transportation) program is outlined. The possible impact of recent technological advances in aircraft design (supercritical airfoils, optimized wing geometry, longitudinal stability augmentation, composites, new metallic structures) on fuel conservation is examined. (Paper: Society of Automotive Engineers, Air Transportation Meeting, New York, NY, May 18 - 20, 1976)

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B.1.3.2.6 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the Forum, Detroit, Michigan, October 15, 1975)

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B.1.3.2.7 AD-A066 985/8ST Dec 77 - Oct 78
Rockwell International, Los Angeles, CA, Los Angeles Div.
Robinson, Douglas A,.
Title: The Impact of Alternate Fuels on Aircraft Configuration Characteristics

ABSTRACT

Study the effect of alternate fuel usage for three classifications of advanced technology vehicles for a post-2000 time period. Alternate fuel design vehicles offer 35 to 45 percent weight reduction. Life-cycle cost savings estimated as function of fuel cost showed fuels 10 to 15 times the basepoint resulted in breakeven LCC with the more exotic fuels. (Final Report)

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B.1.3.2.8 76N19295 Jan 1976
Pinkel, I. Irving, Consultant, Fairview Park, Ohio
Pinkel, I.I.
Title: Future Fuels for Aviation

ABSTRACT

The fuel supply outlook within the NATO nations is considered. Hydrocarbon fuels, alternate fuels as well as specification changes for fuels and changes in aircraft design and operation are discussed. Recommendations for future programs are included.

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B.1.3.2.9 N74-32432/8SL 1 Aug 74
National Aeronautics and Space Administration, Langley Research Center, Langley Station, VA
Snow, D.
B.
Title: A Study of Subsonic Transport Aircraft Configurations Using Hydrogen (H2) and Methane (CH4) as Fuel

ABSTRACT

The acceptability of alternate fuels for futu e commercial transport aircraft are discussed. Using both liquid hydrogen and methane, several aircraft configurations are developed and energy consumption, aircraft weights, range and payload are determined and compared to a conventional Boeing 747-100 aircraft. The results show that liquid hydrogen can be used to reduce aircraft energy consumption and that methane offers no

advantage over JP or hydrogen fuel. (Report)

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B.1.3.2.10 N79-32637/7 Sep 1979
National Aeronautics and Space Administration, Langley Research Center, Hampton, VA
Witcofski, R.D.
Title: Comparison of Alternate Fuels for Aircraft

ABSTRACT

Liquid hydrogen, liquid methane, and synthetic aviation kerosene were assessed as alternate fuels for aircraft in terms of cost, capital requirements, and energy resource utilization. Fuel transmission and airport storage and distribution facilities are considered. Environmental emissions and safety aspects of fuel selection are discussed and detailed descriptions of various fuel production and liquefaction processes are given. Technological deficiencies are identified. (Paper: Presented at the International Dglr/Dflr Symp. On Hydrogen in Air Transportation, Stuttgart, Germany, 11-14 Sep 1979)

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B.1.3.2.11 78A18669 1977
Direction Generale de l'Aviation Civile, Paris, France
Troadec, J.P.
Title: Current and Future Fuels for Transport Aircraft

ABSTRACT

Some of the basic characteristics of liquid hydrogen and methane as aircraft fuels are compared with the characteristics of the current Jet A and synthetic Jet A fuels. Liquid hydrogen's advantages include an elevated ratio of calorific value to mass, its nonpolluting combustion, and the fact that it can be obtained nearly everywhere without large transportation costs. Its disadvantages include the storage problem, the safety question, and its cost. Liquid methane has smaller production cost and requires less energy for production than liquid hydrogen. (Article: France Transports - Aviation Civile, Fall 1977, in French)

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B.1.3.2.12 N75-21154/0ST Apr 75
NASA, Ames Research Center, Moffett Field, CA
Alexander, A.D. III
Title: United States Transportation Fuel Economics (1975 - 1995)

ABSTRACT

Review/evaluation of aviation fuels; JP, liquid methane, liquid hydrogen; economics, portable fuel-processing alternatives; guidance/strategy for NASA development of aviation/air transport research and technology. (Report)

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B.1.3.2.13 N72-32742 Sep 72
NASA, Ames Research Center, Moffett Field, CA
Alexander, A.D. III
Title: Economic Study of Future Aircraft Fuels (1970- 2000)

ABSTRACT

Future aircraft fuels are evaluated in terms of fuel resource availability and pricing, processing methods, and economic projections over the period 1970-2000. Liquefied hydrogen, methane and propane are examined as potential turbine engine aircraft fuels relative to current JP fuel. (Report)

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B.1.3.2.14 75A44769# Mar 1974
Union Carbide Corp., New York, NY
Johnson, J.E.
Title: An Economic Perspective on Hydrogen Fuel

ABSTRACT

Economic aspects of the production of different energy carriers are reviewed. Synthetic kerosene, hydrogen, methane, ammonia, and methanol are considered. Major factors discussed: (1) the capital investment required to convert fuel to energy; and (2) the total resources consumed in accomplishing a given task efficiently. (Paper: Hydrogen energy: Proceedings of the Hydrogen Economy Miami Energy Conference, Miami Beach, FL, March 18-20, 1974, Part A)

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B.1.3.2.15 75N16980 1974
Pinkel, I. Irving, Fairview Park, Ohio
Pinkel, I.I.
Title: Alternative Fuels for Aviation

ABSTRACT

The status of energy programs to provide hydrocarbon fuels from new sources is examined. Experience in the United States with non-hydrocarbon fuels for turbine powered aircraft is analyzed. The various alternate sources of hydrocarbon fuels are defined. The use of metals and metal slurries as turbine fuels is proposed. The advantages and disadvantages of liquid hydrogen as an aircraft fuel are discussed. A specific example of an aircraft operating on liquid hydrogen is described. (Paper: AGARD The 1974 AGARD Ann. Meeting)

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B.1.3.2.16 79A49376 Jun 1978
Unknown
Newman, M.
Title: Utilization of Alternative Fuels for Transportation; Proceedings of the Symposium, University of Santa Clara, Santa Clara, CA, June 19-23, 1978

ABSTRACT

Overview of alternative fuel development deals with such issues as energy supply and fuel manufacturing/processing and storage and distribution. Attention is given to fuels for vehicles and aircraft. (Paper: Symposium sponsored by the U.S. Dept. of Energy New York, American Institute of Aeronautics and Astronautics, Inc., 1978)

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B.1.3.2.17 76A24265 Mar 1976
Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Flugtreib- und Schmierstoffe, Munich, West Germany
Jantzen, E.
Title: Aviation Fuels and Lubricants --- Review

ABSTRACT

Review of investigations concerned with the availability of currently used aviation fuels and possibilities for their replacement. The use of liquid hydrogen as fuel appears, in principle, to be feasible. A number of difficulties have to be overcome. An intermediate employment of liquid

methane is considered. Attention also given to studies regarding the use of synthetic hydrocarbons obtained from coal or oil shale products. (Article: VDI-Z, vol. 118, no. 5, Mar 1976. In German)

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B.1.3.2.18 79N13026 Jan 1977
General Dynamics/Convair, San Diego, CA
Oman, B.H.
Title: Vehicle Design Evaluation Program (VDEP).

ABSTRACT

The NASA Langley Research Center vehicle design evaluation program (VDEP-2) was expanded by incorporating into the program a capability to conduct preliminary design studies on subsonic commercial transport type aircraft using both JP and such alternate fuels as hydrogen and methane. (Report)

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B.1.3.2.19 75A36719 May 1975
Cranfield Institute of Technology, Cranfield, Beds., England
Goodger, E.M.
Title: Alternative Fuels for Aviation

ABSTRACT

Overall characteristics of alternative fuels, proposed to meet the desired technological improvements are discussed, together with the feasibility of using these possible replacements for petroleum products in the aviation industry. Low and high density fuels, hydride fuels, carbon containing fuels, vaporising and/or endothermically reacting fuels, hydrocarbon fuels, aromatic mixtures, liquid methane, liquid hydrogen, nitrogen hydrides, alcohols, nuclear fuels, and various mixtures are analyzed for their performance, levels of volumetric and combined gravimetric energy densities, handling safety, pollution, thermal stability and capacity, and availability. (Paper: Aeronautical Journal, vol. 79, May 1975)

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B.1.3.2.20 78A23420# Feb 1978
Lockheed California Co., Burbank, CA
Hawkins, W.M.
Title: Where Aerospace Can Serve Afresh - Paths to Energy Independence

ABSTRACT

Feasibility of of developing new energy technologies. Among the new technologies proposed are: using fusion explosions to generate superheated steam, nuclear-based conversion of seawater hydrogen, methane production from plants and waste, ocean thermal energy conversion, and coal gasification. (Paper: Astronautics and Aeronautics, vol. 16, Feb 1978)

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B.1.3.2.21 79A49381# Jun 1978
Pan American World Airways
Borger, J.C.
Title: Alternative Fuels in Aviation

ABSTRACT

The state of the art and expected future advances of alternative fuels in aviation are discussed. Consideration is given to uses of liquid hydrogen and methane, broadening of turbine fuel specifications, increased aromatics, decreased flashpoint, increased freeze point, thermal stability, synthetic fuels, and the refinery process. It is noted that major fuel efficiency improvements resulting from the NASA ACEE program probably will not appear before the late 1980s. (Paper: Utilization of Alternative Fuels for Transportation; Proceedings of the Symposium, Santa Clara, CA, June 19-23, 1978)

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B.1.3.2.22 76A45397# Sep 1976
Rand Corp., Washington, DC
Mikolowsky, W.T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels

ABSTRACT

The paper examines the potential of very large airplanes (VLA) in the context of Air Force missions. Synthetic jet fuel, liquid methane, liquid hydrogen, and nuclear propulsion are the fuel alternatives selected for detailed analysis. It is shown that for most military applications, VLA with gross weight exceeding one million pounds promise to be superior to

contemporary vehicles in terms of cost and energy effectiveness. The conventional jet fuel (made from coal, oil shale or crude oil) appears to be the most effective at least up to year 2000. Nuclear propulsion is attractive only for station-keeping missions requiring larger station radii (greater than about 4000 nautical miles). (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Dallas, TX, Sep 27-29, 1976)

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B.1.3.2.23 77A47271# Sep 1977
Rand Corp., Washington DC
Mikolowsky, W.T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

Study evaluating very large airplanes (VLAs) in the context of Air Force missions and the most attractive alternative fuel for these airplanes. The chemical fuel alternatives considered are liquid hydrogen, liquid methane, and synthetic JP, each of which can be readily synthesized from coal. The nuclear-fueled VLA was a fourth candidate aircraft. Concluded that overall conventional hydrocarbon jet fuel remains the most attractive fuel for military aircraft. Nuclear propulsion is attractive only for station-keeping missions requiring large station radii. (Paper: Astronautics and Aeronautics, vol. 15, Sep 1977)

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B.1.3.2.24 77N33154# Dec 1976
Rand Corp., Santa Monica, CA
Mikolowsky, W.T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels: ExecutiveSummary

ABSTRACT

This report summarizes the military utility of very large airplanes (over 1 million pounds gross weight) and examines several alternative fuels that could be used by such airplanes. (Exec Summary Report)

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B.1.3.2.25 78N29063*# 1978
NASA, Langley Research Center, Langley Station, VA
Witcofski, R.D.
Title: Progress on Coal-Derived Fuels for Aviation Systems

ABSTRACT

The results of engineering studies of coal-derived aviation fuels and their potential application to the air transportation system are presented. Synthetic aviation kerosene (Syn. JET-A), liquid methane (LCH4) and liquid hydrogen (LH2) appear to be the most promising coal-derived fuels. Aircraft configurations fueled with LH2, their fuel systems, and their ground requirements at the airport are identified. Energy efficiency, transportation hazards, and costs are among the factors considered. It is indicated that LCH4 is the most energy efficient to produce, and provides the most efficient utilization of coal resources and the least expensive ticket as well. (Paper: CTOL Transport Technol., 1978)

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B.1.3.2.26 78N28051# Sep 1977
Rand Corp., Santa Monica, CA
Mikolowsky, W.T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

The specific objectives of this work were: Evaluate very large airplanes (VLAs) in the context of exsisting and possible future Air Force Missions, and determine the most attractive alternative fuel for airplanes of this type. (Report)

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B.1.3.2.27 79N13193# Sep 1978
Imperial Coll. of Science and Technology, London, England
Macfarlane, J.J.
Title: Future Fuels for Aviation

ABSTRACT

Background of the current aviation gas turbine fuel specification is described. The prospects for petroleum based aviation fuel are evaluated. The long term sources of aviation fuel are described and the problem areas enumerated. The need for a research program on alternative fuels is demonstrated. Potential contribution of fundamental research in the

alternative aviation fuels program is outlined. (Paper: AGARD Aircraft Eng. Future Fuels and Energy Conserv.)

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B.1.3.2.28 AD-A060 322 Jan 75 - Aug 77
Dayton Univ. Ohio Research Inst.
Berner, William E.
Title: Behavior of Nonmetallic Materials in Shale Oil Derived Jet Fuels and in High Aromatic and High Sulfur Petroleum Fuels

ABSTRACT

The increased pressure on decreasing fuel supplies has prompted the Air Force to examine fuels previously considered unacceptable. Fuels derived from shale oil and fuels high in sulfur and mercaptan sulfur were among those considered unacceptable. The objective of this program was to evaluate nonmetallic aircraft materials relative to increased levels of aromatics, sulfur, and mercaptan sulfur. Aircraft materials that are normally in contact or exposed to fuels were evaluated in ten fuel formulations. (Final Report)

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B.1.3.2.29 78A15021 Jun 1977
ONERA, Chatillon-sous-Bagneux Hauts-de-Seine, France
Barrere, M.
Title: Future Fuels for Aviation

ABSTRACT

A review is presented of global energy consumption. Fuel characteristics currently required by aircraft engines are discussed. Suggestions are made with regard to the development of policies for both fuel consumption reduction and the development of new fuel sources, such as (1) economic analyses of fuels currently used and their projected availability, (2) the potential combination of oil-derived and synthetic fuels, and (3) the creation of wholly synthetic fuels, perhaps based on methane and hydrogen. (Paper: L°Aeronautique et l°Astronautique, No. 66, 1977)

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B.1.3.2.30 EI 790314064 Sep 1978
Boeing Commer. Airpl. Co., Seattle, Washington
Miller, M.P.
Title: Transportation and the U.S. Petroleum Resource: An Aviation Perspective

ABSTRACT

This paper provides an overview of several facets of commercial aviation fuel consumption: the merits of its public services, the conservation measures taken to date, the consequences of future shortages, energy conservation strategies, modal efficiency comparisons, and alternate fuels considerations. (Paper: J Energy v2 n5 Sep - Oct 1978)

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B.1.3.2.31 N79-33205/2 Aug 79
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Taylor, J.R.
Title: Analytical Evaluation of the Impact of Broad Specification Fuels on High Bypass Turbofan Engine Combustors

ABSTRACT

Six conceptual combustor designs for the CF6-50 high bypass turbofan engine and six conceptual combustor designs for the NASA/GE E3 high bypass turbofan engine were analyzed to provide an assessment of the major problems anticipated in using broad specification fuels. Designs were analyzed to estimate combustor performance, durability, and pollutant emissions when using commercial Jet A aviation fuel and when using experimental referee board specification fuel. Results indicate that lean burning, low emissions double annular combustor concepts can accommodate a wide range of fuel properties without a serious deterioration of performance or durability. However, rich burning, single annular concepts would be less tolerant to a relaxation of fuel properties. (Final Report)

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B.1.3.2.32 78A31308# Oct 1977
Imperial Oil Enterprises, Ltd., Sarnia, Ontario, Canada
Rupar, C.
B.
Title: Aviation Fuels - A Supplier's Perspective

ABSTRACT

Current availability of aviation kerosene is limited by the freeze point, flash point and aromatics content. In the future these constraints will become more critical as increasing volumes of synthetic liquids are produced to supplement natural petroleum. Ideally, to maximize security of supply and to control cost, the next generation of aircraft should be designed to operate safely and efficiently on fuels with a wider range of properties. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings)

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B.1.3.2.33 78N24369*# Oct 1978
NASA, Lewis Research Center, Cleveland, Ohio
Rudey, R.A.
Title: Impact of Future Fuel Properties on Aircraft Engines and Fuel Systems

ABSTRACT

Paper describes and discusses the propulsion-system problems that will most likely be encountered if the specifications of hydrocarbon-based jet fuels must undergo significant changes in the future and, correspondingly, the advances in technology that will be required to minimize the adverse impact of these problems. (Lecture Ser. 96, Paris, Munich, and London, 12-20 Oct 1978: sponsored by AGARD)

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B.1.3.2.34 79A12376 Oct 1977
Western Michigan University, Kalamazoo, Michigan
Behm, H.D.
Title: National Conference on Energy Conservation in General Aviation, 1st Kalamazoo, Mich., October 10, 11, 1977, Proceedings

ABSTRACT

Topics discussed include alternative aviation turbine fuels, economy in flight operations, and efficiency through angle-of-attack monitoring. (Proceedings)

B.1.3.2.35 N78-13056/4ST Sep 77
NASA, Lewis Research Center, Cleveland, Ohio
Butze, H.F.
Title: Effect of Fuel Properties on Performance of Single Aircraft Turbojet Combustor at Simulated Idle, Cruise, and Takeoff Conditions

ABSTRACT

The performance of a single-can JT8D combustor was investigated with a number of fuels exhibiting wide variations in chemical comosition and volatility. Performance parameters investigated were combustion efficiency, emissions of CO, unburned hydrocarbons and nitrogen oxides, as well as liner temperatures and smoke. The most pronounced effect of changes in fuel composition were observed at simulated cruise and takeoff conditions where smoke and liner temperatures increased significantly as the hydrogen content of the fuel decreased. At the simulated idle condition, emissions of CO and unburned hydrocarbons increased slightly and, accordingly, combustion efficiencies decreased slightly as the hydrogen content of the fuels decreased. (Report)

B.1.3.2.36 AD-A042 272 Apr 75 - Sep 76
Institute for Defense Analyses, Arlington, VA, Science and Technology Div.
Riddell, F.R.
Title: DoD Energy R and D. Part II. Military Fuel Options. Performance and R and D Implications

ABSTRACT

Questions addressed and conclusions reached in study are: (1) What range of multifuel capability may be desirable in military engines to relieve possible fuel supply problems? Conclusion is that it would be advantageous for military aircraft to be able to use all types of jet fuels. (2) What liquid hydrocarbon fuel options may be considered without incurring major performance degradation or severe maintenance problems? Conclusion is that with appropriate modifications to fuel supply and starting systems, the range of fuels defined in (1) could be used. However, R and D is needed. Fuels from syncrudes should be included in this R and D work. (Final Report)

B.1.3.2.37 AD-A067 709/6ST Jun - Nov 76
Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH
Jackson, Thomas A.
Title: Fuel Hydrogen Content as an Indicator of Radioactive Heat Transfer in an Aircraft Gas Turbine Combustor

ABSTRACT

Eleven fuels representing a wide range of hydrogen content were studied using a T56 single can combustor rig. Test fuels included single and double ring aromatic types as well as paraffins blended with each other and with JP-4. Fuel mixtures with hydrogen contents ranging from 9.9 to 15.9 per cent by weight were examined. (Final Report)

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B.1.3.2.38 79N12192# Oct 1978
Advisory Group for Aerospace Research and Development, Paris, France
Unknown
Title: Aircraft Engine Future Fuels and Energy Conservation

ABSTRACT

Current and forecasted world energy demand, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs. The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal, oil shale, and tar sands) and techniques for reducing energy consumption in refining processes are examined. Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems. An assessment is made as to what technology advancements are currently underway and what other advancements are needed with reference to engine components, engine systems, aircraft designs and operational procedures to help conserve fuel resources. (AGARD Lectures in Munich and London, Oct 1978)

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B.1.3.2.39 N68-35584*# Aug 1968
NASA, Lewis Research Center, Cleveland, Oh
Weber, Richard J.
Title: A Review of the Potential of Liquid Methane Fuel for Supersonic Transports

ABSTRACT

Substitution of liquid methane fuel for conventional kerosene promises reductions in direct operating cost of 30 per cent or more. The best solution to the problem of fuel evaporation during flight is not yet evident. (Paper in Cryog. Eng. Conf., Cleveland, 19 - 21 Aug 1968)

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B.1.3.2.40 N70-30536 1970
NASA, Lewis Research Center, Cleveland, Ohio
Weber, R. J.
Title: Research in USA on LNG as an Airplane Fuel

ABSTRACT

Methane, the principal constituent of liquefied natural gas, is an attractive fuel for advanced airplanes. In particular, the commercial supersonic transport derives considerable benefit from methane's improved heating value and cooling capacity compared to conventional kerosene. Potential increases of about 30 per cent payload and a like reduction in direct operating cost have been predicted. However, the characteristics of liquid methane, such as its low boiling temperatures and relatively low density, cause practical problems in airplane design and operation. Research is being conducted in an attempt to illuminate and solve these problems. The work includes such areas as fuel tanks and insulation, engine fuel systems, combustors, and turbines. (Paper: 2nd Intern. Conf. on Liquefied Gas, Paris, 19 - 23 Oct. 1970, Sponsored by Intern. Gas Union,. Intern. Inst. of Refrig., and Intern. Inst. of Gas Technol.)

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B.1.3.2.41 SSIE: ZH 970129 1 0/79
NASA Lewis Research Center, 21000 Brookpark R., Cleveland, Ohio, 44135,
unk
Title: Broad Specification Fuels Technology

ABSTRACT

The objective of this effort is to demonstrate the technology required to utilize broad specification fuels in current and next generation commercial jet aircraft. (Plan)

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B.1.3.2.42 78N27059*# Jun 1978
NASA, Lewis Research Center, Cleveland Ohio
Grobman, J. S.
Title: Impact of Broad-Specification Fuels On Future Jet Aircraft Engine Components And Performance

ABSTRACT

The effects that broad specification fuels have on airframe and engine components were discussed along with the improvements in component technology required to use broad specification fuels without sacrificing performance, reliability, maintainability, or safety. (Paper: NASA Langley Res. Center CTOL Transport Technol., 1978)

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B.1.3.2.43 SSIE: GQF 460030 2 2/76 To 9/79
Monsanto Research Corp., 1515 Nicholas Rd., Box 8, Dayton Ohio, 45407
Hodgson, N.
Title: Analysis Of Aircraft Fuels

ABSTRACT

Program designed to provide a capability for solving non-routine problems in aircraft fuels technology. Encompasses the establishment of causes of operational problems, definition of fuel properties critical for optimizing combustion behavior and engine performance, and the development of techniques for determining specific fuel additives and trace contaminants. (Plan)

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B.1.3.2.44 78-17229/3ST Jun 77
NASA Lewis Research Center, Cleveland, Ohio
Longwell, J. P.
Title: Alternative Aircraft Fuels

ABSTRACT

The efficient utilization of fossil fuels by future jet aircraft may necessitate the broadening of current aviation turbine fuel specifications. The most significant changes in specifications would be an increased aromatics content and a higher final boiling point in order to minimize refinery energy consumption and costs. The effects that broadened specification fuels may have on present-day jet aircraft and engine components and the technology required to use fuels with broadened specifications are discussed. (Report)

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B.1.3.2.45 EI790314064 Sep 1978
Boeing Commer Airpl Co, Seattle, Wash
Miller, M. P.
Title: Transportation And The U. S. Petroleum Resource: An Aviation Perspective

ABSTRACT

This paper provides an overview of several facets of commercial aviation fuel consumption: the merits of its public services, the conservation measures taken to date, the consequences of future shortages, energy conservation strategies, modal efficiency comparisons, and alternate fuels considerationss. (Paper: J Energy V 2 N 5 Sep-Oct 1978)

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B.1.3.2.46 AD-A-065046 Apr 1976 Sep 1977
IIT Research Inst., Chicago, Il
Gray, A.
Title: Amine Fuels Via The Urea Process. Technical Report

ABSTRACT

Study of the production of hydrazine via the urea process. Primary effort of the program was devoted to the study of the chemistry of the reactions. Engineering design data were developed for several of the unit processes and have permitted a preliminary process design and economic evaluation. (Report)

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B.1.3.2.47 SSIE:ZQF4080602 7/75 To 9/80
U.S. Dept of Defense Air Force Engineering and Services Center, Engineering and Services Lab., Tyndall Air Force Base, Panama City, Florida 32403
MacNaughton, M.J.
Title: Environmental Fate of Hydrazine Fuels

ABSTRACT

Because of the increased use of the hydrazine family compounds in rocket fuels and in monopropellent generators, it is necessary to understand the chemistry of these compounds in the environment subsequent to their release by spills, venting or incomplete combustion. This data is necessary because of the toxic nature of these fuels and the requirement to assess the environmental effect of their use. The time dependent fate of these fuels will be determined in the atmospheric, aquatic and terrestrial phase. (Plan)

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B.1.3.2.48 N78-22073/8ST Jun 1977
National Aeronautics and Space Administration, Washington, D.C.
Aiken, W.S.
Title: Alternate-Fueled Transport Aircraft Possibilities

ABSTRACT

(1) NASA°s cryogenically fueled aircraft program; (2) LH2 subsonic and supersonic transport design possibilities (3) the fuel system and ground side problems associated with LH2 distribution; (4) a comparison of LCH4 with LH2; (5) the design possibilities for LCH4 fueled aircraft. (Paper: 13th Congr. Intern. Aeron., Paris, 2-3 Jun. 1977)

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B.1.3.2.49 75N16981 1974
National Aerospace Lab., Amsterdam (Netherlands)
Jaarsma, F.
Title: Impact of Future Fuels On Military Aero-Engines

ABSTRACT

The expected impact of the fossil fuel shortage on the design and operation of aircraft engines is discussed. Alternate fuels such as cryogenic fluids and synthetic fuels are proposed. Various aspects related to combustion of cryogenic and synthetic fuels are analyzed to examine the effects on seals, pumps, contamination, and engine operating

procedures. (Paper: 1974 AGARD Ann Meeting)

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B.1.3.2.50 AD-A054465/0ST 20 Jul 20 Aug 77
Air Force Aero Propulsion Lab Wright-Patterson AFB Ohio
Butler, Roland D.
Title: Hydrogen Content of Hydrocarbon Fuels by A Low-Resolution Nuclear Resonance Method

ABSTRACT

A low-resolution (wide-line) nuclear magnetic resonance determination of the hydrogen content of aircraft and missile fuels. The method is rapid and convenient, and requires minimal operator training. Accuracy and precision of the results compare favorably witth the best microcombustion techniques. (Interim Report).

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B.1.3.2.51 SSIE:DJ 501 1 1/69 to cont
U.S. Dept. of Energy, Div. of Petroleum and Natural Gas, Washington, District of Columbia, 22203
Ball, JS.
Title: Characterization of Petroleum

ABSTRACT

The objectives of this project are measurement of appropriate thermodynamic properties of organic compounds; analysis of the quality of gasoline, aviation and diesel fuels, and burner fuel oils; development of analytical methods for separating heavy ends of crude oils, removing acids, bases, and nitrogen compounds and separating heavy paraffins from aromatics; analysis of asphalts to predict durability as roadbuilding material; and determination of chemical and physical properties by the Bureau of Mines. (Plan)

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B.1.3.2.52 77R0093895 Mar 1976
Deutsche Forschungs-Und Versuchsanstalt Fuer Loft- Und Raumfahrt E.V., Lampoldshausen (Germany, F.R.)
Schmucker, R.H.
Title: Propellant Selection For Ramjets With Solid Fuel

ABSTRACT

A simplified theory for calculating the performance of possible ramjet propellants is presented, and they are classified with respect to maximum fuel-specific impulse. The optimal choice of fuel, from a system standpoint, must consider volume constraints, and defines the requirements for motor geometry. (In German)

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B.1.3.2.53 SSIE: GQF462490 5/79 to 7/81
Marquardt Co., 16555 Saticoy St., Van Nuys, California, 91409, United States of America
Piercy T.
Title: Boost Sustain Integration Study

ABSTRACT

Study the possibility of combining the separate propulsion stages of boost and sustain into a single propulsion unit for ramjets (Solid fuel, liquid fuel and ducted rocket). Eliminate booster ejectables during boost-to-sustain transition phase. (Plan).

.....

B.1.3.2.54 E170X030426 Oct 1969
Unknown
Greenberg, S.
Title: Methane Fuel Systems for High Mach Number Aircraft

ABSTRACT

JP and methane fuels are competitive for SSTs in Mach 3 to 4.5 range. Methane seems best in Mach 4.5 to 6 range, while hydrogen will probably be most useful in higher speed applications. Fuel system characteristics are considered. (paper: SAE Meeting Oct 6-10, 1969)

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B.1.3.2.55 78J00282329 Jul 1977
Indian Inst of Sci., Bangalore
Kishore, K.
Title: Storage Stability of Solid Rocket Fuels. I. Effect of Temperature

ABSTRACT

Aging behavior of polystyrene/ammonium perchlorate rocket propellant was studied. Attempts were made to elucidate the mechanism of aging so that useful predictions on the aging characteristics may be made. The changes in the ballistic properties (e.g. burning rate) have been monitored during the accelerated aging of the propellant. (Report)

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B.1.3.2.56 DH-15-1 1/76 to cont
Arizona State University School of Engineering _ Applied Sciences, Tempe, Arizona 85281
Kuester, J. L.
Title: Conversion of Cellulosic and Waste Polymer Material To Gasoline

ABSTRACT

The project is aimed at the conversion of cellulosic or waste polymer materials to liquid, transportable fuels. The cellulose source may be from urba.. refuse, agricultural or forest residues or from crops deliberately grown for energy conversion purposes (land or marine). Diesel or jet fuel type material is produced. If a high octane gasoline is desired, a final reaction step is used (reforming).

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B.1.3.2.57 DU-40 6/68 to 10/80
University of Santa Clara, School of Engineering, Santa Clara, California 95053
Pefley, R. K.
Title: Utilization Of Alcohols As Alternate Transportation Fuels

ABSTRACT

Alcohols are being studied as alternatives to petroleum fuels for transportation. Comparative alcohol and jet engine fuel studies are also being conducted.

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B.1.3.2.58 SSIE No.: CQF 49610 2 7/77 to 11/79
Cornell University, Ithaca Campus School of Engineering, Dept. of Chemical Engineering, 242 Carpenter Hall, Ithaca, New York, 14853
Merrill, RP
Title: Fundamental Studies Of The Structure And Chemistry of Solid Surfaces

ABSTRACT

Propulsion and power generation systems for future AF weapon systems may depend upon synthetic fuels and surface induced combustion. Heterogeneous catalysis is an essential element for the synthesis of fuels and for the decomposition of propellants used to generate power and/or thrust. Physical degradation of catalyst particles in monopropellant thrustors has become a limiting factor in engine life. This research has two major objectives. One is directed toward the theoretical and experimental studies of oxidation and hydrazine decompositions occurring on noble metal surfaces such as iridium. An equally important and collateral objective is to understand how oxide layers on aluminum and titanium surfaces withstand corrosive attack. (Plan)

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B.2 PROPULSION TECHNOLOGY

B.2.1 GAS TURBINES

B.2.1.1 NAVY FUNDED

B.2.1.1.1 SSIE: CQN 975316 3/79 to Cont
Colorado State University, School of Engineering, Dept. of Civil Engineering, Fort Collins, Colorado 80523
Sadeh, W.Z.
Title: Turbulence Effects on Axial Compressor Cascade Flows

ABSTRACT

Objective of study is to develop a better understanding of the interaction of the free stream turbulence with the boundary layer of an airfoil in a cascade, and to investigate the possibility of controlling that interaction to reduce boundary layer separation losses and delay the onset of stall. Such information can lead to increased blade loading and efficiency, and ultimately to improved propulsion systems for Naval weaponry applications. (Plan)

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B.2.1.1.2 SSIE: CQN975266 3/79
University of Washington, School of Engineering, Dept. of Mechanical Engineering, 206 Guggenheim Hall, Seattle, Washington, 98105
Gessner, F. B.
Title: Turbulent Corner Flows In An Adverse Pressure Gradient

ABSTRACT

The objective of this study is to improve current knowledge on the nature of turbulent flow along a streamwise corner in the presence of an adverse pressure gradient, and to better predict boundary layer separation in such flows. This information is needed for improved design of rectangular ducts, diffusers, guide vanes, and blade passsages in aircraft turbojet engines, and ultimately should lead to better propulsion systems for Naval weaponry applications. (Plan)

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B.2.1.1.3 AD-862 843/0ST 18 Dec 68-15 Sep 69
Lockheed-California Co Burbank
Anderson, Arthur B.
Title: Propulsion Study for STOL Air-Sea Craft

ABSTRACT

Study to investigate aerodynamic-propulsion concepts applicable to the canard configuration STOL air-sea craft, and in particular to develop and use a methodology for optimizing combinations of direct lift and augmented wing lift. A computer program was developed that optimized the propulsion system by maximizing the airplane radius for a given mission and a fixed initial airplane weight. (Final Report)

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B.2.1.1.4 SSIE: GQN889783 1 1/78 to 6/80
General Motors Corp., Detroit Diesel Allison Div, 4700 W. 10th St., Indianapolis, Indiana, 46206
Weber, J.
Title: Advanced Engine Control/Diagnostics Integration and Demonstration

ABSTRACT

The objectives of this program are to develop, verify and demonstrate computer software (control logic) capable of closed-loop control of an advanced variable cycle engine (VCE). Alternate control logic will be developed for verification via hybrid computer simulation, which will fully demonstrate the VCE features, such as airflow regulation, specific fuel consumption (SFC) optimization, thrust response optimization, etc. The logic will include system diagnosis as well as some sensor, actuator and engine performance condition monitoring. (Plan)

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B.2.1.1.5 N75-18241/0ST Feb 75
NASA, Lewis Research Center, Cleveland, Ohio
Knip, G.
Title: Preliminary Study of Advanced Turbofans for Low Energy Consumption

ABSTRACT

This analysis determines the effect of higher overall engine pressure ratios (OPR°s), bypass ratios (BPR°s), and turbine rotor-inlet temperature on a Mach 0.85 transport having a range of 5556 km (3000 nmi) and carrying a payload of 18144 kg. Takeoff gross weight (TOGW), fuel consumption and

direct operating cost are used as the figures of merit. Based on predicted 1985 levels of engine technology and a noise goal of 96 EPNdB, the higher OPR engine results in an airplane that is 18 percent lighter in terms of TOGW, uses 22.3 percent less fuel, and has a 14.7 percent lower DOC than a comparable airplane powered by a current turbofan. Cooling the compressor bleed air and lowering the cruise Mach number appear attractive in terms of further improving the figures of merit. (Report)

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B.2.1.1.6 SSIE: GQN475466 3 5/74
Purdue University School of Aero. Astr. Eng. Sci., Life Sciences Bldg. West Lafayette, Indiana, 47907
Reese, B. A.
Title: Energy Conversion Stagnation Region Gas Film Cooling For Turbine Cooling Applications

ABSTRACT

The effort is aimed at optimizing engine performance while utilizing higher turbine inlet temperatures with necessary cooling schemes. The research contributes to increasing the performance of aircraft and marine gas turbine engines. (Plan)

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B.2.1.1.7 SSIE: GQN796807 1 6/76 to 3/79
United Technologies Corp., Government Products Division, P.O. Box 2691, West Palm Beach, Florida, 33402
Reilly, R. S.
Title: VORBIX Augmentation Development

ABSTRACT

Evaluate mixed flow augmentation improvements derived from a unique vortex burning and mixing (VORBIX) concept. Specific goals include increased combustion efficiency (↑90%) over a complete A/B fuel schedule, improvement in A/B stability, continuous A/B fuel flow modulation and significant length reduction potential. (Plan)

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B.2.1.1.8 SSIE: GQN975360 1/79
Southern Methodist University, School of Engineering and Applied Sciences, Dept. of Civil and Mechanical Engineering Hillcrest and University, Dallas, Texas, 75222
Simpson, R. L.
Title: Weaponry: Turbulent Boundary Layer Separation In Adverse Pressure Gradient

ABSTRACT

The objective of this study is to improve current knowledge on the structure of turbulence for separated and separating boundary layers in adverse pressure gradients. Such information is needed for better design of diffusers and blade passage in aircraft turbojet engines, and ultimately should lead to improved propulsion systems for naval weaponry applications. (Plan)

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B.2.1.1.9 A80-19301# Jan 1980
U.S. Navy, Naval Air Propulsion Test Center, Trenton, N.J.
Piscopo, P. F.
Title: Fuel Conservation Benefits and Critical Technologies of Recuperative and Advanced Conventional Cycle Turboshaft Engines

ABSTRACT

Navy's concern for energy efficient propulsion kindled interest in both the recuperative and advanced conventional turboshaft engine cycles as candidates for re-engining its long range subsonic patrol aircraft. Studies were conducted to define the specific fuel consumption characteristics of advanced conventional cycle turboshafts. This paper presents the results of these cycle studies and identifies the payoff and critical technology areas for each system. (Paper: American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif, Jan 14-16, 1980)

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B.2.1.1.10 SSIE: GQN975229 12/78
Massachusetts Inst. of Technology, Div. of Sponsored Research, 77 Massachusetts Ave., Cambridge, Massachusetts, 02139
Louis, J. F.
Title: Energy Conversion: Studies of Transonic Turbines With Film-Cooled Blades

ABSTRACT

The effort is aimed at reducing the amount of cooling required per unit of work extracted. The research will contribute to increased performance of gas turbine engines needed particularly for naval aircraft propulsion. (Plan)

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B.2.1.1.11 AD-901 614/8ST 30 Apr 71-29 Feb 72
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Evans, Dennis C.
Title: Feasibility Study for a Practical High Rotor Tip Clearance Turbine

ABSTRACT

Turbine tip clearance loss prediction methods were investigated analytically. For a model core turbine, a potential 30% reduction in clearance loss relative to an equivalent free vortex turbine is predicted. (Final Report)

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B.2.1.1.12 AD-A030 074/9ST Apr 76
TRW Inc., Cleveland Ohio
Brentnall, William D.
Title: Metal Matrix Composites for High Temperature Turbine Blades

ABSTRACT

The continued development and evaluation of the refractory wire reinforced FeCrAlY composites designed for application in advanced gas turbine engines is described. Investigations of 1000-hour creep and stress rupture properties in the temperature range 1037-1148C. Preliminary burner rig tests indicated no significant problems for W/FeCrAlY composites exposed to this type of environment. (Report)

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B.2.1.1.13 AD-A067 970/4ST Feb-Apr 78
AiResearch Mfg. Co of Arizona, Phoenix
Arenare, J. A.
Title: Ceramic Gas Turbine Engine Demonstration Program

ABSTRACT

The objective of the 36-month "Ceramic Gas Turbine Engine Demonstration Program" is to design, fabricate, develop and conduct demonstration tests with ceramic hot-flow-path components for the Airesearch Model TSE331C-1 Engine operating at an average turbine inlet temperature of 2200 F with a peak turbine inlet temperature of approximately 2500 F. Performance improvement goals projected for the engine with the uncooled, high-temperature ceramic components include a 40-percent increase in output power and a 10-percent reduction in specific fuel consumption. (Interim Report)

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B.2.1.1.14 SSIE: GQN-975276-1 3/79 to Cont
Kansas State University, School of Engineering, Anderson Hall, Manhattan, Kansas 66502
Lester, T.W.
Title: Isotopic Studies of the Chemical Mechanisms of Soot Nucleation

ABSTRACT

The objective of this research is to determine experimentally the principal chemical mechanisms of soot nucleation at temperature and pressures comparable to those found in gas turbine combustors. Such information is needed to better understand gas turbine combustor design, alternate and synthetic fuels; this should ultimately lead to improved power plants for naval aircraft and marine applications. (Plan)

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B.2.1.1.15 NTIS FE-1765-4 June-September 1975
General Electric Co., Schenectady, NY
Flynt, F.V.
Title: High Temperature Gas Turbine Engine Component Materials Testing Program. Quarterly Progress Report No.

ABSTRACT

Report describes progress of test program for turbine components using coal-derived liquid fuels. (Progress Report)

B.2 PROPULSION TECHNOLOGY

B.2.1 GAS TURBINES

B.2.1.2 NON NAVY FUNDED

B.2.1.2.1 77A26400 Sept 1976
Unknown
Jackson, A.H., Jr.
Title: Multi-Mission Uses for Prop-Fan Propulsion

ABSTRACT

The potential of the advanced turboprop has emerged as particularly attractive for reduction in fuel consumption. Using recent technical advancements in aerodynamics and structures and configured to very high power loadings, advanced turboprops or Prop-Fans should achieve marked fuel savings when compared to the turbofan, even at the high subsonic cruise speeds. The Prop-Fan will display considerable operational versatility over a wide spectrum of potential subsonic missions, both military and commercial. Its ability to maintain excellent performance levels with large variations in aircraft speeds and altitudes results from the high rotor efficiencies gained with the use of variable fan blade angle. (Paper: NATO, AGARD, Conference on Variable Geometry and Multicycle Engines, Paris, France, Sept 6 - 10, 1976)

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B.2.1.2.2 74A38898 Mar 1974
New York, American Institute of Aeronautics and Astronautics, Inc.
Grey, J.
Title: Aircraft Fuel Conservation: An AIAA View: Proceedings of a Workshop Conference, Reston, VA, March 13 - 15, 1974

ABSTRACT

Aspects of aircraft fuel conservation are reviewed and discussed, and measures are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Principal measures included: increasing load factors, achieved by revised rerouting and scheduling and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical °winglet° located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuels currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics.

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B.2.1.2.3 78A37114 May 1978
Unknown
Hewish, M.
Title: Aero Engines Climb Towards Better Fuel Efficiency

ABSTRACT

The low-by-pass-ratio turbofans of the early 1960s had specific fuel consumptions about 15 percent lower than the previous straight turbojets. The introduction of high-bypass turbofans in the early 1970s led to a further 20 percent reduction. Studies financed by NASA have the objective to reduce fuel consumption by another 12 percent. Gains to be made are related to improved components performance, revised maintenance procedures to reduce deterioration in use, reduced sensitivity to factors which cause performance to fall while the engine is in service, and a modified operating cycle, mainly involving changes in bypass ratio, overall pressure ratio, and turbine inlet temperatures. The integrated fan duct, which provides structural strength and damps out fan noise, contributes to performance gains by more efficient mixing of the fan flow and hot gas stream from the engine core. (Article: New Scientist, vol. 78, May 11, 1978)

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B.2.1.2.4 76A36605 May 1976
Lockheed California Co., Burbank, CA
Foss, R.L.
Title: Fuel Conservative Potential for the Use of Turboprop Powerplants

ABSTRACT

Turboprop propulsion offers one of the most significant means of achieving reduced fuel consumption. The prop-fan high speed propeller concept allows the superior propulsive efficiency exhibited by the turboprop to be extended to crise speeds compatible with current turbofan aircraft. Comparison of prop-fan and turbofan powered aircraft used to illustrate the prop-fan benefits. (Paper: Society of Automotive Engineers, Air Transportation Meeting, New York, NY, May 18 - 20, 1976)

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B.2.1.2.5 74A38315 Jun 1974
Unknown
Cuesta Alvarez, M.
Title: The Energy Crisis of Fuel and the Procedures of Cruising Flight

ABSTRACT

The energy crisis has focused attention on questions concerning the aircraft type with the lowest operational fuel consumption. Other important questions are related to the flight procedures which have optimum characteristics with regard to fuel consumption and total operational costs. It has been found that aircraft equipped with turbojet engines require the least amount of fuel for their operation. Details of turbojet design and operation are discussed along with questions of cruising range, thrust, and velocity, taking into account conditions at various altitudes. The characteristics of cruising flight undertaken under conditions of constant Mach number and constant altitude and of constant thrust and constant altitude are considered. (Paper: Revista de Aeronautica y Astronautica, vol. 34, June 1974, in Spanish)

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B.2.1.2.6 75A29812 1975
Unknown
Fishbein,
Title: Analysis of the Characteristics of a Ducted-Fan Engine with a Small-Size Gas-Turbine Engine in the Outer Duct

ABSTRACT

The results of a thermodynamic analysis of the thrust and fuel-consumption characteristics of a ducted-fan engine containing a gas-turbine in the outer duct are examined and are compared with those of a turbojet engine with an afterburner. A means of reducing the specific fuel consumption during takeoff, acceleration, and supersonic flight conditions is proposed for the configuration employing a gas turbine. (Paper: Aviatsionnaia Tekhnika, vol. 18, no. 1, 1975. In Russian)

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B.2.1.2.7 75A47509 May 1975
Boeing Commercial Airplane Co., Seattle, WA
Hanks, G.W.
Title: Weight Contribution to Fuel Conservation for Terminal Area Compatible Aircraft

ABSTRACT

Reductions in fuel consumption by weight characteristics of advanced aircraft are considered, and trades between weight reduction versus increased aerodynamic and operating efficiency are discussed. Direct reductions in fuel use may be obtained by application of advanced technology in structure and airfoils, proper engine choice, and revised environmental control features. Weight penalties involved in wing planform optimization are countered by increased aerodynamic efficiency. Results of studies incorporating advanced structure, airfoils, and propulsion show 21.6 percent reductions in operational empty weight and takeoff gross weight compared to a conventional design. Implementation of the described fuel reduction approaches will yield an estimated 25 percent reduction in fuel consumption. (Paper: Society of Allied Weight Engineers, Annual Conference, 34th, Seattle, WA, May 5 - 7, 1975)

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B.2.1.2.8 78A45097 July 1978
United Technologies Corp., East Hartford, CN
Hines, R.W.
Title: Fuel Consumption Improvement in Current Transport Engines

ABSTRACT

A review is conducted of improvements which can be made with respect to the fuel consumption of current engines and new production versions of current engines. A description is presented of an engine diagnostics program which has the objective to identify and quantify the causes and sources of performance deterioration in the JT9D turbofan engine and to develop basic data which will be applied to minimize performance degradation of current and future engines. General areas where performance losses occur are examined, taking into account seals, blades and vanes, and cases. Potential performance improvement concepts are related to improved component aerodynamics, improved flowpath sealing, blade tip clearance control, improved turbine cooling effectiveness, improved turbine materials and coatings, duct and nozzle aerodynamic refinements, nacelle aerodynamic refinements, forced exhaust mixers, advanced nacelle materials, and advanced fuel control. (Paper: AIAA and SAE, Joint Propulsion Conference, 14th, Las Vegas, Nev., July 25 - 27, 1978)

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B.2.1.2.9 76A42426 July 1975
McDonnell Douglas Corp., St. Louis, MO
Kawai, R.T.
Title: Advanced Integration Technology to Improve Installed Propulsion Efficiency

ABSTRACT

Past major improvements in transport aircraft productivity from advances in propulsive engines are reviewed, followed by an assessment of areas for future advancements. Different trades will exist between weight, maintainability, and fuel consumption. Past design approaches and concepts are re-evaluated because of the need to increase emphasis on reducing fuel consumption. Recent studies have identified improvement possibilities through advancements in engine/airframe integration. Current McDonnell Douglas advanced propulsion technology programs which are exploring these possibilities and can lead to significant fuel savings are described. The barriers to utilization of this fuel conservative technology are discussed. (Paper: AIAA and SAE, Propulsion Conference, 12th, Palo Alto, CA, July 26 - 29, 1976)

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B.2.1.2.10 77A17762 1976
Unknown
Maslov, V.G.
Title: Theoretical Aspects of Optimization of Aviation Gas Turbine Engine Design Variables

ABSTRACT

Typical aircraft systems optimization criteria are presented with emphasis on their use in finding regions of optimum gas turbine engine (GTE) performance in early design stages. Attention is centered on comparative evaluations of two salient criteria: the effective specific weight of the GTE in the aircraft design system and losses incurred per ton-kilometer. Analytic formulas minimizing specific weight and specific fuel consumption are derived, along with the boundaries of those optimum performance variables in the neighborhood of minima. Optimization results for a helicopter GTE and a fixed-wing GTE with respect to the two criteria are compared numerically. (Paper: Aviatsionnaia Tekhnika, vol. 19, no 3, 1976. In Russian)

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B.2.1.2.11 78A49723 Sep 1977
Unknown
Scrofani, O.
Title: Choice of Cycle for a Regnerative Bypass Turbojet for Long-Range Aircraft

ABSTRACT

A thermodynamic and dynamic analysis of a bupass turbojet with heat exchange is presented. Engine components and the dependence of the specific heats of air and combustion products on the temperature and air/fuel ratio are taken into account, and the effect of cycle parameters on specific fuel consumption and specific thrust is examined. These parameters are considered with respect to engine weight and aerodynamic drag, and the performance capabilities of bypass turbojets with and without heat exchange are compared. (Paper: Associazione Italiana di Aeronautica e Astronautica, Congresso Nazionale, 4th, Milan, Italy, Sept. 19 - 23, 1977, in Italian)

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B.2.1.2.12 AIAA-80-0896 May 1980
NASA, Lewis Research Center, Cleveland, Ohio
Grobman, J.
Title: The Impact of Fuels on Aircraft Technology Through The Year 2000,

ABSTRACT

Broadening fuel properties could penalize the performance, durability, and reliability of the propulsion system unless actions are taken to develop the technology required to use broader property fuels. This paper describes research being conducted to (1) determine the potential range of properties for future jet fuels, (2) establish a data base of fuel property effects on propulsion system components, (3) evolve and evaluate advanced component technology that would permit the use of broader property fuels and (4) identify technical and economic trade-offs within the overall fuel production-air transportation system associated with variations in fuel properties. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000" May 6 - 8 1980, Baltimore, MD)

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B.2.1.2.13 AIAA: 80-0914 May 1980
NASA, Lewis Research Center, Cleveland, Ohio 44135
Weber, R.
Title: Aeropropulsion in Year 2000

ABSTRACT

Many advances can be anticipated in propulsion systems for aircraft in the next 20 years. This paper presents a sampling of probable future engine types such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports. This is followed by a brief review of related technology improvements in propellers, materials, noise suppression, etc. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8 1980, Baltimore, MD)

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B.2.1.2.14 AIAA: 80-0906 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Technology Advancements for Energy Efficient Transports

ABSTRACT

Ongoing government and industry supported research activities pertaining to improved fuel efficiency of commercial transports are described with particular attention to advancements in aerodynamics, avionics, and controls technologies. Emphasis is placed on the interaction of these technologies with the structure, propulsion, and other technologies involved in transport configuration design, as well as the impact on airline operation they could imply. The potential benefits offered by these technologies and the research activities required to support their commitment to future models are discussed. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.2.1.2.15 75A22324 Feb 1975
Unknown
Yaffee, M. L.
Title: Developers Face 1975 CFM56 Decision

ABSTRACT

The CFM56 engine now in the engineering development stage is a high-bypass-ratio turbofan engine designed to exceed 22,000 lb thrust at sea level on an 86 F day and to exceed a specific fuel consumption of 0.376 lb/hr/lb. Test engines have achieved these goals. The primary potential of the CFM56 is on derivatives of present short-, medium-, and long-range aircraft such as the DC-9, the B-737, the B-727, the HS.121 Trident, the B-707, and the DC-8. Applications on military tankers and transports, as well as commercial aircraft, are possible. Tests indicate that the CFM56 will be able to meet noise standards set for 1979, but the emission of nitrogen oxides and carbon monoxide presently exceed EPA limits. Sector burning is the only combustor concept which shows promise of decreasing these levels. Short-duct, confluent-flow, and mixed-flow installation configurations are under study. (Article: Aviation Week and Space Technology, vol. 102, Feb 24, 1975)

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B.2.1.2.16 78A24765 Feb 1978
Pratt and Whitney, East Hartford, CN
Wilson, M.
Title: The First Refan

ABSTRACT

The Pratt and Whitney JT8D-209 refan is evaluated, and compared with new generation commercial jet engines in terms of thrust and cost parameters. Attention is given to the DC-9-80 aircraft and its suitability for retro-fitting with the JT8D-209. When noise regulations and fuel economy considerations eventually force the first generation by-pass engines out of the air, the lower development, maintenance, and acquisition costs, and higher thrust (18,500 lbs.) of the JT8D-209, as compared with completely new engines, should prove an attractive alternative for commercial aviation. (Paper: Flight International, vol. 113, Feb 18, 1978)

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B.2.1.2.17 76A45784 Nov 1975
Pratt and Whitney Aircraft Group, East Hartford, CN
Sens, W. H.
Title: Future Trends in Transport Aircraft Propulsion

ABSTRACT

Twenty-one charts on possible future trends in transport aircraft propulsion technology are presented. Attention is paid to future engine requirements, airline economics, engine related costs, subsonic transport fuel consumption, potential turbofan fuel consumption, advanced technology long range quadjet fuel use trends, fan efficiency improvement, technology advancements in fan blade design, compressor efficiency improvement, turbine airfoil alloys, coatings on turbine airfoils, progress in compressor airfoil reduction, lower aspect ratio blading, fabrication technology for lower cost, digital electronic engine control, a variable stream control engine (VSCE-502B), and the VSCE relative to the first generation SST turbojet. (Paper: The Future of Aeronautical Transportation: Proceedings of the Princeton University Conference, Princeton, NJ, November 10, 11, 1975.)

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B.2.1.2.18 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the Forum, Detroit, Michigan, October 15, 1975)

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B.2.1.2.19 76A38260 July 1976
General Electric Co., Aircraft Engine Group, Cincinnati, OH
Neitzel, R. E.
Title: Comparisons of Alternate Energy Efficient Engines for Future Subsonic Transports as Affected by Engine Technology Improvements

ABSTRACT

The major contenders for engines to power future subsonic transports include the conventional high bypass turbofan, the geared turbofan of somewhat higher bypass ratio, and the high disc loading turboprop. Typical designs involving projected advancements in technology are described and compared to a current turbofan. The key technology features for each of the advanced engines are identified and their relative importance in achieving an improvement in fuel usage and aircraft economics indicated. Goals for technology development are suggested on the basis that a new engine must provide a significant advantage in both aircraft economics and fuel usage. (Paper: AIAA/SAE Propulsion Conference, 12th, Palo Alto, CA July 26 - 29 1976)

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B.2.1.2.20 77A20719 1976
Lockheed-Georgia Co., Marietta, GA
Lange, R.H.
Title: Effects of Artificial Stability on Configuration Design

ABSTRACT

The use of active controls for maneuver load alleviation in the development of transport aircraft in the 1980s is considered. As part of the NASA Advanced Transport Technology Program, Lockheed conducted a relaxed static stability analysis including an assessment of the benefits to be derived from the application of advanced technologies such as low noise level propulsion systems, supercritical wing, advanced filamentary composite materials, and active controls. Attention is also given to the JetStar redesign study, taking account of wing optimization, geometry constraints, and loads analysis. (Paper: Air Transportation for the 1980°s, University of Maryland, College Park, Maryland, 1976).

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B.2.1.2.21 76A39189 July 1976
Rolls-Royce Ltd., Derby, England
Jones, A.D.
Title: Maintenance of Performance in Service Operation Experience on the Rolls-Royce RB 211-228 Engine

ABSTRACT

The sensitivity of cruise specific fuel consumption due to deterioration in component performance has been assessed for various engine cycle parameters. The data compares today's large bypass ratio engines with the previous generation ofjet engines. With this knowledge, certain design features were incorporated into the RB 211 such as to minimize the performance deterioration during service operation. These features are examined and discussed in relation to their effect on individual component performance and hence the overall engine performance. In service operational data has been measured and analyzed such as to assess the change in the various components, and to introduce rework procedures and modifications to eliminate or minimize the performance deterioration. (Paper: AIAA/SAE Propulsion Conference, 12th, Palo Alto, CA, July 26 - 29, 1976)

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B.2.1.2.22 SSIE: ZQF141540 2 11/77
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio, 45433
Watts, R. W.
Title: Closed Environmental Control System Evaluation

ABSTRACT

Reduction of significant mission take-off-gross-weight (TOGW) penalties is possible through development of a closed-loop ECS. This ECS concept can reduce engine bleed air and ram air penalties by approximately 80 percent. The objective of this effort is to develop criteria for the most important elements of the closed-loop ECS (The air cycle machine (ACM), drive system, expansion devices). (Plan)

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B.2.1.2.23 SSIE: ZH 870007 10/77 to 9/78
NASA Office of Aeronautics and Space Technology, Lewis Research Center 21000 Brookpark Rd., Cleveland, Ohio, 44135
Unknown
Title: Engine Composite Structures

ABSTRACT

Objective of this program is to develop the structures technology required to permit the timely introduction of composite materials into advanced turbine engine components such as fan blades, engine frames, blade containment systems and other structural components which can benefit from the unique strength, weight, and cost characteristics of composite materials. (Plan)

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B.2.1.2.24 COO-37077-136 Nov 76
New York Univ., NY, Courant Inst. of Mathematical Sciences
McIntyre, E.A., Jr.
Title: Design of Transonic Cascades by Conformal Transformation of the Complex Characteristics

ABSTRACT

A procedure for the numerical design of transonic turbine and compressor blade profiles in two dimensions is considered. The procedure might be used in the construction of lighter, more efficient airplane engines for better fuel consumption. (Report)

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B.2.1.2.25 77A14563 Nov 1976
ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France
Wanner, J.C.
Title: Air Transportation and Fuel Consumption

ABSTRACT

Various options in present technology for reducing fuel consumption are examined. Improvements in thermodynamic efficiency by altering specific fuel consumption and bypass ratio, and two ways of raising the temperature upstream of the turbine, are considered. Advantages of the delta sweepback wing and supercritical airfoils are outlined, in addition to possible weight reduction through the use of new advanced materials (more Ti, less steel, more composites) and optimized dimensional design of aircraft by finite element methods. Control configured vehicle approaches to aeronautical design are outlined briefly, and outlook for reliance on

liquid hydrogen as fuel is sketched. (Paper: In Sciences et Techniques, Nov 1976, In French)

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B.2.1.2.26 79A14136* Apr 1977
NASA, Washington, DC
Klineberg, J.M.
Title: Technology for Aircraft Energy Efficiency

ABSTRACT

Six technology programs for reducing fuel use in U.S. commercial aviation are discussed. The six NASA programs are divided into three groups: Propulsion - Engine component improvement, energy efficient engine, advanced turboprops; Aerodynamics - energy efficient transport, laminar flow control; and Structures - Composite primary structures. Schedules, phases, and applications of these programs are considered. (Paper: International Air Transportation Conference, Washington, DC, April 4 - 6, 1977, Proceedings, New York, American Society of Civil Engineers, 1977, p. 127 - 171)

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B.2.1.2.27 79A31912*# Dec 1978
NASA, Washington, DC
Klineberg, J.M.
Title: The NASA Aircraft Energy Efficiency Program

ABSTRACT

A review is provided of the goals, objectives, and recent progress in each of six aircraft energy efficiency programs aimed at improved propulsive, aerodynamic and structural efficiency for future transport aircraft. Attention is given to engine component improvements, an energy efficient turbofan engine, advanced turboprops, revolutionary gains in aerodynamic efficiency for aircraft of the late 1990s, laminar flow control, and composite primary aircraft structures. (Paper: Energy and Aerospace: Proceedings of the Anglo/American Conference, London, England, December 5 - 7, 1978. (A79-31908 12 - 44) London, Royal Aeronautical Society, 1979)

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B.2.1.2.28 SSIE: GQF 29660 7 1978
University of Southern California, School of Engineering, Dept. of Mech. Engin., 3551 University Ave., Los Angeles, CA 90007
Gerstein, M.
Title: Fundamental Principles of Flow-Flame Interactions and Transient Flame Phenomena

ABSTRACT

This investigation deals with flow-flame interactions of a fuel spray under realistic combustor conditions simulating the behavior of mixed fuels, fuel impingement on hot surfaces, and the use of spontaneous reactive additives designed to provide programmed ignition in vortex combustion and fuel-air clouds. (Plan)

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B.2.1.2.29 N79-33205/2 Aug 79
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Taylor, J.R.
Title: Analytical Evaluation of the Impact of Broad Specification Fuels on High Bypass Turbofan Engine Combustors

ABSTRACT

Six conceptual combustor designs for the CF6-50 high bypass turbofan engine and six conceptual combustor designs for the NASA/GE E3 high bypass turbofan engine were analyzed to provide an assessment of the major problems anticipated in using broad specification fuels. Designs were analyzed to estimate combustor performance, durability, and pollutant emissions when using commercial Jet A aviation fuel and when using experimental referee board specification fuel. Results indicate that lean burning, low emissions double annular combustor concepts can accommodate a wide range of fuel properties without a serious deterioration of performance or durability. However, rich burning, single annular concepts would be less tolerant to a relaxation of fuel properties. (Final Report)

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B.2.1.2.30 78N24369*# Oct 1978
NASA, Lewis Research Center, Cleveland, Ohio
Rudey, R.A.
Title: Impact of Future Fuel Properties on Aircraft Engines and Fuel Systems

ABSTRACT

Paper describes and discusses the propulsion-system problems that will most likely be encountered if the specifications of hydrocarbon-based jet fuels must undergo significant changes in the future and, correspondingly, the advances in technology that will be required to minimize the adverse impact of these problems. (Lecture Ser. 96, Paris, Munich, and London, 12-20 Oct 1978: sponsored by AGARD)

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B.2.1.2.31 N78-13056/4ST Sep 77
NASA, Lewis Research Center, Cleveland, Ohio
Butze, H.F.
Title: Effect of Fuel Properties on Performance of Single Aircraft Turbojet Combustor at Simulated Idle, Cruise, and Takeoff Conditions

ABSTRACT

The performance of a single-can JT8D combustor was investigated with a number of fuels exhibiting wide variations in chemical comosition and volatility. Performance parameters investigated were combustion efficiency, emissions of CO, unburned hydrocarbons and nitrogen oxides, as well as liner temperatures and smoke. The most pronounced effect of changes in fuel composition were observed at simulated cruise and takeoff conditions where smoke and liner temperatures increased significantly as the hydrogen content of the fuel decreased. At the simulated idle condition, emissions of CO and unburned hydrocarbons increased slightly and, accordingly, combustion efficiencies decreased slightly as the hydrogen content of the fuels decreased. (Report)

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B.2.1.2.32 75N31074 1975
NASA, Lewis Research Center, Cleveland, Ohio
Dugan, J.F., Jr.
Title: Fuel-Conservative Engine Technology

ABSTRACT

Aircraft Fuel consumption is discussed in terms of its efficient use and the conversion of energy from sources other than petroleum. Topics discussed include: fuel from coal and oil shale, hydrogen deficiency of alternate sources, alternate fuels evaluation program, and future engines. (Article: Aero. Propulsion)

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B.2.1.2.33 78N29061*# 1978
NASA, Ames Research Center, Moffett Field, CA
Williams, L.J.
Title: Short-Haul CTOL Aircraft Research --- On Reduced Energy for Commercial Air Transportation

ABSTRACT

The results of the reduced energy for commercial air transportation studies on air transportation energy efficiency improvement alternatives are reviewed along with subsequent design studies of advanced turboprop powered transport aircraft. The potential fuel savings and cost savings for advanced turboprop aircraft appear substantial, particularly at shorter ranges. (Paper: NASA, Langley Res. Center CTOL Transport Technol., 1978)

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B.2.1.2.34 77A20717# 1976
United Technologies Corp., Commercial Engineering Dept., East Hartford, Connecticut
Witherspoon, J.W.
Title: Air Transport Propulsion for the 1980°s

ABSTRACT

Attention is given to propulsion technology that will be important in the 1980s, including the JT8D refan engine, the JT10D engine, and the reduction of fuel consumption through component development. Also considered are the energy shortage and future engine cycles, and the development of SST engines. (Paper: Air transportation for the 1980°s, College Park, MD, University of Maryland, 1976)

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B.2.1.2.35 EI 750742663 Mar 1975
Univ. of Calgary, Alberta
Kentfield, J.A.C.
Title: Regenerative Turbofans: A Comparison with Nonregenerative Units

ABSTRACT

A Theoretical study of the performance of small regenerative turbofans from the aerodynamic drag, mechanical arrangement, and weight viewpoints. It was concluded that compared with conventional nonregenerative, high pressure ratio, high bypass ratio units, regenerative turbofans can have specific fuel consumptions about 17 percent lower for flight, and up to 24 percent lower for sea level static, operation. (Article: J Aircr v 12, n 3, Mar 1975)

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B.2.1.2.36 N79-15051/2ST 1979
NASA, Lewis Research Center, Cleveland, OH
Koenig, R.W.
Title: Preliminary QCGAT Program Test Results

ABSTRACT

NASA Lewis Research Center is conducting a program to demonstrate that large commercial engine technology can be applied to general aviation engines to reduce fuel consumption, and to develop new technology where required. The overall engine program, design, and technology incorporated into the QCGAT engines are described. Preliminary engine test results are presented. (Report)

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B.2.1.2.37 N75-24739/5ST May 1975
NASA, Lewis Research Center, Cleveland, OH
Kraft, G.
Title: Preliminary Study of Advanced Turboprops for Low Energy Consumption

ABSTRACT

The fuel savings potential of advanced turboprops (operational about 1985) was calculated. Variable camber propellers were used with an efficiency of 85 percent. The study indicated a fuel savings of 33 percent, a takeoff gross weight reduction of 15 percent, and a direct

operating cost reduction of 18 percent. Increasing overall pressure ratio from 25 to 50 saved little fuel and slightly increased takeoff gross weight. (Report)

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B.2.1.2.38 78A43357*# Jul 1978
NASA, Washington, DC
Kramer,J.J.
Title: Planning a New Era in Air Transport Efficiency

ABSTRACT

The current status of the NASA Aircraft Energy Efficiency (ACEE) program is briefly reviewed with reference to CTOL aircraft. Attention is given to four basic technologies: turboprop, advanced aerodynamics and active controls, laminar flow control, and composites. (Paper: Astronautics and Aeronautics, vol. 16, July - Aug 1978)

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B.2.1.2.39 N77-23072/OST Jun 76
Douglas Aircraft Co., Inc., Long Beach, CA
Kraus, E.F.
Title: Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System. Volume 1: Technical Analysis

ABSTRACT

The effectiveness of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state-of-the-art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. (Final Report)

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B.2.1.2.40 77A12192*# May 1976
NASA, Ames Research Center, Moffett Field, CA
Williams, L.J.
Title: Air Transportation Energy Efficiency - Alternatives and Implications

ABSTRACT

Results from recent studies of air transportation energy efficiency alternatives are discussed. Included are aircraft operation, aircraft modification, derivative aircraft, and new aircraft. In order to obtain significant improvements in energy efficiency, new aircraft must truly exploit advanced technology in such areas as aerodynamics, composite structures, active controls, and advanced propulsion. (Paper: Society of Allied Weight Engineers, Annual Conference, 35th, Philadelphia, PA, May 24 - 26, 1976)

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B.2.1.2.41 79N13192# Oct 1978
Advisory Group for Aerospace Research and Development, Paris, France
Unknown
Title: Aircraft Engine Future Fuels and Energy Conservation

ABSTRACT

Current and forecasted world energy demands, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs. The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal, oil shale, and tar sands) and techniques for reducing energy consumption in refining processes are examined. Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems. An assessment is made as to what technology advancements are currently underway and what other advancements are needed with reference to engine components, engine systems, aircraft designs and operational procedures to help conserve fuel resources. (AGARD Lectures in Munich and London, Oct 1978)

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B.2.1.2.42 77A14563 Nov 1976
ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France
Wanner, J.C.
Title: Air Transportation and Fuel Consumption

ABSTRACT

Various options in present technology for reducing fuel consumption are examined. Improvements in thermodynamic efficiency by altering specific fuel consumption and bypass ratio, and two ways of raising the temperature upstream of the turbine, are considered. Advantages of the delta sweepback wing and supercritical airfoils are outlined, in addition to possible weight reduction through the use of new advanced materials (more Ti, less steel, more composites) and optimized dimensional design of aircraft by finite element methods. Control configured vehicle approaches to aeronautical design are outlined briefly, and outlook for reliance on liquid hydrogen as fuel is sketched. (Paper: Sciences et Techniques, Nov. 1976, In French)

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B.2.1.2.43 AD-A080 748 Mar 78 - Oct 79
Air Force Aero Propulsion Lab, Wright-Patterson AFB, OH
Henderson, Robert E.
Title: Turbopropulsion Combustion Technology Assessment

ABSTRACT

General overview of the state of combustion technology today; some general projections and trends for the future. State-of-the-art review of the five special areas of interest covered during the assessment --- main burners, afterburners, combustion modeling, structural and mechanical design, and alternative fuels. Advanced technology trends and projected technology needs. A five-year technology plan is outlined. (Summary Report)

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B.2.1.2.44 AD-A039 597 Dec 76
Rand Corp. Santa Monica, CA
Gebman, J.R.
Title: The Potential Role of Technological Modifications and Alternative Fuels in Alleviating Air Force Energy Problems

ABSTRACT

Short- and long-term measures to reduce the consumption of petroleum jet fuels by the Air Force. Engine retrofits and aerodynamic modifications to existing aircraft can save significant quantities of jet fuel. Synthetic JP fuels derived from oil shale or coal appear to be the most attractive future alternatives to petroleum jet fuels. (Report)

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B.2.1.2.45 78A18022 Oct 1977
Unknown
Walsh, B.
Title: Advances in Aircraft Efficiency

ABSTRACT

The paper surveys NASA's Aircraft Energy Efficiency program. Six major elements: (1) engine component improvement, aimed at a 5 percent reduction in annual fuel consumption. (2) the energy efficient engine program. (3) the development of advanced turboprop propulsion systems. (4) the creation of advanced aerodynamics and active control technology applicable to transport aircraft. (5) the development of alternative laminar flow designs, and (6) the study of potential composite primary structures for weight reduction and fuel economy. (Paper: Aviation Engineering and Maintenance, vol 1, Oct 1977)

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B.2.1.2.46 SSIE: GQA 44010 2 6/75 to N/A
Avco Corp., Lycoming Division, 550 S. Main St., Stratford, Connecticut 06497
White, S.D.
Title: Turbine Tip Clearance Measurement, Army Aircraft

ABSTRACT

The objective is to obtain realistic data including accurate tip clearance measurements for use in evaluating, validating, and refining turbine tip clearance prediction techniques in order to provide the gas turbine designer with a useful tool for analyzing operating tip clearances

and for designing effective tip clearance control techniques. The resulting tip clearance reductions will provide improved performance in small gas turbine engines yielding reduced fuel consumption at all engine power levels and minimizing hardware damage during engine develoment. (Plan)

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B.2.1.2.47 AD-C019 324L Jun 79
Rockwell International El Segundo CA, North American Aircraft Div.
Wiler, C.D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase II.

ABSTRACT

This study dealt with technologies and concepts for 1990 and 2000 IOC manned penetrating bombers. Two concepts were selected from the phase I study for in-depth examination of structures, aerodynamics, propulsion and various subsystems. (Final Report (SECRET))

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B.2.1.2.48 N77-2015/1ST May 1975 Jan 1976
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Wisler, D. C.
Title: Preliminary Design Study of Advanced Multistage Axial Flow Core Compressors

ABSTRACT

Preliminary design study was conducted to identify an advanced core compressor for use in new high bypass ratio turbofan engines for the 1980°s. Study of compressor designs was conducted on efficiency, weight, cost, blade life, aircraft direct operating cost, and fuel usage. Trends observed were used to develop three compressor designs studied in greater detail to evaluate their aerodynamic and mechanical feasibility. (Final Report)

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B.2.1.2.49 AD-C016 293L Jun 78
Rockwell International, Los Angeles, Calif, Los Angeles Aircraft Div
Raymer, D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase I

ABSTRACT

Study dealt with technologies and concepts for post-1995 manned penetrating strategic bomber. Technologies were assessed in areas of aerodynamics, propulsion, structures, controls, and stealth, were found to offer up to 50 percent reductions in cost and weight over current technologies. (Final Report)

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B.2.1.2.50 N78-21095/2ST Jan - Aug 1977
Lockheed California Co., Burbank, Commercial Advanced Design Div.
Revell, J. D.
Title: Fuel Conservation Merits of Advanced Turboprop Transport Aircraft

ABSTRACT

Advantages of a propfan powered aircraft for commercial air transportation were assessed by comparison with an equivalent turbofan transport. Comparisons on the basis of fuel utilization and operating costs, as well as aircraft weight and size. (Final Report)

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B.2.1.2.51 75A27777# 1974
1974
Roy, M.
Title: On the Future of Jet Propulsion in Subsonic Transport Aviation

ABSTRACT

Parametric development potential studies on the thermodynamic cycle of transport aviation turbofan engines show that substantial weight and fuel consumption savings can be obtained, without increasing turbine inlet temperatures, from the expected improvements in compressor turbine efficiencies. It is shown that improvements may be obtained by increasing the dilution to roughly mu = 12, while ejector-induced tertiary flow over special wing-flap combinations may provide short takeoff and landing

distances and significant noise reduction. (Paper: Periodica Polytechnica, Transportation Engineering, Vol 2 No 1, 1974)

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B.2.1.2.52 N80-10222/1 Aug 1979
Pratt and Whitney Aircraft, East Hartford, Conn., Commercial Products Div
Howlett, R. A.
Title: VSCE Technology Definition Study

ABSTRACT

Refined design definition of the variable stream control engine (VSCE) concept for advanced supersonic transports is presented. Operating and performance features of the VSCE are discussed, including the engine components, thrust specific fuel consumption, weight, noise, and emission system. A preliminary engine design is presented. (Final Report)

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B.2.1.2.53 80N24316*# July 1980
NASA, Lewis Research Center, Cleveland, Ohio
Saunders, N. T.
Title: Advanced Component Technologies for Energy-Efficient Turbofan Engines

ABSTRACT

The Energy Efficient Engine Project, to develop the advanced technology base for future commercial development of a new generation of more fuel conservative turbofan engines for airline use, is described. Engine configurations that are dependent upon technology advances in each major engine component are defined and current design and development of the advanced components are included. (Paper: Presented at the 16th Joint Propulsion Conf., Hartford, 30 Jun 2 Jul. 1980; cosponsored by AIAA, ASME and SAE)

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B.2.1.2.54 N78-26442/1ST Jul 78
NASA, Lewis Research Center, Cleveland, Ohio
Saunders, N. T.
Title: Design Approaches to More Energy Efficient Engines

ABSTRACT

The status of NASA's Energy Efficient Engine Project is summarized. Results of recently completed studies are reviewed. These studies involved selection of engine cycles and configurations that offer potential for at least 12% lower fuel consumption that current engines. Emphasis is on the advancements required in component technologies and systems design concepts to permit future development of these more energy efficient engines. (Paper: 14th Propulsion Conf., Las Vegas, Nev., 25-27 Jul 1978; Cosponsored by AIAA and SAE.)

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B.2.1.2.55 77N17032# Feb 1976
Committee on Aeronautical and Space Sciences (U.S. Senate)
Unknown
Title: Aircraft Fuel Efficiency Program

ABSTRACT

A technology plan is described for developing fuel-efficient aircraft. Inputs were obtained from industry, NASA research centers, and other governmental agencies. Six major programs are defined: engine component improvement, composite primary structures, turboprops, laminar flow control, fuel conservative transport, and the fuel conservative engine. Funding requirements and benefits are discussed. (Paper: GPO Rept. for Comm. on Aeronautical and Space Sci., 94th Congr. 2d Sess. 17 Feb 1976)

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B.2.1.2.56 79N13198# Sept 1978
Pratt and Whitney Aircraft Group, East Hartford, Conn.
Sens, W. H.
Title: Engine Component Improvement and Performance Retention

ABSTRCT

Methods of reducing fuel consumption of current engines considered include: (1) Cycle improvement incorporated in growth and derivative engine models by changes in bypass ratio, overall pressure ratio, and turbine inlet temperature; (2) Component performance improvements through

design refinements incorporated into the existing engines during routine overhaul; and (3) Improved engine performance retention through revised maintenance procedures and improved design. (Paper: In AGARD Aircraft Eng. Future Fuels and Energy Conserv.)

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B.2.1.2.57 79N13199# Sept 1978
Prart and Whitney Aircraft Group, East Hartford, Conn.
Sens, W. H.
Title: Low Energy Consumption Engines

ABSTRACT

Improvements in aircraft gas turbine engine economy over four decades are briefly reviewed. Possibilities for the evolution of the turbofan cycle to give improved engine performance are discused with emphasis on the Energy Effficient Engine Program. Alternative cycles are also considered. These include: Brayton cycle; regenerative cycle; compound fan; shrouded propeller; and the prop-fan. The prop-fan is considered the most promising. (Paper: In AGARD Aircraft Eng. Future Fuels and Energy Conserv.)

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B.2.1.2.58 N78-16055/3ST 1978
NASA, Lewis Research Center, Cleveland, Ohio
Stewart, W. L.
Title: A Review of NASA's Propulsion Programs for Aviation

ABSTRACT

A review of five NASA engine-oriented propulsion programs of major importance to civil aviation are presented and discussed. Included are programs directed at exploring propulsion system concepts for (1) energy conservation subsonic aircraft (improved current turbofans, advanced turbofans, and advanced tuboprops); (2) supersonic cruise aircraft (variable cycle engines); (3) general aviation aircraft (improved reciprocating engines and small gas turbines); (4) powered lift aircraft (advanced turbofans); and (5) advanced rotorcraft. (Paper: Presented at the 16th Aerospace Sci. Meeting, Huntsville, Ala., 16-18 Jan 1978; Sponsored by AIAA.)

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B.2.1.2.59 N75-16557/1ST Feb 75
Lockheed Aircraft Corp., Burbank, Calif.
Sweet, H. S.
Title: Evaluation of Advanced Lift Concepts and Potential Fuel Conservation for Short-Haul Aircraft

ABSTRACT

The effect of different field lengths, cruise requirements, noise level, and engine cycle characteristics on minimizing fuel consumption and minimizing operating cost at high fuel prices were evaluated for some aircraft using the upper surface, internally blown jet flap, the augmentor wing, and the mechanical flap lift systems. Advanced conceptual STOL engines were evaluated as well as a near-term turbofan and turboprop engine. (Report)

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B.2.1.2.60 75N16979 Dec 1974
Department of the Air Force, Washington, D.C.
Yarymovych, M. I.
Title: Energy-Related Research and Development in the United States Air Force

ABSTRACT

Methods of reducing fuel consumption by aircraft design and structural modification are proposed. The effectiveness of a campaign to reduce energy requirements and expenditures is documented. (Paper: In AGARD, The 1974 AGARD, Ann Meeting)

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B.2.1.2.61 78N22092# Jun 1977
Rolls-Royce Ltd., Derby (England)
Young, P. H.
Title: Some Practical Limitations to Fuel-Conservative Civil Engine Technology

ABSTRACT

Propulsion of future medium and long range subsonic civil aircraft launched before 1990 is discussed. The engines will operate well into the 21st century when natural petroleum sources will dry up. It is forecast that industry will find some means of providing the necessary fuel, which will be similar to current aviation fuels, even if it has to be manufactured from coal or shale. Future medium and long range engines will have the same overall pressure ratio and specific thrust. Long term

shortage of natural fuel does not improve the position of the heat exchanger cycle. Research should continue to concentrate on weight reduction and component efficiency improvement. (Paper: Paris Asoc. Aeron. et Astronautique de France Presented at the 13th Intern. Aeron. Congr. Paris 3 June 1977)

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B.2.1.2.62 N77-15043/1ST Dec 76
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Neitzel, R. E.
Title: Study of Unconventional Aircraft Engines Designed for Low Energy Consumption

ABSTRACT

A study of unconventional engine cycle concepts which may offer significantly lower energy consumption than conventional subsonic transport turbofans, is described. Regenerative, geared, and variable-boost turbofans and combinations thereof, were selected along with advanced turboprop cycles for further evaluation and refinement. Areas of needed technology advancement are identified. (Report)

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B.2.1.2.63 N76-30218/1ST Aug 76
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Neitzel, R. E.
Title: Study of Turbofan Engines Designed for Low Energy Consumption

ABSTRACT

Subsonic transport turbofan engine design and technology features which have promise of improving aircraft energy consumption are described. Task I addressed the selection and evaluation of features for the CF6 family of engines. Task II involved cycle studies and the evaluation of technology features for advanced technology turbofans. Task III pursued the refined analysis of a specific design selected as the result of Task II studies. Task IV summarized recommendations for technology developments. (Report)

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B.2.1.2.64 80N10206*# 1979
NASA, Lewis Research Center, Cleveland, Ohio
Nored, D. L.
Title: Aircraft Energy Efficiency (ACEE) Status Report

ABSTRACT

Fuel efficiency in aeronautics is considered. Projects of the Aircraft Energy Efficiency Program include: (1) engine component improvement directed at performance improvement and engine diagnostics for prolonged service life; (2) energy efficient engine, directed at proving the technology base for the next generation of turbofan engines; and (3) advanced turboprop. Progress in these technology areas is reported. (Paper: Aeropropulsion 1979)

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B.2.1.2.65 78A43360*# Aug 1978
NASA, Lewis Research Center, Cleveland, Ohio
Nored, D. L.
Title: Propulsion - NASA Program For Aircraft Fuel Consumption Reduction

ABSTRACT

NASA aims at developing propulsion technology to reduce the fuel consumption of present engines by 5%, that of new engines of the late 1980s by at least 12%, and that of an advanced early 1990s turboprop by an additional 15%. Programs which take up these aims are Engine Component Improvement, Energy Efficient Engine, and Advanced Turpoprops. (Paper: Astronautics and Aeronautics, Vol. 16, July-Aug 1978)

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B.2.1.2.66 78N27048*# Jun 1978
NASA, Lewis Research Center, Cleveland, Ohio
Nored, D. L.
Title: ACEE Propulsion Overview

ABSTRACT

Technology for fuel-efficient subsonic CTOL transport aircraft is discussed. The engine component improvement project, the energy efficient engine project,, and the advanced turboprop project are included. The overall goals and objectives of each project are reviewed and the approach and schedule for accomplishing these project goals and objectives are given. (Paper: NASA Langley Res. Center CTOL Transport Technol. 1978)

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B.2.1.2.67 N77-11055/9ST 10 Sep 75
NASA, Washington, D.C.
Unknown
Title: Aircraft Fuel Conservation Technology Task Force Report, September 10 1975

ABSTRACT

An advanced technology program is described for reduced fuel consumption in air transport. Cost benefits and estimates are given for improved engine design and components, turboprop systems, active control systems, laminar flow control, and composite primary structures. (Report)

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B.2.1.2.68 SSIE: ZH 3654 8 10/77
NASA, Office of Aeronautics and Space Technology, Lewis Research Center, 21000 Brookpark Rd., Cleveland, Ohio 44135
Unknown
Title: Fan, Compressor and Turbine Technology

ABSTRACT

Approaches to improve efficiency, operating range, distortion tolerance, durability and reliability and to reduce weight, volume and cost of the wide variety of fans and compressors required for advanced propulsion systems will be investigated. (Plan)

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B.2.1.2.69 SSIE: ZH 870018 1 10/77
NASA, Office of Aeronautics and Space Technology, Lewis Research Center, 21000 Brookpark Rd., Cleveland, Ohio 44135
Unknown
Title: Propulsion Pollution Reduction Research

ABSTRACT

The objectives of the programs conducted under this RTOP are to develop, evaluate and demonstrate technology that will significantly reduce gas turbine engine emissions, increase fuel efficiency, and broaden the range of usable fuels for general aviation intermittent combustion engines. (Plan)

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B.2.1.2.70 SSIE: ZH 870033 1 10/77
NASA, Office of Aeronautics and Space Technology, Lewis Research Center, 21000 Brookpark Rd., Cleveland, Ohio, 44135
Unknown
Title: Advanced General Aviation Propulsion Research

ABSTRACT

The objectives are to define the technology base for, and promote the development of, the most promising alternative engine(s) for general aviation use in the late 1980s. The specific improvements and/or capabilities sought are: multifuel; lower BSFC, weight, cost, and maintenance; and improved reliability. (Plan)

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B.2.1.2.71 SSIE: ZH 870120 1 10/77
NASA, Office of Aeronautics and Space Technology, Hugh L. Dryden Flight Research Center, P.O.Box 273, Edwards, California, 93523
Unknown
Title: Advanced Turboprop - Flight Research

ABSTRACT

The objective is to develop and demonstrate by flight research the technology for advanced turboprop propulsion systems having high propulsion efficiencies at cruise speeds and altitudes up to Mach 0.8 and 35,000 feet. This technology could provide fuel savings of 20% to 25% relative to current high-bypass turbofan engines. (Plan)

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B.2.1.2.72 SSIE: ZH 870142 1 10/77
NASA, Office of Aeronautics and Space Technology, Langley Research Center, Hampton, Virginia, 23665
Unknown
Title: Energy Efficient Transport

ABSTRACT

The objective of this RTOP is to expedite industry acceptance and application of advanced aerodynamics and active controls technology in an integrated manner to achieve significant energy, economic, and aircraft sales benefits. In-house and industry experimental and analytical efforts will be continued in the areas of supercritical aerodynamics, high-lift systems, propulsion/airframe integration, and wing/empennage/flight control systems. (Plan)

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B.2.1.2.73 SSIE: ZH 870149 2 10/77
NASA, Lewis Research Center, 21000 Brookpark Rd., Cleveland, Ohio 44135
unk
Title: Energy Efficient Engine Project

ABSTRACT

The objective of this project is to develop and demonstrate technology for a next-generation turbofan engine having 10-15% lower specific fuel consumption compared to current high-bypass turbofan aircraft engines. (Plan)

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B.2.1.2.74 N79-16850/6ST Mar 1978 - Sep 1978
Pratt and Whitney Aircraft, East Hartford, CT.
Owens, R. E.
Title: Energy Efficient Engine: Propulsion System - Aircraft Integration Evaluation

ABSTRACT

Flight performance and operating economics of future commercial transports utilizing the energy efficient engine were assesed as well as the probability of meeting NASA's goals for TSFC, DOC, noise, and emissions. Results of the initial evaluation include estimates of engine performance, predictions of fuel burns, operating costs. (Report)

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B.2.1.2.75 EI770314592 Mar 1976
Univ of Padua, Italy
Quaggiotti, V.
Title: Pressure Ratio Optimization Criteria In Aircraft Turbojet-Engines Design

ABSTRACT

The most important parameters in the design of efficient aircraft turbojet engine are reviewed. Specific thrust is examined with regard to the best flying conditions and maximized at a constant parametric value of the propulsive efficiency, in order to make a design based on the best operative position. (Paper: Int Symp on Air Breathing Engines, 3rd, Proc. Munich, Ger, Mar 7-12 1976)

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B.2.1.2.76 N76-32182/7ST 1976
Boeing Co., Wichita, Kans.
Pasley, L. H.
Title: Evaluation of Low Wing-Loading Fuel Conservative, Short-Haul Transports

ABSTRACT

Fuel conservation that could be attained with two technology advancements, Q fan propulsion system and active control technology (ACT) was studied. (Report)

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B.2.1.2.77 78A15020 Jun 1977
Societe Nationale Industrielle Aerospatiale, Division Helicopteres, Paris, France
Petit, G.
Title: Helicopters and Energy Savings

ABSTRACT

The article discusses various means to economize helicopter fuel consumption noting possible modifications in engine specific fuel consumption, rotor aerodynamic quality, parasitic drag of the fuselage, helicopter empty weight, and flight path optimization. Improvements in specific fuel consumption (30 percent reduction predicted) and in structural characteristics (15 percent reduction predicted). (Paper: Congress International Aeronautique, 13th Paris, France, June 2,3, 1977, L°Aeronautique et l°Astronautique, no. 66, 1977, In French)

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B.2.1.2.78 79A31911 Dec 1978
Royal Aircraft Establishment, Farnborough, Hants, England
Pope, G. G.
Title: Prospects for Reducing the Fuel Consumption of Civil Aircraft

ABSTRACT

Outline of technological advances that contribute to the reduction of fuel consumption. Attention concentrated on advances being made in the UK. Advances in power plants are examined along with developments in aerodynamics taking into account advances in design techniques, experimental facilities, wing tip design, drag reduction, and laminar flow

control. Attention is also given to materials and structures, active control technology and operational considerations. (Paper: Energy and Aerospace; Proceedings of the Anglo/American Conference, London, England, December 5-7, 1978)

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B.2.1.2.79 76A19593*# Feb 1976
NASA, Office of Aeronautics and Space Technology, Aircraft Energy Efficiency Office
Povinelli, F. P.
Title: Improving Aircraft Energy Efficiency

ABSTRACT

Investigations by NASA task force concerning fuel-conservation technology are considered. The task force estimated fuel savings potential prospects for implementation in the civil air-transport fleet and the impact of the technology on fuel use. Propulsion advances are related to existing engines in the fleet, to new production of current engine types and to new engine designs. Studies aimed at the evolutionary improvement of aerodynamic design and a laminar flow control program are discussed, and possibilities concerning the use of composite structural materials are examined. (Paper: Astronautics and Aeronautics, Vol. 14, Feb. 1976)

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B.2.1.2.80 78A24034 Feb 1978
Douglas Aircraft Co., Long Beach, CA
Hage, R.E.
Title: The Challenge of Advanced Fuel-Conservative Aircraft - A Manufacturer's View

ABSTRACT

Costs and technological problems associated with advanced fuel-conservative aircraft are discussed, with particular attention given to the current NASA Aircraft Energy Efficiency (ACEE) program, which focuses on engine component improvement, turboprops, laminar flow control and composites. (Paper in American Inst. of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th, Washington, DC, Feb 7-9, 1978)

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B.2.1.2.81 EI750742662 Mar 1975
Univ. of Toledo, Ohio
Beans, E.W.
Title: Design Study of a Fan Augmented Ramjet

ABSTRACT

The characteristics of a hybrid propulsion system, which fills the gap between turbojets and ramjets, are presented. The hybrid system is a fan augmented ramjet and consists of a ramburner fed by an externally driven low pressure ratio fan. Cycle analyses, performance estimates and scaling relationships for subsonic and supersonic operation, and a preliminary design of a subsonic version are presented. A 50 to 100 percent improvement in cruise performance above that of a ramjet can be expected in the subsonic regime. (ASME paper n75-GT-57 Mar 2-6, 1975 meeting)

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B.2.1.2.82 78A47423 Aug 1978
Unknown
Brindley, J.F.
Title The Second Generation of High-Bypass Turbofans - A Market Clouded by Uncertainty

ABSTRACT

Second-generation high bypass turbofan concepts for commercial aviation are reviewed in terms of performance and fuel economy. The General Electric/SNECMA CFM56 is considered the most advanced, offering fuel savings on the order of 30 % per passenger over older engines. The CFM56 will be rated at 10.885 kp and could enter service by 1981. Other engines are also reviewed, including the RB.211-535; the JT10D, rated at 14.515 kp, to be used in a new Boeing trijet; and the CF6-32, which maintains the core of the Dash-6D2 while incorporating a new LP turbine and turbine mid-frame. (Article in Interavia, vol. 33, Aug 1978)

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B.2.1.2.83 AD-A063 211/7ST Sep 75-Dec 77
General Electric Co., Lynn, MA, Aircraft Engine Group
Irons, G. Steele
Title: Refinement of Casting Techniques for Small Air-Cooled Turbine Blades

ABSTRACT

The design of the T700 stage-one turbine blade was reevaluated to permit application of advanced coring techniques to investment cast turbine blades. These techniques resulted in improved use of cooling air, and they can increase blade life or specific fuel consumption over the standard configuration. (Final Report)

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B.2.1.2.84 76A30625 Mar 1975
Rolls-Royce Ltd., Derby, England
Jackson, A.J.B.
Title: Some Future Trends in Aero Engine Design for Subsonic Transport Aircraft

ABSTRACT

Problems presented to the aero engine designer by the decreasing world oil and aviation fuel supplies are discussed. A key parameter for subsonic transport aircraft is specific fuel consumption. Technical parameters which will influence the choice of specific thrust (bypass ratio) in the next generation of engines are examined, including installation standard, engine weight, cruise to take-off thrust ratio. (Paper in American Society of Mechanical Engineers, Gas Turbine Conference, Houston, TX, Mar 2-6, 1975)

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B.2.1.2.85 EI750207270 Apr 1974
GE, Cincinnati, Ohio
Jahnke, L.P.
Title: Requirements for and Characteristics Demanded of High Temperature Gas Turbine Components

ABSTRACT

Composite structures consisting of high-strength fibers or plates in ductile matrices with outstanding high temperature properties are achievable in directionally solidified eutectics. This new class of materials represents a major innovation in gas turbine blade technology. The advantages and limitations of the two more promising eutectic systems

and the relationship of these properties to turbine blade design are discussed. 14 refs. (Paper in AGARD Conf. Proc. n156, 1974, for Meet, Washington, DC, Apr 23-24, 1974)

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B.2.1.2.86 N79-20069/7ST 1979
NASA, Lewis Research Center, Cleveland, Ohio
Jeracki, R.J.
Title: Wind Tunnel Performance of Four Energy Efficient Propellers Designed for Mach 0.8 Cruise

ABSTRACT

Several advanced aerodynamic concepts were investigated in recent wind tunnel tests performed in the NASA-Lewis Research Center 8x6 foot wind tunnel. These concepts included aerodynamically integrated propeller/nacelles, area-ruling, blade sweep, reduced blade thickness, and power (disk) loadings several times higher than conventional designs. Four eight-bladed propeller models were tested to determine aerodynamic performance. (Report)

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B.2.1.2.87 73A16634 Oct 1972
US Army, Air Mobility Research and Development Laboratory, Fort Eustis, VA
Johnson, E.T.
Title: Small Turbine Advanced Gas Generator for Future Propulsion requirements

ABSTRACT

Review of philosophy, background, approach, and anticipated results of the Small-Turbine Advanced Gas Generator (STAGG) program initiated in November 1971. Its chief objectives are to resolve integration and matching problems, reduce specific fuel consumption, and define realistic levels of technology for small aircraft engines at an early date. It is expected that the program will provide engineers with advanced engine technology to meet future DOD requirements. (Paper in Society of Automotive Engineers, National Aerospace Engineering and Manufacturing Meeting, San Diego, CA, Oct 2-5, 1972)

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B.2.1.2.88 N78-31108/1ST Jan 1977 - Apr 1978
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Johnston, R.P.
Title: Energy Efficient Engine: Preliminary Design and Integration Studies

ABSTRACT

Parametric design and mission evaluations of advanced turbofan configurations were conducted. Economics, environmental suitability and fuel efficiency were investigated and compared with goals set by NASA. Of the candidate engines which included mixed- and separate-flow, direct-drive and geared configurations, and advanced mixed-flow, direct-drive configuration was selected for further design and evaluation. (Final Report)

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B.2.1.2.89 78N27054 1978
General Electric Co., Fairfield, Conn
Johnston, R.P.
Title: Energy Efficient Engine Preliminary Design and Integration Studies

ABSTRACT

The characteristics and systems benefits of an energy efficient engine (E3) were determined. Relative to a current CF6-50C engine, the following benefits were estimated: 14.4 percent reduction in installed cruise specific fuel consumption, and a reduction in direct operating cost of more than 5 percent. (In NASA, Langley Res. Center CTOL Transport Technol., 1978)

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B.2.1.2.90 SSIE: 20A 53812 1 10/77 to N/A
Army Aviation Research and Development Command, Applied Technology Lab., Fort Eustis, Newport News, VA 23604
Lane, J.
Title: Ceramic Component Definition and Screening -- Army Aircraft

ABSTRACT

Conduct an investigation to assess applicability of ceramics for use in the helicopter gas turbine engine components. Use of ceramics offers the potential of a 10 percent decrease in fuel consumption and a 30-40 percent increase in horsepower while reducing engine weight and cost over

advanced technology engines for use in future army helicopters. (Plan)

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B.2.1.2.91 EI790858352 Apr 1979
MIT, Cambridge, Mass
Larrabee, F. Eugene
Title: Practical Design of Minimum Induced Loss Propellers

ABSTRACT

An efficient procedure, adapted to pocket calculators, developed to determine the geometry of minimum induced loss propellers matched to a specified operating point characterized by disc loading, advance ratio, and number of blades. (Paper in SAE mtg. Apr 3-6, 1979)

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B.2.1.2.92 N79-25017/1ST 26 Jun 79
Williams Research Corp., Walled Lake, MI
Lays, E.J.
Title: Advanced General Aviation Turbine Engine (GATE) Concepts

ABSTRACT

Concepts are discussed that project turbine engine cost savings through use of geometrically constrained components designed for low rotational speeds and low stress to permit manufacturing economies. Aerodynamic development of geometrically constrained components is recommended to maximize component efficiency. Conceptual engines, airplane applications, airplane performance, engine cost, and engine-related life cycle costs are presented. The powerplants proposed offer encouragement with respect to fuel efficiency and life cycle cost, and make possible remarkable airplane performance gains. (Final Report)

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B.2.1.2.93 E172X049998 Sep 1971
National Gas Turbine Establ., Hampshire, England
Lewis, W.G.E.
Title: Some Experiments on Two-Stream Propelling Nozzles for Supersonic Aircraft

ABSTRACT

The unacceptably severe penalty in range/payload performance for a shortfall in nozzle gross thrust efficiency accentuates the need to obtain high quality nozzle performance data from experiments at model scale. This paper describes a technique for evaluating the internal performance of propelling nozzles and presents results for a family of two-stream ejector-type nozzles designed for crusing flight in the region of Mach 2. (Paper in Aeron J v 75 n 729 Sep 1971)

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B.2.1.2.94 77A20713 1976
American Airlines, Inc., New York, NY
Linn, R.J.
Title: Future Aircraft Requirements - A Notebook of Airline Thoughts

ABSTRACT

Future technologies applied to next generation of commercial transports hold promise for increasing productivity while keeping a lid on operating costs. Technologies considered are those of composite structures, supercritical aerodynamics, winglets, active controls, turboprop technology, and laminar flow. The work of NASA on fuel conservative turbofan engines and on regenerative turbofan engines is briefly discussed. (Paper in Air transportation for the 1980°s. College Park, MD, University of Maryland 1976)

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B.2.1.2.95 78A31311 Oct 1977
Computing Devices, Co., Ottawa, Canada
Mackintosh, G.B.
Title: Thrust Computing System Applications to Increase Engine Life and Provide Fuel Conservation

ABSTRACT

Method of computing the gross thrust required by a jet engine based only on measurements of pressure in the engine tailpipe and of ambient static pressure. Technique can be applied to improve the overall

efficiency of engine operations; the result is that the number of engines operating at abnormally high exhaust gas temperatures can be reduced. In addition to the fuel saving achieved, very great reductions in hot-section parts consumption and maintenance requirements can result. (Paper in Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977)

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B.2.1.2.96 A80-19300*# Jan 1980
NASA, Lewis Research Center, Performance Improvement Section, Cleveland, Ohio
McAulay, J.E.
Title: Engine Component Improvement Program - Performance Improvement

ABSTRACT

The Engine Component Improvement (ECI) Program is NASA sponsored and is specifically directed at reducing the fuel consumption of commercial aircraft in the near-term. As part of the ECI program, a Performance Improvement (PI) effort aimed at developing fuel saving and retention components for new production and retrofit of JT9D, JT8D and CF6 engines is under way. This paper reviews the manner in which the PI concepts were selected for development and summarizes the current status of each of the 16 NASA selected concepts. (Paper in American Inst. of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, CA, Jan 14-16, 1980)

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B.2.1.2.97 VN070074 1 May 1979
NASA, Lewis Res. Center
Mikkelson, D.C.
Title: Low-Speed Propeller Technology

Abstract

The objective of this program is to advance the technology of propellers for general aviation aircraft to reduce energy consumption, lower noise, and improve aircraft safety. Encompasses analytical and experimental work on propeller performance, acoustics, aeroelastic characteristics and low cost composites. Gap advanced technology will be oriented toward aircraft including (1) low speed-low power (up to 200 kts with up to 250 hp); (2) high speed-high power (turboprop); and (3) low speed-high power (up to 100kts with 600-1000 hp) (Plan)

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B.2.1.2.98 N79-21076/1ST 20 Mar 79
Pratt and Whitney Aircraft Group, East Hartford, CT
Gaffin, W.O.
Title: JT8D Revised High-Pressure Turbine Cooling and Other Outer Air Seal Program

ABSTRACT

The JT8D high pressure turbine was revised to reduce leakage between the blade tip shrouds and the outer air seal, and engine testing was performed to determine the effect on performance. The addition of a second knife-edge on the blade tip shroud, the extension of the honeycomb seal land to cover the added knife-edge and an existing spoiler on the shroud, and a material substitution in the seal support ring to improve thermal growth characteristics are included. Significant specific fuel consumption and exhaust gas temperature improvements were demonstrated. (Report)

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B.2.1.2.99 79N31208 Jun 1979
Pratt and Whitney Aircraft, East Hartford, CT, (Commercial Products Div.)
Gaffin, W.O.
Title: JT9D-70/59 Improved High Pressure Turbine Active Clearance Control System --- For Specific Fuel Consumption Improvement

ABSTRACT

The JT9D-70/59 high pressure turbine active clearance control system was modified to provide reduction of blade tip clearance when the system is activated during cruise operation. The modification increased the flow capacity and air impingement effectiveness of the cooling air manifold to augment turbine case shrinkage capability, and increased responsiveness of the airseal clearance to case shrinkage. The simulated altitude engine testing indicated a significant improvement in specific fuel consumption with the modified system. (Report)

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B.2.1.2.100 N79-30189/1ST Mar 1978 - Feb 1979
Pratt and Whitney Aircraft Group, East Hartford, CT, Commercial Products Div.
Gardner, W.B.
Title: Energy Efficient Engine Flight Propulsion System Preliminary Analysis and Design Report

ABSTRACT

A flight propulsion system preliminary design was established that meets the program goals of at least a 12 percent reduction in thrust specific fuel consumption. (Report)

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B.2.1.2.101 EI770207430 1976
Tech Univ. Berlin, Ger
Gasparovic, Nebojsa
Title: Turbofan Jet Engine with Optimal and Non-Optimal Design

ABSTRACT

The quality of a turbofan jet engine in comparison with a turbojet engine is indicated by the ratio of their thrusts. At given flight parameters and at a given amount of energy available for thrust generation, the maximum of thrust ratio is only achieved at a very high bypass ratio which cannot be realized. The choice of bypass ratio and fan pressure ratio requires consideration of the optimal relation of these parameters. Deviations from the optimal case are discussed. (Article in German: Forsch Ingenieurwes v42 n 5 1976)

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B.2.1.2.102 76A32649 May 1976
Unknown
Geddes, J.P.
Title: Civil Transport Technology Up to 2000 - NASA Believes Fuel Consumption is the Major Consideration

ABSTRACT

Recommendations of a NASA task force to establish goals in a program for fuel conservation technology compared with typical industry views of developments that are feasible in the near future. Improved engine components for JT8D, JT9D, and CF6, including mechanical mixers to mix the core and duct stream before discharge through a common nozzle, clearance control to improve compressor and turbine efficiency, and improved blade

shapes. Four aerodynamic approaches to fuel consumption selected for future study: drag clean-up, improved aerodynamic design, laminar flow control, and the use of small vertical end-plates on wing-tips to augment thrust. Accelerated effort in the development of composite structures is urged. Fuel savings of 79 percent predicted for the year 2005. (Article in Interavia, vol. 31, May 1976)

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B.2.1.2.103 N79-21073/8ST 10 Apr 79
Detroit Diesel Allison, Indianapolis, IN
Gill, J.C.
Title: Study of an Advanced General Aviation Turbine Engine (GATE)

ABSTRACT

Technology program for a small, economically viable gas turbine engine applicable to the general aviation helicopter and aircraft market for 1985-1990 was studied. Turboshaft and turboprop engines were considered. A power class of 373 kW (500 hp) was recommended for technology advance where large improvements in fuel economy and engine mass appear possible through component research and development. (Report)

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B.2.1.2.104 80A38905 Jun 1980
Douglas Aircraft Co., Inc. Long Beach, CA
Goldsmith, I.M.
Title: Potential Benefits for Propfan Technology on Derivatives of Future Short- to Medium-Range Transport Aircraft

ABSTRACT

Several NASA-sponsored studies have identified a substantial potential fuel savings for high subsonic speed aircraft utilizing the propfan concept compared to the equivalent technology turbofan aircraft. (Paper in AIAA, SAE, and ASME, Joint Propulsion Conference, 16th, Hartford, CT, June 30-July 2, 1980)

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B.2.1.2.105 EI790967108 Aug 1979
NASA Lewis Res Cent. Cleveland, Ohio
Graham, R. W.
Title: Fundamental Mechanisms That Influence The Estimate Of Heat Transfer To Gas Turbine Blades

ABSTRACT

The quest for improved efficiency has motivated the elevation of turbine inlet temperatures in all types of advanced aircraft gas turbines. Higher gas temperatures necessitate complex blade cooling schemes so as not to sacrifice structural integrity and operational life in advanced engines. (Paper: ASME Pap n 79-HT-43 for Meet Aug 6-8 1979)

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B.2.1.2.106 79N12084*# Nov 1978
Pratt and Whitney Aircraft Group, East Hartford, Conn., Commercial Products Div.
Gray, D. E.
Title:ilu Energy Efficient Engine Preliminary Design and Integration Study

ABSTRACT

The technology and configurational requirements of an all new 1990°s energy efficient turbofan engine having a twin spool arrangement with a directly coupled fan and low-pressure turbine, a mixed exhaust nacelle, and a high 38.6:1 overall pressure ratio were studied. Design features required were a high pressure ratio compression system, a thermally actuated advanced clearance control system, lightweight shroudless fan blades, a low maintenance cost one-stage high pressure turbine, a short efficient mixer, and structurally integrated engine and nacelle. (Report)

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B.2.1.2.107 76A36603* May 1976
United Technologies Corp., Pratt and Whitney Aircraft Div., East Hartford, Conn.
Gray, D. E.
Title: Fuel Conservative propulsion Concepts for Future Air Transports

ABSTRACT

Results of a feasibility study of proposed fuel conservative propulsion concepts are summarized. All engines considered are based on projected 1985 technology. The study indicates that an advanced Brayton

cycle gas generator in a turbofan engine or geared to an advanced multibladed, small diameter propeller with a projected efficiency of 80% at Mach 0.8 offers the greatest potential for energy conservation. (Paper: Society of Automotive Engineers, Air Transporation Meeting, New York, N.Y., May 18-20, 1976)

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B.2.1.2.108 N76-22197/7ST Apr 76
Pratt and Whitney Aircraft, East Hartford, Conn.
Gray, D. E.
Title: Study of Turbofan Engines Designed for Low Energy Consumption

ABSTRACT

The near-term technology improvements which can reduce the fuel consumed in the JT9D, JT8D, and JT3D turbofans in commercial fleet operation through the 1980's are identified. Technology advances are identified for new turbofans to be developed after 1985. (Final Report)

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B.2.1.2.109 N76-29233/3ST Jun 76
Pratt and Whitney Aircraft, East Hartford, Conn.
Gray, D. E.
Title: Study of Unconventional Aircraft Engines Designed for Low Energy Consumption

ABSTRACT

Most promising uncoventional aircraft engines based on potential for fuel savings and improved economics are identified. Engines in long-range and medium-range aircraft were evaluated. Projected technology advances are identified for state-of-readiness. (Final Report)

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B.2.1.2.110 75A41698*# Aug 1975
Boeing Commercial Airplane Co., Seattle, Wash.
Hanks, G. W.
Title: Fuel Conservation Possibilities for Terminal Area Compatible Transport Aircraft

ABSTRACT

Design characteristics that would reduce mission fuel consumption and improve terminal-area operations for advanced transports are discussed. Sensitivity studies of the effects of cruise speed, wing geometry, propulsion cycle, operational procedures, and payload on fuel usage are presented. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Los Angeles, Calif., Aug 4-7 1975)

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B.2.1.2.111 AD-C005376 Feb 1976
Rand Corp., Santa Monica Calif.
Harris, E. D.
Title: Potential For Advanced Technology To Reduce Military Aircraft Energy Consumption for 1975-2000

ABSTRACT

Technological options for reducing peacetime USAF jet fuel consumption in this century are evaluated. Half the projected reduction comes from changing to the B-1 with hypothetical energy-effficient tanker, and another 30% from new energy-efficient fighter/attack/reconnaissance planes. Lightweight airframe structural materials hold promise mainly for new designs. Variable cycle and turboprop engines do not offer substantial fuel savings. Re-engining the C-141S with TF-39 turbofan engines could start now. Recommended: Limiting military airlift to higher-value cargo; shifting more to the C-5; shorter mission legs; increased load factor; cutting training flights as far as practicable. RPVS would produce sizable savings only when replacing manned missions. (Secret Report)

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B.2.1.2.112 DF487016 1976
Boeing Company, Wichita Division
Heilman, J. J.
Title: KC-135 Modernization Study

ABSTRACT

Assess modern developments in engine and wing technology applicable to potential modifications of the KC-135 which may result in performance improvements, increased off load capability, reduced energy consumption and reduced O/M costs. Five different combinations of propulsion (TF33-P7, CFM-56, JT-10D) and wing (existing, 707/320B, supercritical) improvements. (Final Report in three volumes)

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B.2.1.2.113 79A10818# Apr 1978
General Electric Co, Cincinnati, Ohio
Hemsworth, M. C.
Title: Making Turbofan Engines More Energy Efficient

ABSTRACT

A review of transport aircraft gas turbine engine development and evolution in terms of energy consumption. The interaction and effects of cycle pressure, ratio, firing temperature, bypass ratio, and component efficiencies on installed fuel consumption are reviewed. (Paper: American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, London, England, Apr. 9-13, 1978.)

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B.2.1.2.114 76A36604 May 1976
General Electric Co., Fairfield, Conn.
Hirschkron, R.
Title: Alternative Concepts for Advanced Energy Conservative Transport Engines

ABSTRACT

Projected fuel consumption characteristics of three unconventional engine design concepts were compared with those of a conventional advanced direct drive turbofan. Engines considered based on technology compatible with entry into service in mid to late 1980s. Regeneration and other cycles involving heat exchangers did not offer fuel advantages over the conventional design due to size and weight. Geared turbofans and turboprop engines based on projected improvements in propeller effficiency to the 80% range for Mach 0.8 high disk loading designs showed potential

for significant improvements in specific fuel consumption. (Paper: Society of Automotive Engineers Air Transportation Meeting, New York, N.Y., May 18-20, 1976)

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B.2.1.2.115 76A38400*# July 1976
United Technologies Corp., Pratt and Whitney Aircraft Group, East Hartford, Conn.
Hines, R. W.
Title: Potential Improvements In Turbofan Engine Fuel Economy

ABSTRACT

Method for initial evaluation of improvements in the NASA Aircraft Energy Efficiency Program directed toward improving fuel economy of turbofan engines is outlined. Results of the evaluation of 100 candidate engine modifications are presented. Fuel consumption improvements of as much as 5% may be possible in current JT3D, JT8D and JT9D turbofan engines. Aerodynamic thermodynamic material and structural advances are expected to yield fuel consumption improvements on the order of 10 to 15% in advanced turbofan engines. Greatest improvement stems from significantly higher cycle pressure ratios. Higher turbine temperature and fan bypass ratios are also expected to contribute to fuel conservation. (Paper: American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Propulsion Conference, 12th, Palo Alto, Calif., July 26-29, 1976)

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B.2.1.2.116 77A42784*# Aug 1977
NASA, Langley Research Center, Hampton, Va.
Hood, R. V., Jr.
Title: The Aircraft Energy Efficiency Active Controls Technology Program

ABSTRACT

Broad outlines of the NASA Aircraft Energy Efficiency Program for expediting the application of active controls technology to civil transport aircraft are presented. Advances in propulsion and airframe technology to cut down on fuel consumption and fuel costs, a program for an energy-efficient transport, and integrated analysis and design technology in aerodynamics structures and active controls are envisaged. (Paper: Guidance and Control Conference, Hollywood, Fla., August 8-10, 1977)

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B.2.1.2.117 N77-15008/4ST Nov 1974, Mar 1976
Lockheed-California Co., Burbank
Hopkins, J. P.
Title: Study of the Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System

ABSTRACT

Practical means assessed for achieving reduced fuel consumption in commercial air transportation. Five areas were investigated: current aircraft types, revised operational procedures, modifications to current aircraft, derivatives of current aircraft, and new near-term fuel conservative aircraft. (Summary of Final Report Vol I. See also Vol II: N77-15007/6ST)

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B.2.1.2.118 N80-10222/1 Aug 79
Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div
Howlett, R. A.
Title: VSCE Technology Definition Study

ABSTRACT

Refined design definition of the variable stream control engine (VSCE) concept for advanced supersonic transports is presented. Operating and performance features of the VSCE are discussed, including the engine components, thrust specific fuel consumption, weight, noise, and emission system. A preliminary engine design is presented. (Final Report)

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B.2.1.2.119 78A35893 Jun 1977
Societe Nationale Industrielle Aerospatiale, Toulouse, France
Cormery, G.
Title: Supersonic Transport in Terms of Energy Savings

ABSTRACT

The Utilization of petroleum-based fuel for civil aviation is considered within the framework of total energy consumption. Attention is given to developments in the United States and France, both currently and over the near-term future (through the 1980°s). Various improvements in engine and aerodynamic design are discussed, including use of composite

materials, supercritical wings, high bypass engines, and improved engine geometries. (Paper in L°Aeronautique et l°Astronautique, no. 69, 1978, in French)

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B.2.1.2.120 78A31310 Oct 1977
Rolls-Royce, Ltd., Aero Div., Bristol, England
Denning, R.M.
Title: Energy Conserving Aircraft from the Aircraft Viewpoint

ABSTRACT

The paper is mainly concerned with fuel-efficiency improvement in conventional gas turbine propulsion systems for airline operation. A broad philosophy of engine improvements for short, medium and long-haul aircraft is reviewed. (Paper in Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings)

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B.2.1.2.121 78A15022 Jun 1977
SNECMA, Paris, France
Devriese, J.
Title: The Improvement of Various Engine Installation Components in a Subsonic Transport Aircraft

ABSTRACT

Attention given to energy losses via thermal, aerodynamic, and propulsion characteristics of aircraft engines. Suggestions made for modification of several engine components in order to conserve fuel, including (1) the development of new materials for turbine blades, (2) increased turbine entry temperature, (3) improved compressor efficiency, (4) active control of turbine clearances, and (5) a possible heat exchanger between gases and compressor delivery air. (Paper in L°Aeronautique et L°Astronautique no. 66, 1977, in French)

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B.2.1.2.122 AD-A017 379/9ST Oct 73-Dec 74
Institute for Defense Analyses Arlington, VA Science and Technology Div.
Dix, Donald M.
Title: Small Aircraft Engine Technology: An Assessment of Future Benefits

ABSTRACT

This study analyzes relationships between technology-base efforts applicable to small aircraft engines and DOD needs, identified in terms of future aircraft systems: helicopters, cruise missiles, and RPVs. (Report)

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B.2.1.2.123 71A35625 Jun 1971
NASA, Lewis Research Center, Advanced Systems Div., Cleveland, Ohio
Dugan, J.F.
Title: Propulsion Systems Trends

ABSTRACT

Propulsion systems trends for 1980°s, discussing environmental noise levels, stoichiometric gas turbine engines for military aircraft, high bypass ratio engines for V/STOL aircraft, etc. (Paper in U. of Tennessee Space Inst. Systems Oriented Workshop on U.S. Transportation, Tullahoma, Tenn., Jun 20-Jul 17, 1971)

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B.2.1.2.124 71A14977 Unknown
Daimler-Benz Ag. Stuttgart, West Germany
Eckert, B.
Title: Why Jet Engines - Past, Present, and Future of the Aeronautical Gas Turbine

ABSTRACT

Aircraft propulsion, discussing piston, turbojet, turboprop and turbofan engines in terms of thrust to weight ratio, specific fuel consumption and propulsive efficiency. (Paper in American Astronautical Society, In-Aerospace Research and Development, Edited by E.A. Steinhoff, AAS Science and Technology Series, Volume 24)

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B.2.1.2.125 N76-23249/5ST 6 Oct 75
Econ, Inc., Princeton, NJ
Unknown
Title: An Assessment of the Benefits of the Use of NASA Developed Fuel Conservative Technology in the US Commercial Aircraft Fleet

ABSTRACT

Cost and benefits of a fuel conservative aircraft technology program proposed by NASA are estimated. NASA defined six separate technology elements for the proposed program: (a) engine component improvement (b) composite structures (c) turboprops (d) laminar flow control (e) fuel conservative engine and (f) fuel conservative transport. (Report)

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B.2.1.2.126 78A31303 Oct 1977
De Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada
Eggleston, B.
Title: Prospects for Energy Conserving STOL Transports Using Prop-Fans

ABSTRACT

Study examined the application of the prop-fan type of advanced propeller design to a 1986 technology, 50 passenger, STOL transport aircraft. In a 1986 technology aircraft the greatest fuel savings were found at Mach 0.50. The energy efficiencies of a prop-fan aircraft designed for Mach 0.70 were found superior to 1977 technology STOL and jet-CTOL aircraft by 10 - 20 percent. (Paper in Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977 Proceedings)

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B.2.1.2.127 N79-33206/0 Sep 79
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Fasching, W.A.
Title: CF6 Jet Engine Performance Improvement Program. Short Core Exhaust Nozzle Performance Improvement Concept

ABSTRACT

The short core exhaust nozzle was evaluated in CF6-50 engine ground tests. The short core exhaust nozzle provides an internal cruise sfc

reduction of 0.9 percent. (Report)

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B.2.1.2.128 N79-21074/6ST Mar 79
General Electric Co., Cincinnati, Ohio, Aircraft Engine Group
Fasching, W.A.
Title: CF6 Jet Engine Performance Improvement Program. Task 1: Feasibility Analysis

ABSTRACT

Technical and economic engine improvement concepts selected for subsequent development include: (1) fan improvement; (2) short core exhaust; (3) HP turbine aerodynamic improvement; (4) HP turbine roundness control; (5) HP turbine active clearance control; and (6) cabin air recirculation. The fuel savings for the selected engine modification concepts for the CF6 fleet are estimated. (Final Report)

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B.2.1.2.129 N79-12083/8ST Nov 78
NASA, Lewis Research Center, Cleveland, Ohio
Fishbach, L.H.
Title: Preliminary Study of Optimum Ductburning Turbofan Engine Cycle Design Parameters for Supersonic Cruising

ABSTRACT

The effect of turbofan engine overall pressure ratio, fan pressure ratio, and ductburner temperature rise on the engine weight and cruise fuel consumption for a mach 2.4 supersonic transport was investigated. Design point engines, optimized purely for the supersonic cruising portion of the flight where the bulk of the fuel is consumed, are considered. Based on constant thrust requirements at cruise, fuel consumption considerations would favor medium bypass ratio engines (1.5 to 1.8) of overall pressure ratio of about 16. Engine weight considerations favor low bypass ratio (0.6 or less) and low overall pressure ratio (8). Combination of both effects results in bypass ratios of 0.6 to 0.8 and overall pressure ratio of 12 being the overall optimum. (Report)

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B.2.1.2.130 AD-868 088/6ST Jan 70
Mechanical Technology Inc., Latham, NY
Frost, Alan
Title: An Investigation of Air Bearings for Gas Turbine Engines

ABSTRACT

Army aircraft require propulsion systems having improved power-to-weight ratio and specific fuel consumption. Simultaneous increases in engine operating pressures and temperatures are required. Because of the high temperatures and high rotational speeds, new lubrication methods will be required. One method is the air-lubricated (gas) bearing. Report presents a summary of results of work performed during the first six months of an investigation of air bearings for gas turbine engines. (Interim Report)

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B.2.1.2.131 AD-683 164 1965
Foreign Technology Div., Wright-Patterson AFB, Ohio
Fu T°ing
Title: Survey of Modern Aircraft Powerplants

ABSTRACT

The author points out that the turbo-jet engine can no longer satisfy the demands of the modern world; he therefore describes briefly the various types of engines under study at present in certain countries. These fall into two main categories: (1) Supersonic aircraft engines, which include turbo-fan after-burner engine, a turbo-fan ram-jet combination, and a turbo-rocket engine. (2) VTOL jet engines which do not need long runways, including a turbo-jet lift engine, a turbo-fan lift engine, a conventional turbo-jet engine with a lift fan attachment, and a deflected lift engine. A reheating gas turbine engine which has the advantage of a low fuel requirement is also briefly described. (Edited trans. of Hang K°ung Chih Shih (Mainland China) v2 n5 1965)

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B.2.1.2.132 AD-A081 182 Sep 79
Federal Aviation Administration, Washington DC Office of Environment and Energy
UNK
Title: Energy Conservation Potential of General Aviation Activity

ABSTRACT

Three approaches for reducing energy consumption were investigated: hardware modification, pilot education, and air traffic control. It is recommended that research into new aircraft engine designs, automatic mixture controls, conventional engine fuel saving improvements, composite materials development, and aerodynamic drag reduction continue. (Report)

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B.2.1.2.133 76A26670 Mar 1976
Deutsche Forschungs und Versuchsanstalt fuer t und Raumfahrt. Institute fuer Antriebssysteme, Braunschweig, West Germany
Alvermann, W.
Title: Propulsion Systems --- Aircraft Engine Technology Review

ABSTRACT

The current status of development of aircraft engines is examined taking into account a search for new fuels, economic demands for aircraft engines, the development of new engines with more favorable environmental characteristics, plans for the development of an acceptable engine for supersonic aircraft, and general studies concerned with the enhancement of the operational efficiency of the engine. Attention is given to current and future jet engines, turbine engines for helicopters, piston engines, and ramjet engines. (Paper in German)

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B.2.1.2.134 78A12031 June 1977
Avions Marcel Dassault-Breguet Aviation, Vaucresson, Hauts-de-Seine, France
Amblard, P.
Title: Energy Savings - The Viewpoint of an Aircraft Manufacturer

ABSTRACT

Technological developments leading to the design of aircraft which consume less fuel than present models are reviewed. In particular, high bypass ratio engines, supercritical wingspans, active control, and the use of light-weight composite materials for both secondary and primary aircraft structures are considered. Advanced techniques in aerodynamic analysis, especially in the field of boundary layer control, are also mentioned. (Paper in French)

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B.2.1.2.135 EI780530889 Feb 1978
NASA
Aronson, Robert B.
Title: Return of the Propeller

ABSTRACT

A new hybrid design combines features of the conventional prop and the fan section of a turbofan engine. Preliminary research indicates that the new "prop-fan" will use significantly less fuel than present turbofan engines. NASA says the new prop-fan could be flying by the 1990s. (Article in Machine Design Vol 50, No. 4, Feb 23, 1978)

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B.2.1.2.136 EI750100221 Sep 1974
Rolls-Royce,Ltd.
Unknown
Title: Gas Turbine Engines: A State-Of-The-Art Review

ABSTRACT

A review is given of Rolls-Royce Ltd. and the performance characteristics of various engines developed by the company. The RB.211 provides a considerable increase in operating economy over earlier-generation engines; its specific fuel consumption is 25 per cent lower. Other turbofan engines also evaluated, plus an advanced lift jet for V/STOL aircraft. (Article in Aircraft Engineering, Vol. 46 No. 9, Sept. 1974)

.....

B.2.1.2.137 EI741060025 Jul 1974
Rolls-Royce, Ltd.
Unknown
Title: High Temperature Operation

ABSTRACT

Experimental jet engine at combustion outlet temperatures exceeding 1800 degrees K. Increasing the operating temperature of an engine gives substantial thrust increases. Enables the size of reheat systems to be reduced and, when combined with a high pressure ratio, it provides a combination of low fuel consumption during subsonic cruise and low engine weight for a multi-role aircraft. (Article in Aircraft Engineering Vol. 46 No. 7 July 1974)

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B.2.1.2.138 RA750356 Jul 74
AVSCOM Air Mobility R and D Lab
Unknown
Title: Aircraft Propulsion Technology

ABSTRACT

Objective is to provide a firm validated hardware foundation for major propulsion subsystem advanced and engineering development programs by developing improved technology propulsion components. Component programs will consider performance, weight, energy conservation, producibility and cost. Results will provide validated advanced component technology for propulsion subsystems oriented toward future army aircraft and other DOD small engine and drivetrain requirements. Four technology areas: engine related components, drivetrain related components, cost reduction approaches, and advanced component investigations. Achievements in engine and drive train component technology have been applied to the Stagg and T700 engine programs and are being applied to the ASH, AAH, UTTAS, and HLH aircraft system programs. (Plan)

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B.2.1.2.139 VNO70178 April 4 79
National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center
Baron, R.S.
Title: Advanced Turboprop - Flight Research

ABSTRACT

The objective is to develop and demonstrate by flight research the technology for advanced turboprop propulsion systems having high propulsion efficiencies at cruise speeds and altitudes up to Mach 0.8 and 35,000 feet. This technology could provide fuel savings of 20% to 25% relative to current high-bypass turbofan engines. (Plan)

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B.2.1.2.140 EI790421934 1978
Soc Natl D°Etud Et De Constr De Mot D°Aviat, FR
Bensimhon, V.
Title: Fuel Conservation in Aircraft Engines and Its Limits

ABSTRACT

The Evolution of aircraft engines towards lower fuel consumption by improvements in efficiencies, cycles and weights. Starting from current situation, future possible trends are described for subsonic transport engines. (Paper in French)

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B.2.1.2.141 76A38188# July 1976
United Technologies Corp, Commercial Products Div., East Hartford, Conn.
Beyerly, W. R.
Title: Life Cycle Fuel Consumption of Commercial Turbofan Engines

ABSTRACT

Paper presents an overview and analysis of fuel consumption variations for Pratt and Whitney Aircraft JT3D, JT8D and JT9D engines through successive periods of on-the-wing service. (Paper: American Institute of Aeronautics and Asstronautics and Society of Automotive Engineers, Propulsion Conference, 12th, Palo, Alto, Calif. July 26-29, 1976).

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B.2.1.2.142 78A31305# Oct 1977
Canadair, Ltd., Montreal, Canada
Bernstein, S.
Title: Improved Energy Efficiency for Small CTOL Transport Aircraft

ABSTRACT

Potential improvements in fuel efficiency by application of new airframe and propulsion system technologies (supercritical wings, advanced composite materials, high aspect ratio wings, advanced propulsion systems, wing tip winglets, active controls and laminar flow) to the smaller CTOL transport aircraft. Fuel savings of up to 12% are possible by increasing aspect ratio alone. Incorporation of supercritical airfoils and advanced composites with the higher aspect ratios can save a further 5%. Advanced propulsion system technology offers similar or higher potentials for fuel savings: 15-20% with new turbofans and a further 15-20% with prop-fans. Total cumulative fuel savings of 40-45% are possible with incorporation of all the new technologies investigated. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977)

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B.2.1.2.143 N78-32066/OST Sep 78
Hamilton Standard, Windsor Locks, Conn.
Black, D. M.
Title: Aerodynamic Design and Performance Testing of an Advanced 30 Deg Swept, Eight Bladed Propeller at Mach Numbers From 0.2 to 0.85

ABSTRACT

Emphasis on fuel conservation in the world has stimulated studies of both conventional and unconventional propulsion systems for commercial aircraft. Preliminary results indicate that a fuel saving of from 15 to 28 percent may be realized by the use of an advanced high speed turboprop. An advanced turboprop concept was wind tunnel tested. Results are presented which indicate propeller net efficiencies near 80 percent were obtained at high disk loadings at Mach 0.8. (Final Report)

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B.2.1.2.144 SSIE: ZQF4526706 9/63 to 12/80
Aero Propulsion Lab, Wright Patterson AFB Dayton, Ohio 45433
Blevins, E.G.
Title: Turbine Engine Integration Analysis Procedures

ABSTRACT

To generate the propulsion system (inlet, engine, exhaust) performance trends and establish the engineering techniques necessary for improving delivered thrust-fuel flow characteristics during engine part-power operation. (Plan)

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B.2.1.2.145 EI761171825 1974
Unknown
Bogomolov, E.N.
Title: Efficiency of High-Temperature Turbojet Engine With Air-Cooled Turbine

ABSTRACT

Specific parameters of a high-temperature cooled turbojet engine are compared with the parameters of low-temperature nonafterburning and afterburning engines with uncooled turbine. It is shown that the presence of the air cooling system reduces significantly and may even eliminate the advantages of the high-temperature nonafterburning engine over the afterburning version. Theoretical data are presented on the efficiency of the turbine considered as a component of a turbojet engine consisting of the turbine proper and its air cooling system. (Paper: Sov Aeronaut V 17 N 1 1974)

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B.2.1.2.146 75A40502* May 1975
Lockheed-Georgia Co., Marietta, Ga.
Bowden, M. K.
Title: Design of Short Haul Aircraft For Fuel Conservation

ABSTRACT

Interaction of airfoil technology and desirable engine characteristics is important: the supercritical airfoil permits higher aspect ratio wings with lower sweep; these, in turn, lower the cruise thrust requirements so that engines with higher bypass ratios are better matched in terms of lapse rate. Lower cruise speeds (which are also better for fuel and operating cost economy) push the desired bypass ratio up further. Effects on fuel consumption of design field length, powered

lift concepts and turboprop as well as turbofan propulsion are discussed. (Paper: Society of Automotive Engineers, Air Transportation Meeting, Hartford, Conn., May 6-8, 1975)

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B.2.1.2.147 N74-20654/1 Dec 20 1973
National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
Braslow, A. L.
Title: Aeronautical Fuel Conservation Possibilities for Advanced Subsonic Transports

ABSTRACT

Fuel-conservation possibilities attainable through the application of advances in aeronautical technology to aircraft design are identified with the intent of stimulating NASA R and D and systems-study activities in the various disciplinary areas. The material includes: drag reduction; weight reduction; increased efficiency of main and auxiliary power systems; unconventional air transport of cargo; and operational changes. (Report)

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B.2.1.2.148 N77-23109/OST 1977
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Bresnahan, D. L.
Title: NASA Quiet Clean General Aviation Turbofan (QCGAT) Program Status

ABSTRACT

The suitability of large engine technology to reduce noise, emissions, and fuel consumption of small turbine engines and develop new technology where required is determined. The design, fabrication, assembly, test, and delivery of the experimental engines to NASA are discussed. (Report)

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B.2.1.2.149 EI760 '4 1974
Inst ı Werkstoff-Forschung, Lindder Hoehe, Ger
Bunk, W.
Title: Artificial and Natural High-Temperature Composites

ABSTRACT

Composites will probably replace conventional superalloys as turbine blades in jet engines allowing higher temperatures of combustion and therefore resulting in higher efficiency. Examples of such composites as materials for engine design are discussed. (Paper: Inst Counc of the Aeronaut Sci (ICAS), 9th Congr. Proc Haifa, Isr, Aug 25-30 1974)

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B.2.1.2.150 AD-A037 349/8ST 1 May 73 - 30 June 76
Battelle Pacific Northwest Labs, Richland, Wash.
Busch, R.
Title: Application of Sputter-Deposited Lamellar Composite Technology to the Development of High Temperature Turbine Blade Materials and Airfoil Fabrication

ABSTRACT

Data and results from the third year's work on application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication is presented and discussed. (Final Report)

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B.2.1.2.151 ERDA/NASA-0067/77/1 Feb 77
United Technologies Corp., South Windsor, Conn., Power Systems Div.; Pratt and Whitney Aircraft Group, East Hartford, Conn.; Department of Energy
Carlson, N.
Title: Thermal Barrier Coating On High Temperature Industrial Gas Turbine Engines

ABSTRACT

Study program identified significant benefits from applying thermal barrier coatings to hot section components of high temperature industrial gas turbine engines. The thermal barrier coating used in this study was a yttria-stabilized zirconia material with a NiCrAly undercoat and the base engine used to establish improvements was the P and WA FT50A-4 industrial gas turbine engine. Cooling flow reductions and improved heating rates achieved with thermal barrier coating result in improved performance.

Economic benefits include reduced consumption. Fuel savings equivalent to $5 million are projected and specific power (megawatts/mass of engine airflow) improvements on the order of 13 percent are estimated. (Report)

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B.2.1.2.152 SSIE: GQF 479903 3/77 to 4/80
General Electric Co., 1 Jimson Rd., Cincinnati, Ohio 45215
Carlson, R. G.
Title: Effect of Bonding Characteristics on Metal Matrix Composite Properties

ABSTRACT

Air Force Propulsion systems of the future are expected to contain metal matrix composites because of their attractive mechanical properties at substantially reduced weight. A better technical understanding is required for design and application of this class of materials. Objective - this research will develop an understanding of the metal matrix composites to effect a balanced increase in mechanical properties, placing specific emphasis on increased impact resistance. (Plan)

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B.2.1.2.153 SSIE: GQF 354806 6/72 to N/A
University of Southern California, School of Engineering, Dept. of Mechanical Engineering 3551 University Ave., Los Angles, California, 90007
Choudhury, P.R.
Title: Turbulent Vortex Flame Stability and Spreading With Gas Jets And Spray Control Homogeneous Ignition Of Fuel-Air Explosions

ABSTRACT

Provide additional understanding and realistic analytical modeling of the transient and steady-state behavior of turbulent reactive flow fields and of spontaneous reactive additives on programmed homogeneous ignition in vortex combustion and fuel-air clouds, and will contribute to establishing realistic guidelines for developing efficient, stable advanced air-breathing combustors and determining the feasibility of possible new single-event fuel-air explosive devices, and in the application of broad range alternate fuels such as those derived from shale and coal. (Plan)

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B.2.1.2.154 E1760100310 Aug 1975
Noel Penny Turbines Ltd.
Clarke, J. M.
Title: Availability And Propulsion

ABSTRACT

The first and second laws applied to steady-flow systems are expressed in forms which emphasize the distinction between energy, which is conserved, and available energy, which is depleted in real processes. The maximum thrust power obrainable from the combustion of the fuel is shown to be dependent on the composition, state and velocity of the fuel and also on the composition and state of the environment in which the unit works. (Paper: J Mech eng Sci V 17 N 4 Aug 1975)

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B.2.1.2.155 79N27141*# Aug 76
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Chamberlin, R.
Title: Energy Efficient Aircraft Engines

ABSTRACT

Description and status of propulsion portion of NASA°s Aircraft Energy Efficiency Program. (1) Engine Component Improvement -- directed at current engines. (2) Energy Efficiency Engine -- directed at new turbofan engines, and (3) Advanced Turboprops -- directed at technology for advanced turboprop-powered aircraft with cruise speeds to Mach 0.8. Unique propulsion system interactive ties to the airframe resulting from engine design features to reduce fuel consumption are discussed. Emphasis on advanced turboprop. (Paper: Presented at Aircraft Systems Meeting, New York, 20-22 Aug 1979; sponsored by AIAA)

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B.2.1.2.156 N78-31086/9ST Jul 78
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Study of Fuel Systems for LH2-Fueled Subsonic Transport Aircraft, Volume 2

ABSTRACT

Engine concepts examined for use with hydrogen fuel in aircraft. Candidate designs of tank structure and cryogenic insulation systems evaluated. Designs of aircraft fuel system (pumps, lines, valves,

regulators, and heat exchangers) received attention. Designs of boost pumps mounted in the LH2 tanks, and high pressure pump mounted on the engine were defined. Aircraft compared with conventionally fueled counterpart. (Final Report)

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B.2.1.2.157 SSIE: GQF 468702 1/77 to 2/81
Aerochem Research Lab Inc., P.O. Box 12, Princeton, New Jersey, 08540
Calcote, H.F.
Title: Ionic Mechanisms of Carbon Formation In Flames

ABSTRACT

Study in progress will develop models of soot formation in air-breathing engines not now available, using conventional hydrocarbon and synthetic fuels derived from coal, shale oil, and sand tars. (Plan)

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B.2.1.2.158 N77-31155/3ST 1977
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Dugan, J.F.
Title: Advanced Turboprop Technology Development

ABSTRACT

The efficiency of high-speed turboprop propulsion systems is considered with emphasis on fuel savings. Specific topics discussed include: High efficiency and low noise of propeller design; engine-airframe integration. (Paper: Conf-Presented At Aircraft Systems And Technol. Meeting, Seattle, 22-24 Aug. 1977; sponsored by AIAA.)

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B.2.1.2.159 76A47847 Aug 1976
Rolls-Royce Ltd., Aero Div., Derby, England
Denning, R.M.
Title: Future Trends I - Aero Gas Turbine Design I - Conventional Engines

ABSTRACT

Single-stage turbofan engines of high bypass ratio are compared and classified as the preferred design for aircraft cruising at high subsonic Mach numbers. Specific fuel consumption is singled out as the most

important criterion. (Paper: Aeronautical Journal, Vol. 80 Aug. 1976)

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B.2.1.2.160 AD-A040 189/3ST Mar 77
Advisory Group for Aerospace Research and Development, Paris (France)
Unknown
Title: Variable Geometry and Multicycle Engines

ABSTRACT

Session I - Military aspects of variable geometry engines; opportunities for variable geometry engines in military aircraft; Session II - Application of variable geometry engines for future aircraft; Session III - Variable-geometry fans, compressors, and propellers; Session IV - Variable geometry - combustors and turbines; Session V - Round table discussion. (Paper: Presented at meeting of the AGARD Propulsion and Energetics Panel (48th), Paris (France), 6-9 Sep 76)

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B.2.1.2.161 AD-A052 669/9ST Jul 77
Army Armament Research and Development Command, Watervliet NY, Benet Weapons Lab
Ahmad, I.
Title: Reinforced Cobalt Alloy Composite For Turbine Blade Application

ABSTRACT

A composite of 0.42 V(f)-27 ThO2 filament reinforced cobalt base alloy has been developed. It can be fabricated by conventional investment casting process, has a 1093 C (2000 F), 100 hr. stress-to-rupture of 206 MN/sq M (30Ksi), and a charpy impact strength of 280.0 in-lb at 835 C as compared with 20.6 in-lb for the unreinforced alloy. Also the feasibility of casting a prototype first stage blade of JT9D engine has been demonstrated. (Report)

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B.2.1.2.162 N76-19152/7ST Mar 76
National Aeronautics and Space Administration, Hugh L. Dryden Flight Research Center, Edwards, Calif.
Albers, J. A.
Title: Status Of The NASA YF-12 Propulsion Research Program

ABSTRACT

The YF-12 research program was initiated to establish a technology base for the design of an efficient propulsion system for supersonic cruise aircraft. The major technology areas under investigation in this program are inlet design analysis, propulsion system steady-state performance, propulsion system dynamic performance, inlet and engine control systems, and airframe/propulsion system interactions. The objectives, technical approach, and status of the YF-12 propulsion program are discussed. Also the results obtained to date by the NASA Ames, Lewis, and Dryden research centers. The expected technical results and proposed future programs are given. Propulsion system configurations are shown. (Report)

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B.2.1.2.163 79A11600 1978
Lewis Research Center, Cleveland, Ohio
Rudey, R.A.
Title: Impact of Future Fuel Properties on Aircraft Engines and Fuel Systems

ABSTRACT

From current projections of the availability of high-quality petroleum crude oils, it is becoming increasingly apparent that the specifications for hydrocarbon jet fuels may have to be modified. The problems that are most likely to be encountered as a result of these modifications relate to engine performance, component durability and maintenance, and aircraft fuel-system performance. The severity of the potential problems is described in terms of the fuel characteristics most likely to change in the future. Selected technological advances that can reduce the severity of the problems are described and discussed. (Paper: NATO, AGARD, Lecture Series on Energy Conservation in Aircraft Propulsion, 96th, Munich, West Germany, Oct. 26, 1978)

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B.2.1.2.164 N78-24359/8ST 1978
NASA, Lewis Research Center, Cleveland, Ohio
Rudey, R.A.
Title: Impact of Future Fuel Properties on Aircraft Engines and Fuel Systems

ABSTRACT

This paper describes and discusses the propulsion-system problems that will most likely be encountered if the specifications of hydrocarbon-based jet fuels must undergo significant changes in the future and, correspondingly, the advances in technology that will be required to minimize the adverse impact of these problems. Illustrations are used to describe the relative effects of selected fuel properties on the behavior of propulsion-system components and fuel systems. Programs that are under way to address these needs are briefly discussed. (Report)

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B.2.1.2.165 79N13195 Unknown
Imperial Coll. of Science and Technology, London, England
MacFarlane, J.J.
Title: The Role of Fundamental Combustion in the Future Aviation Fuels Program --- Carbon Formation in Gas Turbine Primary Zones

ABSTRACT

Alternative fuels research using can type engine combustors is briefly summarized. Flame research undertaken to study the way in which carbon is formed in gas turbine primary zones was described. (Article: AGARD Aircraft Eng. Future Fuels and Energy Conserv.)

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B.2.1.2.166 FE-2664-6(DOE) 10 Apr 78
AiResearch Mfg. Co. of Arizona, Phoenix
Unknown
Title: Ceramic Technology Readiness Program. Sixth Monthly Technical Progress Report, February 27 - April 2, 1978

ABSTRACT

Research on ceramic turbine components for use with coal-derived fuels. (Progress Report)

B.2.1.2.167 EI791292374 Sep 1978
NASA, Lewis Research Center
Nored, Donald L.
Title: Fuel Conservation Aircraft Engine Technology

ABSTRACT

A major new thrust in NASA°s aeronautical research is the aircraft energy efficiency program. This program, initiated in an effort to minimize the adverse effect of the world-wide fuel crisis on the aviation industry, will develop technology for more fuel-efficient subsonic transport aircraft. It includes three major propulsion projects: Engine Component Improvement - Directed at current Engines; Energy Efficient Engine - Directed at new turbofan engines; and Advanced Turboprops - Directed at technology for advanced turbopropowered aircraft. This paper reviews each project, describes some of the technologies and recent accomplishment, and summarizes their respective status. 22 refs. (Paper: Proceedings Internat. Counc. of the Aeronaut Sci 11th Congr., Lisbon, Port. Sep 10-16 1978)

B.2 PROPULSION TECHNOLOGY

B.2.2 NUCLEAR PROPULSION

B.2.2.1 NAVY FUNDED

No information was found under this sub-category.

B.2 PROPULSION TECHNOLOGY

B.2.2 NUCLEAR PROPULSION

B.2.2.2 NON NAVY FUNDED

B.2.2.2.1 75A43968 1975
Unknown
Grey, J.
Title: Future Engines and Fuels --- Advanced Cycles, Fuels and Nuclear Propulsion

ABSTRACT

The variable-cycle engine and the supersonic-combustion ramjet (for hypersonic aircraft) are discussed, with emphasis on the first topic. Flexible variable-cycle engines could power high-thrust STOL opertions and low-noise takeoffs and landings while still permitting high-speed economical cruise; others could permit a single airplane to fly efficiently at both subsonic and supersonic speeds. The supersonic-combustion ramjet will find application farther in the future than the variable-cycle engine; it is the only envisoned air-breathing engine which could operate effectively above Mach 5. The use of hydrogen as a fuel and the need for rejuvenation of the nuclear aviation power development effort are also discussed. (Article: Exxon Air World, v 27, n 4, 1975)

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B.2.2.2.2 75A41951 1974
Nederlandse Vereniging voor Luchtvaarttechniek
Sterk, F.J.
Title: Nederlandse Vereniging voor Luchtvaarttechniek, Yearbook 1974

ABSTRACT

Some selected topics in recent developments in the design of new aeronautical systems are discussed including nuclear-propelled aircraft. (Book, Dutch and English)

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B.2.2.2.3 75-4666 1974
University of Virginia
Bettenhausen, Lee H.
Title: Gaseous- Fueled Nuclear Rocket Engine

ABSTRACT

An energy exchange and nuclear reactor model for a gaseous-fueled nuclear rocket engine is examined in detail. On the basis of the model used in this study, it does not appear feasible to design a regeneratively-cooled, gaseous-fueled nuclear rocket engine to operate at

a power level as high as 20,000 Mw and meet realistic conditions of temperature, pressure, and critical mass of fissioning fuel. A reduction of a factor of 2 or 3 in the power level or a more sophisticated energy transfer analysis may yield a realistic design for the rocket engine. (Ph.D. Thesis)

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B.2.2.2.4 78A23420# Feb 1978
Lockheed California Co., Burbank, CA
Hawkins, W.M.
Title: Where Aerospace Can Serve Afresh - Paths to Energy Independence

ABSTRACT

Feasibility of developing new energy technologies. Among the new technologies proposed are: using fusion explosions to generate superheated steam, nuclear-based conversion of seawater to hydrogen, methane production from plants and waste, ocean thermal energy conversion, and coal gasification. (Paper: Astronautics and Aeronautics, vol. 16, Feb 1978)

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B.2.2.2.5 71A17694*# 1969
NASA, Lewis Research Center, Cleveland, OH
Rom, F.E.
Title: Status of the Nuclear Powered Airplane

ABSTRACT

NASA has been carrying out a low-level effort to determine and solve the problems facing practical, safe and economical nuclear aircraft. The key problem is safety. The prevention of fission product release after a major accident on land is difficult. Studies indicate in principle that fission products can be contained; however, much work needs to be done. Over-water flight minimizes the safety problem. Thermal reactors make possible the avoidance of nuclear excursions in accidents by minimizing the fuel inventory. Nuclear aircraft must weigh more than one million pounds in order that payloads of 15 percent of the gross weight or greater can be carried. (Paper: Journal of Aircraft, vol. 8)

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B.2.2.2.6 N70-17470*# Nov 1969
United Aircraft Corp., East Hartford, CN
Mc Lafferty, G.H.
Title: Investigation of Gaseous Nuclear Rocket Technology, Summary Technical Report, 15 Sep. 1963 - 15 Nov. 1969

ABSTRACT

A feasibility study was made of a gaseous nuclear rocket engine concept: the closed-cycle nuclear light bulb engine. This engine is based on the transfer of energy by thermal radiation from gaseous nuclear fuel suspended in a neon vortex through an internally cooled transparent wall to seeded hydrogen propellant. Engine offers spe ific impulse greater than 1500 sec, values of thrust-to-weight ratio greater than 1, and containment of the gaseous nuclear fuel without loss of fuel or fission products in the exhaust. The investigations include: the characteristics of one-component and two-component vortex flows; the characteristics of coaxial flows; the spectral and total radiant energy emitted from the fuel-containment region; the transmission characteristics of fused silica exposed to nuclear radiation. (Report)

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B.2.2.2.7 N70-12923*# 1 Dec 1969
Silverstein, (Calvin C.), Baltimore, MD
Silverstein, Calvin C.
Title: A Study of Heat Pipe Applications in Nuclear Aircraft Propulsion Systems, Final Report

ABSTRACT

Preliminary studies of heat pipe systems for reactor-to-jet engine heat transport and for emergency distribution of reactor afterheat over the surface of the reactor containment vessel are described. (Report)

.....

B.2.2.2.8 75J0003272 Apr 1965
Aerojet-General Corporation, Sacramento, CA
Duke, Edward E.
Title: Nuclear Heating and Propellant Stratification

ABSTRACT

In order to obtain maximum vehicle performance for a nuclear system employing liquid hydrogen, the vehicle must be designed to obtain optimized propellant utilization while minimizing system weight. A major problem encountered in this endeavor is caused by propellant heating. Propellant heating has the undersirable effect of raising the temperature of the liquid to a value that is no longer acceptable for adequate main feed pump operation. To insure proper propellant utilization and to prevent pump cavitation, the propellant temperature distribution during pump operation must be accurately predicted. (Paper: AIAA Journal, vol. 3, no. 4)

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B.2.2.2.9 AD-881176L Mar 71
Arnold Engineering Development Center, Arnold Air Force Station Tenn
Gilfillan, D. R.
Title: Nuclear Aircraft Propulsion Development Facilities Study

ABSTRACT

This study identifies the facility requirements associated with the initial phase of the Air Force technology program to develop nuclear-powered aircraft. (Final Report)

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B.2.2.2.10 75A22509 Feb 1975
Lockheed-Georgia Co., Marietta, GA
Lange, R.H.
Title: Design Concepts for Future Cargo Aircraft

ABSTRACT

Results of preliminary design studies of advanced technology cargo aircraft including novel distributed-payload spanloader designs, hydrogen-fueled transports, nuclear-powered transports, and ram-wing vehicles. (Paper: 11th Ann: Meeting AIAA Washington, DC, Feb 24-26, 1975)

.....

B.2.2.2.11 AD-B039 187L May 79
Air Command and Staff Coll Maxwell AFB, Ala
Baker, Vincent T.
Title: Alternate Fuel Sources for Future USAF Aircraft

ABSTRACT

Study of abililty of synfuel (coal or shale oil derived), liquid hydrogen, and nuclear energy to perform airlift and station-keeping AF missions. Synfuel and liquid hydrogen are attractive; nuclear power considered unacceptable. (Report)

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B.2.2.2.12 AD-B008 941 1 Mar 74 - 7 Feb 75
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio, School of Engineering
Amos, Michael W.
Title: Nuclear Aircraft Feasibility Study

ABSTRACT

Study to assess the feasibility of applying nuclear propulsion to aircraft in performance of the Air Force Mission. This was accomplished by using a systems approach divided into six areas: (1) Mission Selection, (2) Required Mission Avionics, (3) Aircraft Design, (4) Propulsion System Design, (5) Public Safety, and (6) Cost. (Master's Thesis, Executive Summary plus two volumes. See also AD-B008 942L and AD-B008 943L.)

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B.2.2.2.13 73X77604 Dec 1971 - Jul 1972
Westinghouse Electric Corp., Pittsburgh, PA
Unknown
Title: Investigations of Containment Vessel Concepts for Airborne Nuclear Systems. Volume 1: Reactor Safety Study for Nuclear Powered Aircraft

ABSTRACT

A computer program (ESATA II) was developed to analyze the transient temperature and pressure response of a liquid metal-cooled fast and a gas-cooled thermal reactor power plant following earth impact. This program considers (in addition to the standard modes of heat transfer) fission product decay and transport, metal-water reactions, lithium vaporization and condensation, dissociation of hydride materials, reactor and shield melting and displacement, internal pressure buildup, and containment vessel stress response. Rocket sled impact test results

recommended shield design of a single tungsten layer surrounding the reactor followed by alternate layers of lithium hydride filled honeycomb structure and insulation such as zirconia and alumina. The use of this shielding configuration resulted in the containment vessel remaining intact for 2,000,000 seconds following impact (the time point at which the computations were terminated). (Report)

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B.2.2.2.14 73X71038 Jul 1971 - Feb 1972
United Aircraft Corp., East Hartford, Conn
Robson, F.L.
Title: Analysis of Nuclear Propulsion and Power Conversion Systems for Large Subsonic Aircraft

ABSTRACT

Studies made of alternate conceptual propulsion and power conversion systems identify two systems that are the most suitable for converting nuclear energy to aircraft propulsion. Performance of these systems has been defined and a logical program leading to the demonstration of the concepts has been identified. Approach was based upon technology currently available as well as attainable in the 1975-1980 time period. Take-off, climb, and cruise thrust requirements for a one-million-pound aircraft designed for cruising at M = 0.7, 30,000 ft were estimated. Take-off, climb to cruise altitude, descent and landing use normal chemical fuel, whereas only the 30-day cruise requirement would be performed using the nuclear reactor heat source. (Final Report - Conf.)

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B.2.2.2.15 79A33835 Apr 1979
Unknown
Layton, J.P.
Title: Advanced Nuclear Systems for Large Aircraft

ABSTRACT

An approach to the interdependent definition of future military missions and credible nuclear aircraft based on a carefully conceived program of analysis, research, and technology is outlined. Particular consideration is given to advanced nuclear aircraft concepts, including heavier-than-air and lighter-than-air. Aspects of operational safety are emphasized. (Paper: AIAA Very Large Vehicle Conference, Arlington, VA, April 26-27, 1979)

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B.2.2.2.16 AD-B017 795/6ST Apr 77
Lockheed-Georgia Co., Marietta, GA; and Westinghouse Electric Co., Advanced Energy Systems Div.
Muehlbauer, John C.
Title: Innovative Aircraft Design Study. Task II. Nuclear Aircraft Concepts

ABSTRACT

Parametric analyses and design refinement studies were performed for conventional, canard, and spanloader aircraft configurations to determine the lightest ramp weight configuration with a nuclear propulsion system. For mission ranges exceeding 9200 n. m, the nuclear aircraft will be lighter than a JP-fueled aircraft. The nuclear aircraft has less life cycle cost for a range exceeding 1200 n.m. This range lessens as conventional fuel prices increase. (Report)

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B.2.2.2.17 79A41913 Apr 1979
Lockheed-Georgia Co., Marietta, GA and Westinghouse Electric Corp., Advanced Energy Systems Div., Pittsburgh, PA
Muehlbauer, J.C.
Title: Nuclear Aircraft Innovations and Applications

ABSTRACT

Determination of the minimum weight nuclear propulsion cycle and aircraft configuration, identification of technologies and innovations for enhancing mission accomplishment, and evaluation of alternate mission applications in the framework of the Innovative Aircraft Design Study (IADS) program are discussed. While sea control, cruise missile carrier, tanker, and airborne command post are prospective alternate mission applications, the nuclear powered cruise missile carrier aircraft (NuCMCA) concept provides unique strategic capabilities. (Paper: American Institute of Aeronautics and Astronautics, Very Large Vehicle Conference, Arlington, VA, Apr 26, 27, 1979)

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B.2.2.2.18 75N13830 1974
Luftschifftechnik ALV, Graz (Austria)
Vonveress, E.
Title: The Nuclear Airship ALV-C/1 --- Helium Gas Turbines with High Temperature Nuclear Reactor

ABSTRACT

The design of an airship propelled by helium closed cycle gas turbines in combination with a high temperature nuclear reactor is discussed. (Article: DGLR Airships)

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B.2.2.2.19 72N12604 Dec 1971
NASA, Lewis Research Center, Cleveland, Ohio
Rom, F.E.
Title: Analysis of Cost Effectiveness of Cargo Transportation by Nuclear Propelled Aircraft and Impact Damage Tests of Nuclear Reactor Containment Vessels

ABSTRACT

Nuclear-powered air-cushion vehicles using lightweight aircraft-type nuclear powerplants show promise of carrying transoceanic cargo at cost-per-metric-ton-kilometer rates comparable to railroad rates. Cargo rates for nonstop distances of 4000 n mi are expected to be less than one-half those for similar fossil-fueled air-cushion vehicles. There are no fundamental technical reasons why subsonic nuclear aircraft cannot be made to fly successfully if the gross weight is over 1 million lb. Idealized model containment vessels which have been impacted on reinforced concrete showed no leaks after impact at velocities to 400 mph. (Report)

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B.2.2.2.20 AD-770 723/5 1960
1960
Voronkov,
Title: The Nuclear Reactor as an Object of Control

ABSTRACT

The article deals with the dynamic analysis of a nuclear reactor used in aircraft. In the case of small deviations from the equilibrium position, the nonlinear equation of the reactor can be linearized. The linear equation is then analyzed for stability of the system. The effect of various perturbations on stability and quality of the system is also

discussed. Technical trans. of Avtomaticheskoe Regulirovani Aviadvigatelei (USSR))

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B.2.2.2.21 73N33393 Jun 1973
Sandia Labs., Albuquerque, N Mex
Scott, W.F.
Title: Feasibility Study on Fast-Acting Valves for Airborne Nuclear Containment Systems

ABSTRACT

The feasibility of developing fast-acting valves to seal the coolant lines emanating from a reactor used to power aircraft was studied. The valves must be made integral with the wall of a hardened containment sphere in such a way that the structural integrity of the sphere is unimpaired in the event of a crash. (Report)

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B.2.2.2.22 AD-A054672 July 77 - Jan 78
Westinghouse Electric Corp., Pittsburgh, PA, Advanced Energy Systems Div.
Thompson, R.E.
Title: Nuclear Bi-Brayton System for Aircraft Propulsion Study

ABSTRACT

Parametric and reference system definition studies were performed with respect to a new concept for a nuclear aircraft propulsion system. The Bi-Brayton system combined with a compact gas-cooled (NERVA derivative) reactor was found to be a desirable system for nuclear aircraft propulsion and is recommended for consideration in any further studies of nuclear propelled aircraft. (Final Report)

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B.2.2.2.23 AD-847 784/6ST 1967
Unknown
Poznanski, W.
Title: Application of Atomic Energy to Jet Engines

ABSTRACT

General aspects of the use of atomic energy for jet and rocket propulsion are discussed. Research has been conducted in the Soviet Union and in the West for several years.

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B.2.2.2.24 AD-636 657 1963
Unknown
Vasiljevic, N.
Title: Atomic Aircraft Engines

ABSTRACT

The advantages and disadvantages found in nuclear aircraft engines are discussed. Nuclear powerplants offer advantages in the following areas: high quantities of nuclear fuel; great concentration of energy in nuclear fuels; possibility of simultaneous increase in range and speed; greater power output by using one reactor for more than one engine; convenient variance in power; possibility of adapting vertical takeoffs to heavy aircraft. Shortcomings can be summarized as follows; require special materials for the reactor and its system; difficulties encountered in reactor construction; small thermal efficiency coefficient; danger of radioactivity; small specific energy for small power; weak economic production effectiveness. (Unedited rough draft trans. of Tehnika (Yugoslavia) v18 n3 p 426-8 1963)

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B.2.2.2.25 74A39371 Dec 1973
American Inst. of Aeronautics and Astronautics, Inc., New York, NY
Grey, J.
Title: Nuclear Propulsion - An Epilogue

ABSTRACT

A review is presented of NASA efforts concerned with the development of propulsion systems which are based on nuclear fission. Almost half of the funds were used for research and development on nuclear rockets. The bulk of the remainder was spent on projects related to nuclear propulsion of aircraft. The various programs involved are examined, giving attention

to the reasons which led to the discontinuation of the projects before final success was attained. (Paper: AIAA Student Journal, v11 Dec 1973)

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B.2.2.2.26 AD-864 962 Oct 69
Unknown
Silverstein, Calvin C.
Title: A Survey of Advanced Energy Conversion Systems and Their Applicability to Army Aircraft Propulsion Requirements

ABSTRACT

A survey of advanced energy conversion methods and an evaluation of their applicability to Army aircraft propulsion requirements were carried out. Systems surveyed included: closed Brayton cycle, Rankine cycle, intercool-reheat cycle, fuel cells, MHD converters, thermionic converters, thermoelectric converters, radioisotope heat sources, and nuclear reactor heat sources. Information was also obtained on conventional and superconducting motors, which are required to convert the output of direct electrical generators to shaft power.

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B.2 PROPULSION TECHNOLOGY

B.2.3 ADVANCED PROPULSION SYSTEMS

B.2.3.1 NAVY FUNDED

B.2.3.1.1 AD-A074 595 Nov 78 - Aug 79
Martin Marietta Aerospace Denver Colo, Denver Div
Marcy, William L.
Title: Propulsion Options for the HI Spot Long Endurance Drone Airship

ABSTRACT

Airbreathing, monofueled, stored energy, and solar rechargeable propulsion systems have been studied for the HI SPOT Long Endurance Drone Airship, providing constant level electrical power as well as variable aerodynamic thrust to maintain position in winds varying from 15 to 100 knots at high altitude. A hydrogen fueled, airbreathing engine is optimum for mission lengths up to 30 days or more. (Final Report)

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B.2.3.1.2 AD-675 332 Jul 68
Johns Hopkins Univ., Silver Spring, MD, Applied Physics Lab.
Rabenhorst, David W.
Title: The Turbo-Electric VTOL Aircraft

ABSTRACT

A unique aircraft propulsive/lift power distribution system is described that promises a great deal of flexibility in the design of VTOL aircraft. Its use would permit a significant improvement in many aspects of present and future VTOL designs, including performance, safety, cost, operability, noise, applicability, and operational economy. (Technical Memo)

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B.2 PROPULSION TECHNOLOGY

B.2.3 ADVANCED PROPULSION SYSTEMS

B.2.3.2 NON NAVY FUNDED

B.2.3.2.1 E1800100331 Sep 1979
Case Western Reserve Univ., Cleveland, Ohio
Reshotko, Eli
Title: Drag Reduction By Cooling In Hydrogen-Fueled Aircraft

ABSTRACT

Drag reductions are possible for cryo-fueled aircraft by using fuel to cool selected aerodynamic surfaces on its way to the engines. Calculations for hydrogen-fueled transport show that drag reductions in cruise of about 20% are within reason. Hydrogen fueled aircraft employing surface cooling is attractive as an energy conservative aircraft and warrants more detailed study. (Paper: Journal of Aircraft Vol 16, No. 9, Sept 1979)

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B.2.3.2.2 SSIE: GQF462490 [illegible] /81
Marquardt Co., 16555 Saticoy [illegible] rnia, 91409, United States of America
Piercy T.
Title: [illegible]oost Sustain Integration Study

ABSTRACT

Study the possibility of combining the separate propulsion stages of boost and sustain into a single propulsion unit for ramjets (Solid fuel, liquid fuel and ducted rocket). Eliminate booster ejectables during boost-to-sustain transition phase. (Plan).

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B.2.3.2.3 79N15963*# 1978
NASA, Langley Research Center, Langley Station, V..
Willis, E.A.
Title: General Aviation Energy-Conservation [illegible]earch Programs

ABSTRACT

A review is presented of nonturbine general aviation engine programs underway at the NASA-Lewis Research Center. The program encompasses conventional, lightweight diesel, and rotary engines. Three major thrusts are: (1) reduced SFC°s; (2) improved fuels tolerance; and (3) reducing emissions. Improved fuel management and advanced engine concepts are described. These are expected to lay the technology base, by the mid to latter 1980°s, for engines whose total fuel costs are as much as 30

percent lower than today's conventional engines. (Paper: The Rotary Combust. Engine)

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B.2.3.2.4 N79-31210/4 Aug 1979
NASA, Lewis Research Center Cleveland, OH
Kempke, E.E.
Title: An Overview of NASA Research on Positive Displacement Type General Aviation Engines

ABSTRACT

The general aviation positive displacement engine program encompassing conventional, lightweight diesel, and rotary combustion engines is described. Lean operation of current production type spark ignition engines and advanced alternative engine concepts are emphasized. (Paper: Aircraft Systems and Technol. Meeting N.Y., 20 - 22 Aug 1979: Sponsored by AIAA)

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B.2.3.2.5 SSIE: CQA 39362 4 7/74 to N/A
Universitat Stuttgart, Institut fur Raumfahrtantriebe, 80 Pfaffenwaldring 31, Stuttgart, Federal Republic of Germany, D7000 Stuttgart, Baden Wuert.
Buhler, R.D.
Title: Analysis of High Power Composite Engine Performance

ABSTRACT

The proposed aerothermochemical analysis considers composite propulsion systems combining rocket and airbreathing components for special missions with greatly changing flight conditions, high acceleration requirements and/or V/STOL capability. (Plan)

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B.2.3.2.6 79A39011 Jun 1979
Continental Group, Inc., Palo Alto, CA
Galbraith, A.D.
Title: Electric Propulsion for High Performance Light Aircraft

ABSTRACT

An actual design example is presented for application to a representative light aircraft. Attention is given to concept description and analysis, derivation of requirements and design layout, lithium-aqueous electrolyte fuel cell, lithium recycling, metallic lithium as a fuel, propulsion motor and associated controls, and growth potential of the technology. (Paper: 15th AIAA, SAE, ASME Joint Propulsion Conf., Palo Alto, CA, June 18 - 20, 1979)

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B.2.3.2.7 N77-15045/6ST 1976
NASA, Langley Research Center, Langley Station, VA
Guy, R.W.
Title: Thermal Design and Analysis of a Hydrogen-Burning Wind Tunnel Model of an Airframe-Integrated Scramjet

ABSTRACT

An aerodynamic model of a hydrogen burning, airframe integrated scramjet engine has been designed, fabricated, and instrumented. This model is to be tested in an electric arc heated wind tunnel. (Report)

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B.2.3.2.8 75A43968 1975
Unknown
Grey, J.
Title: Future Engines and Fuels --- Advanced Cycles, Fuels and Nuclear Propulsion

ABSTRACT

The variable-cycle engine and the supersonic-combustion ramjet (for hypersonic aircraft) are discussed, with emphasis on the first topic. Flexible variable-cycle engines could power high-thrust STOL opertions and low-noise takeoffs and landings while still permitting high-speed economical cruise; others could permit a single airplane to fly efficiently at both subsonic and supersonic speeds. The supersonic-combustion ramjet will find application farther in the future than the variable-cycle engine; it is the only envisoned air-breathing

engine which could operate effectively above Mach 5. The use of hydrogen as a fuel and the need for rejuvenation of the nuclear aviation power development effort are also discussed. (Article: Exxon Air World, v 27, n 4, 1975)

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B.3 AERODYNAMIC TECHNOLOGY

B.3.1 NAVY FUNDED

B.3.1.1 AD-B037862L Feb 28, 1979
Lockheed-California Co., Burbank, CA
Robinson, J.
Title: P-3 Fuel Saving Technology Applications Study

ABSTRACT

Candidate fuel saving modifications to the P-3 series aircraft in service are identified and analyzed as to design feasibility and fuel saving capability on a basic 1200 nautical mile radius of action ASW mission. Modifications are recommended for adoption or for further study, and costs and IOC schedules are shown on a first-cut, best estimate basis. (Report)

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B.3.1.2 SSIE: ZQN 678328 2 1/76 to Cont
Naval Ship Research and Development Center, Aviation and Surface Effects Dept., Bethesda, MD 20084
Tai, T.
Title: Aerodynamics Research

ABSTRACT

Conduct an analytical and experimental research program to identify attractive aerodynamic techniques for improving the performance of advanced navy aircraft. Studies will include the development of theoretical methods to determine the viscous drag of three-dimensional bodies, with particular emphasis on interference drag. (Plan)

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B.3.1.3 SSIE: CQN 879006 11/77 to 9/79
Vought Corp., Flight Technologies Division, P.O. Box 5907, Dallas TX 75222
Stancil, R.
Title: Supersonic Wave Drag Prediction

ABSTRACT

To derive improved techniques for predicting supersonic wave drag on generalized aircraft configurations. (Plan)

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B.3.1.4 SSIE: ZQN 785077 1 7/76 to 9/78
Naval Surface Weapons Center, Silver Spring, MD 20910
Weinberg, B.
Title: Turbulent Boundary Layer Calculations

ABSTRACT

The effort will be aimed at developing efficient, cost-effective computational techniques for the solution of the boundary layer, boundary region and Navier-Stokes equations in two and three space dimensions. Such methods are necessary to accurately predict the effects of viscous forces on aircraft and missile performance, heating rates, skin friction distributions and zones of separation. Furthermore, they can be used as design tools for Navy vehicles such as reentry and cruise missiles. (Plan)

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B.3.1.5 AD-A045 315-9ST May 1977
Princeton Univ N J Dept of Aerospace and Mechanical Sciences
Putman, W. F.
Title: Aerodynamics and Hovering Control of LTA Vehicles

ABSTRACT

Navy interest in air vehicles for advanced naval missions has pointed out a need for technology development in certain areas. Technologies requiring study were the aerodynamics and precision hover control characteristics of Lighter-Than-Air (LTA) vehicles. LTA, or buoyant assisted lift, vehicles offer potentially significant increases in on-station endurance over conventional aircraft. Potential of boundary layer control for drag reduction in conventional airships is reviewed and the basic aspects of hovering control of LTA vehicles are developed. (Final Report)

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B.3.1.6 AD-B044 603L Aug 76
David W. Taylor Naval Ship Research and Development Center, Bethesda, Md
Gallington, Roger
Title: Assessment of Wing-In-Ground Effect Vehicle Technology. Volume I

ABSTRACT

In many Navy missions there is a need to carry payload as far as possible, as fast as possible, and using as little fuel as possible. Any

vehicle which can do any of these things better without compromising some other capability, certainly desrves study. This report investigates the Wing-In-Ground Effect Vehicle, which has a superior lift/drag ratio, and can possibly satisfy the three mentioned conditions. (Report)

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B.3.1.7 AD-A064 320/5ST 29 Jun 76 - 31 Dec 77
Vought Corp. Advanced Technology Center, Inc., Dallas, TX
Haight, C. H.
Title: Validation of a Transonic Maneuver/Cruise Airfoil Design Employing Active Diffusion Control

ABSTRACT

The use of advanced active diffusion control has resulted in cruise and maneuvering transonic airfoil design points which are similar enough to permit deployment from a common section while still achieving outstanding performance at both flight conditions. Potential for unique performance and efficiency advantages in advanced airfoil design. (Final Report)

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B.3.1.8 DN981100 Jan 79 To Jun 79
McDonnell Aircraft Corp
Tryon, P. F.
Title: F-4 Fuel Saving Technology Application Study

ABBSTRACT

The objective of this program is to identify feasible modifications to F-4 aircraft which will result in fuel conservation and can be put into operation by 1985. The most promising fuel-saving modification to the F-4 aircraft appears to be drooping flaps and ailerons during cruise, resulting in projected mission fuel savings on the order of seven percent. (Plan -- nadc-78066-60)

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B.3.1.9 AD-A067 122/2ST 1970 - 1974
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD, Aviation and Surface Effects Dept
Lacey, David W.
Title: Aerodynamic Characteristics of the Close-Coupled Canard as Applied to Low-to-Moderate Swept Wings. Volume 2, Subsonic Speed Regime

ABSTRACT

An analysis of the effects of canard size, shape, position and deflection on the aerodynamic characteristics of two general research models having leading edge sweep angles of 25 and 50 degrees is presented. Significant findings include: the excellent correlation between canard exposed area ratio and changes in lift, drag, and pitching moment; the detrimental effect of positive canard deflection; and the optimum longitudual position for each canard shape for maximum improvements in lift and drag. It is concluded that the favorable aerodynamic changes caused by interference of the close-coupled canard are not significantly dependent on wing leading edge sweep or wing leading edge modifications. (Final Report, Vol II of 2 Vols)

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B.3.1.10 AD-A063 819/7ST 1970 - 1974
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD, Aviation and Surface Effects Dept.
Lacey, David W.
Title: Aerodynamic Characteristics of the Close-Coupled Canard as Applied to Low-to- Moderate Swept Wings. Volume 1 General Trends

ABSTRACT

A summary of the general findings of close-coupled canard research at David W. Taylor Naval Ship Research and Development Center is presented. Discussed is the effect of canard placement on lift, drag, and pitching moment and the location of optimum position for canards of different planform. (Final Report Vol 1 of 2 Vols.)

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B.3.1.11 SSIE: GQN5753692 5/75
University of Rochester, School of Enginering and Applied Science, Dept. of Aerospace and Mech Science, 260 Crittenden Blvd., Rochester, New York, 14627
Lessen, M.
Title: The Influence of Compliant Surfaces on the Structure of Turbulent Flows

ABSTRACT

The proposed research will be a theoretical study of the coupling of the shear waves in a compliant surface with a turbulent boundary layer and the effects of the interaction on the Reynolds stresses, which are directly related to the skin friction. Research will examine a possible mechanism for explaining the drag reduction and, hopefully, lead to a better insight into material selection for maximizing the gains. (Plan)

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B.3.1.12 SSIE: GQN475202 5 1/74
General Dynamics Corp., Convair Aerospace Div., P.O. Box 1950, San Diego, California 92112
Levinsky, E.
Title: Navy Vehicle Design and Construction - Airfoil Optimization by Adaptive Control of Camber and Thickness

ABSTRACT

The objective of this investigation is to demonstrate the feasibility of a self-optimizing flexible technology (SOFT) wing which changes its shape (span-wise and chord-wise distribution of camber and thickness) in such a manner as to optimize a given merit function. Such a wing will be able to automatically adapt itself to provide optimal performance throughout the whole flight envelope. (Plan)

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B.3.1.13 SSIE: GQN881476 1 9/77 to 10/78
Advanced Technology Center Inc., P.O. Box 6144, Dallas, Texas, 75222
Mask, R.
Title: Low Drag Airfoil Design Utilizing Passive Laminar Flow And Coupled Diffusion Control Techniques

ABSTRACT

To design a low drag airfoil utilizing passive laminar flow and coupled diffusion control techniques to obtain improved lift-to-drag ratios for advanced subsonic aircraft applications. (Plan)

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B.3.1.14 SSIE: GQN675088 2 9/75
New York University School of Arts and Sciences, Dept. of Aerospace Science, 421 1st Ave., New York, New York, 10012
Miller, G.
Title: Theoretical Studies Of Wave Propagation In Laminar Boundary

ABSTRACT

The instability of laminar boundary layers and the associated transition to turbulence are extremely complex phenomena that have major effects on the performance of aircraft and missiles throughout the speed range. An increased understanding of these occurrences, coupled with an improved predictive capability, could lead to a significant improvement in vehicle performance, particularly as regards range and fuel economy. (Plan)

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B.3.1.15 AD-862 843/OST 18 Dec 68-15 Sep 69
Lockheed-California Co Burbank
Anderson, Arthur B.
Title: Propulsion Study for STOL Air-Sea Craft

ABSTRACT

Study to investigate aerodynamic-propulsion concepts applicable to the canard configuration STOL air-sea craft, and in particular to develop and use a methodology for optimizing combinations of direct lift and augmented wing lift. A computer program was developed that optimized the propulsion system by maximizing the airplane radius for a given mission and a fixed initial airplane weight. (Final Report)

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B.3.1.16 SSIE: GQN123280 7 1/71
Princeton University School of Engineering and Applied Sciences, Dept. of Aerospace and Mechanical Science, Box 430 Princeton, New Jersey, 08540
Cheng, S. I.
Title: Numerical Supersonic Flow Field Studies for Naval Aircraft And Misiles

ABSTRACT

Many complex flow situations about aircraft and missiles cannot be calculated with reliabilty by existing theory. Developments in computer technology together with advances in numerical methodologies now make the study of these complicated flows, within the framework of the fundamental equations of motion, an extremely attractive and fruitful approach. Major emphasis will initially be on the shock-boundary layer interaction problem. Both laminar and turbulent boundary layers will be treated; a phenomenological model will be used to describe the turbulent layer. (Plan)

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B.3.1.17 SSIE: GQN223123 6 12/71
University of California, Berkeley Campus, School of Letters and Science, Dept. of Mathematics, Berkeley, California, 84720
Chorin, A. J.
Title: Numerical Methods For Predicting High Reynolds Number Fluid Flows

ABSTRACT

The development of reliable procedures for solving the Navier-Stokes equations numerically, will lead to accurate predictions of the flows about aircraft, ships and missiles, and, consequently, to much better methods for optimizing their performance. (Plan)

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B.3.1.18 AD-A055 140/8ST Sep 77
David W. Taylor Naval Ship Research and Development Center, Bethesda, Md., Aviation and Surface Effects Dept.
Abramson, Jane
Title: Two-Dimensional Subsonic Wind Tunnel Evaluation of Two Related Cambered 15-Percent Thick Circulation Control Airfoils

ABSTRACT

Two circulation control cambered elliptic airfoil sections with a thickness-to-chord ratio of 0.15- and 1.0-percent circular arc camber were evaluated subsonically to determine their aerodynamic characteristics. The two models, designated NCCR 1510-7067N and NCCR 1510-7567S, have a common leading edge but different Coanda surfaces. (Final Report)

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B.3.1.19 SSIE: GQN8752?2 1 3/78
Stanford University Inst. for Plasma Research , Stanford, California 94305
Buneman, O.
Title: Numerical Vortex Tracing

ABSTRACT

The development of accurate numerical procedures for predicting high reynolds number flows will lead to improved methods for optimizing the performance of aircraft, ships, and missiles. The purpose of the proposed research on three-dimensional turbulence will be to develop a viable and accurate vortex tracing method which will be able to simulate, for special cases, the evolution of turbulence. (Plan)

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B.3.1.20 AD-A040 997/9ST 30 Jun 75 - 30 Oct 76
Northrop Corp., Hawthorne, Calif., Aircraft Div.
Chu, C. W.
Title: Wave Drag Reduction for Aircraft Fuselage-Wing Configurations. Volume1. Analyses and Results

ABSTRACT

An optimization procedure has been developed to minimize the wave drag of an aircraft fuselage-wing configuration subject to constraints imposed by design requirements. Theory, methods, computer programs and results presented in two volumes. Volume I describes analyses, results and the optimization procedure. (Volume I of 2 Volume Final Report).

B.3 AERODYNAMIC TECHNOLOGY

B.3.2 NON NAVY FUNDED

B.3.2.1 74A38898 Mar 1974
New York, American Institute of Aeronautics and Astronautics, Inc.
Grey, J.
Title: Aircraft Fuel Conservation: An AIAA View: Proceedings of a Workshop Conference, Reston, VA, March 13 - 15, 1974

ABSTRACT

Aspects of aircraft fuel conservation are reviewed and discussed, and measures are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Principal measures included: increasing load factors, achieved by revised rerouting and scheduliing and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical °winglet° located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuels currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics.

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B.3.2.2 75A47479 May 1975
Unknown
Anderson, R.D.
Title: Wing Aeroelastic Structural Analysis Appplied to the Study of Fuel-Conserving CTOL Transports

ABSTRACT

The impact on wing weight due to variations in wing geometry and cruise Mach number was studied. Attention was also given to the impact on the aircraft weight, fuel usage, economics, and noise due to variations in wing geometry and cruise Mach number while maintaining constant payload/range performance. Selection of a baseline wing was made on the basis of the results obtained in a wing geometry investigation. Details of the approach used in the studies are discussed, taking into account aspect ratio studies and sweep-thickness studies. (Paper: Society of Allied Weight Engineers, Annual Conference, 34th, Seattle, Washington, May 5 - 7, 1975)

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B.3.2.3 75A11426 Oct 1974
Article: Aviation Week and Space Technology
Unknown
Title: Next Generation Transports Will Emphasize Fuel Savings

ABSTRACT

Technology for the minimum energy airplane is reviewed. Special attention is given to an advanced medium-range aircraft that is being developed to lower fuel economics and twin-engine airplanes are considered that will incorporate new wing and structures technology. Improvements in aircraft design include (1) a long duct and thin wall nacelles. (2) the use of aluminum and titanium alloys for reduced stress corrosion and weight and high fatigue life, and (3) advanced airfoils andhigh lift devices. New concepts for the minimum energy airplane that would embody composities or improve skin and stringer techniques are included.

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B.3.2.4 78A46503 Aug 1978
NASA, Langley Research Center, Hampton, VA
Braslow, A.L.
Title: A Perspective of Laminar-Flow Control

ABSTRACT

A historical review of the development of laminar flow control technology is presented with reference to active laminar boundary-layer control through suction, the use of multiple suction slots, wind-tunnel tests, continuous suction, and spanwise contamination. The ACEE laminar flow control program is outlined noting the development of three-dimensional boundary-layer codes, cruise-noise prediction techniques, airfoil development, and leading-edge region cleaning. Attention is given to glove flight tests and the fabrication and testing of wing box designs. (Paper: AIAA Conference on Air Transportation: Technical Perspectives and Forecasts, Los Angeles, CA, Aug 21 - 24, 1978)

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B.3.2.5 75A47509 May 1975
Boeing Commercial Airplane Co., Seattle, WA
Hanks, G.W.
Title: Weight Contribution to Fuel Conservation for Terminal Area Compatible Aircraft

ABSTRACT

Reductions in fuel consumption by weight characteristics of advanced aircraft are considered, and trades between weight reduction versus increased aerodynamic and operating efficiency are discussed. Direct reductions in fuel use may be obtained by application of advanced technology in structure and airfoils, proper engine choice, and revised environmental control features. Weight penalties involved in wing planform optimization are countered by increased aerodynamic efficiency. Results of studies incorporating advanced structure, airfoils, and propulsion show 21.6 percent reductions in operational empty weight and takeoff gross weight compared to a conventional design. Implementation of the described fuel reduction approaches will yield an estimated 25 percent reduction in fuel consumption. (Paper: Society of Allied Weight Engineers, Annual Conference, 34th, Seattle, WA, May 5 - 7, 1975)

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B.3.2.6 78A49723 Sep 1977
Unknown
Scrofani, O.
Title: Choice of Cycle for a Regnerative Bypass Turbojet for Long-Range Aircraft

ABSTRACT

A thermodynamic and dynamic analysis of a bupass turbojet with heat exchange is presented. Engine components and the dependence of the specific heats of air and combustion products on the temperature and air/fuel ratio are taken into account, and the effect of cycle parameters on specific fuel consumption and specific thrust is examined. These parameters are considered with respect to engine weight and aerodynamic drag, and the performance capabilities of bypass turbojets with and without heat exchange are compared. (Paper: Associazione Italiana di Aeronautica e Astronautica, Congresso Nazionale, 4th, Milan, Italy, Sept. 19 - 23, 1977, in Italian)

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B.3.2.7 76A30916 Apr 1976
Unknown
Staszek, J.
Title: Technical Progress in the Design of Aircraft from the Standpoint of Fuel Economy

ABSTRACT

Reliance on supercritical airfoil profiles, vortex diffusers, boundary layer suction, active control (of control surfaces), and new materials to reduce the size and weight of passenger airliners and cargo aircraft without penalties in performance is reviewed. Supercritical profiles bring about greater L/D ratios which, with increased wing span, are more effective in reducing induced drag than is the use of vortex diffusers. But vortex diffusers mean a smaller moment arm at the wing root, and only 0.5 percent increase in bending moment as against 8.5 percent caused by increased wing span. Boundary layer control through air suction by slits add up to 30 percent fuel savings. Properly selected flexible elastic BLC coating can reduce drag friction by 50 percent. Active control of control surfaces means less static stability, but greater indifference to gusts and flutter. Fiber (glass, boron, graphite) reinforced materials (resins, metals) add strength while reducing weight. Fuel savings up to 35 percent are predicted for the next generation of airliners, and as much as 55 percent for the next generation of cargo aircraft. (Paper: Technika Lotnicza i Astronautyczna, vol. 31, Apr 1976. In Polish)

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B.3.2.8 AIAA: 79-1651 Aug 1979
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Overview of Technology Advancements for Energy Efficient Transports

ABSTRACT

Several research activities, conducted under NASA contract and directed toward improved fuel efficiency of commercial transports, are described. Emphasis is placed on advancements in aerodynamics and avionics/controls. Aerodynamic advancements include wing geometry variations and the winglet concept for improved lift/drag ratio, improved high-lift design, evaluation of natural laminar flow for drag reduction, and improved surfact coatings for reduced drag and surface erosion. Application of active controls; closed-loop flight path control using direct computer control of autopilot and autothrottle during ascent, cruise and descent; and the use of delayed flap operation and precise flight path control in the terminal area are included as potential

improvements that rely on advanced avionics/controls. Evaluation of potential application is provided. (Paper: AIAA Atomospheric Flight Mechanics Conference and Special Session: Energy Efficient Aircraft Design, August 7 - 8 1979, Boulder, Colorado)

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B.3.2.9 AIAA: 80-0906 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Technology Advancements for Energy Efficient Transports

ABSTRACT

Ongoing government and industry supported research activities pertaining to improved fuel efficiency of commercial transports are described with particular attention to advancements in aerodynamics, avionics, and controls technologies. Emphasis is placed on the interaction of these technologies with the structure, propulsion, and other technologies involved in transport configuration design, as well as the impact on airline operation they could imply. The potential benefits offered by these technologies and the research activities required to support their commitment to future models are discussed. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.3.2.10 AIAA: 80-0894 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Kirchner, N. E.
Title: Aerodynamic Expectations Through the Year 2000

ABSTRACT

Envisioned aerodynamic technology development and refinement contributions to achieving air transportation economic expectations through the year 2000 are discussed. Cruise lift/drag ratios of current commercial transport airplanes are compared relative to a potential maximum level for fully turbulent flow. Ideas for improving aerodynamic cruise efficiency are then categorized as to their "evolutionary" or "revolutionary" potential. Advanced aerodynamic technologies currently being researched (e.g., laminar flow control, natural laminar flow, advanced transonic wing design) are reviewed. SST aerodynamic technology status is discussed along with an assessment of the chances of a U.S. SST within this time period. Advanced aerodynamic computing and testing techniques will play important roles in achieving the aerodynamic

advances. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.3.2.11 76A26606 May 1976
Unknown
Stern, J.
Title: Aircraft Propulsion - A Key to Fuel Conservation: An Aircraft Manufacturer's View

ABSTRACT

A range of possible approaches to fuel conservation is examined. The fuel contributions to direct operating costs, aircraft operations and maneuvers designed to conserve fuel, aircraft design variants, modifications, and refittings capable of aiding fuel conservation are discussed. Advantages of turbofan and turboprop derivatives of basic aircraft designs are examined. The RECAT (Reducing Energy Consumption of Commercial Air Transportation) program is outlined. The possible impact of recent technological advances in aircraft design (supercritical airfoils, optimized wing geometry, longitudinal stability augmentation, composites, new metallic structures) on fuel conservation is examined. (Paper: Society of Automotive Engineers, Air Transportation Meeting, New York, NY, May 18 - 20, 1976)

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B.3.2.12 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the

Forum, Detroit, Michigan, October 15, 1975)

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B.3.2.13 78A47905 Aug 1978
Unknown
Park, P. H.
Title: The Effect on Block Fuel Consumption of a Strutted Versus Cantilever Wing for a Short-Haul Transport Including Strut Aeroelastic Considerations

ABSTRACT

A preliminary design of a short-haul aircraft using a strut-braced wing was made to study the possibility of block fuel savings due to the decrease in wing weight allowed by the use of a strut. A computer-aided wing loads and stress analysis was performed to determine the wing weight savings. It was found that the wing weight savings are not large in this aircraft and the induced drag decrease is offset by the strut parasite drag. The final cantilever and strutted configurations have essentially equal block fuel consumptions. A calculated strut flutter velocity was close enough to the flight envelope to warrant design consideration. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, CA, Aug 21 - 23, 1978)

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B.3.2.14 77A20719 1976
Lockheed-Georgia Co., Marietta, GA
Lange, R.H.
Title: Effects of Artificial Stability on Configuration Design

ABSTRACT

The use of active controls for maneuver load alleviation in the development of transport aircraft in the 1980s is considered. As part of the NASA Advanced Transport Technology Program, Lockheed conducted a relaxed static stability analysis including an assessment of the benefits to be derived from the application of advanced technologies such as low noise level propulsion systems, supercritical wing, advanced filamentary composite materials, and active controls. Attention is also given to the JetStar redesign study, taking account of wing optimization, geometry constraints, and loads analysis. (Paper: Air Transportation for the 1980's, University of Maryland, College Park, Maryland, 1976).

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B.3.2.15 VN070074 1 May 1979
NASA, Lewis Res. Center
Mikkelson, D.C.
Title: Low-Speed Propeller Technology

Abstract

The objective of this program is to advance the technology of propellers for general aviation aircraft to reduce energy consumption, lower noise, and improve aircraft safety. Encompasses analytical and experimental work on propeller performance, acoustics, aeroelastic characteristics and low cost composites. Gap advanced technology will be oriented toward aircraft including (1) low speed-low power (up to 200 kts with up to 250 hp); (2) high speed-high power (turboprop); and (3) low speed-high power (up to 100kts with 600-1000 hp) (Plan)

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B.3.2.16 N78-32066/OST Sep 78
Hamilton Standard, Windsor Locks, Conn.
Black, D. M.
Title: Aerodynamic Design and Performance Testing of an Advanced 30 Deg Swept, Eight Bladed Propeller at Mach Numbers From 0.2 to 0.85

ABSTRACT

Emphasis on fuel conservation in the world has stimulated studies of both conventional and unconventional propulsion systems for commercial aircraft. Preliminary results indicate that a fuel saving of from 15 to 28 percent may be realized by the use of an advanced high speed turboprop. An advanced turboprop concept was wind tunnel tested. Results are presented which indicate propeller net efficiencies near 80 percent were obtained at high disk loadings at Mach 0.8. (Final Report)

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B.3.2.17 76A31424# Feb 1976
Aereon Corp., Princeton University, Princeton, NJ
Miller, W. M., Jr.
Title: The Lifting Body Airship -- A Future Delivery System for Remote Area Logistics

ABSTRACT

The problem of gaining access to natural resources located in remote or almost inaccessible regions is considered on the basis of three criteria for an optimal solution. It is argued that the Lifting Body

Airship (LBA) uniquely meets these criteria and can provide "remote area logistics" for the developing world. Fuel efficiency and productivity are compared for conventional airships and CTOL, VTOL, C/STOL, and V/STOL LBAs. It is shown that the STOL LBA is unsurpassed in productivity while the V/STOL LBA is the most energy-efficient vehicle. (Article: Canadian Aeronautics and Space Journal, vol. 22, Jan. - Feb. 1976.)

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B.3.2.18 79A21912*# 1979
NASA, Washington, DC
Klineberg, J.M.
Title: The NASA Aircraft Energy Efficiency Program

ABSTRACT

A review is provided of the goals, objectives, and recent progress in each of six aircraft energy efficiency programs aimed at improved propulsive, aerodynamic and structural efficiency for future transport aircraft. Attention is given to engine component improvement, an energy efficient turbofan engine, advanced turboprops, revolutionary gains in aerodynamic efficiency for aircraft of the late 1990s, laminar flow control, and composite primary aircraft structures. (Paper: In Energy and Aerospace: Proceedings of the Anglo/American Conference, London, Royal Aeronautical Society, 1979)

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B.3.2.19 79A14136* Apr 1977
NASA, Washington, DC
Klineberg, J.M.
Title: Technology for Aircraft Energy Efficiency

ABSTRACT

Six technology programs for reducing fuel use in U.S. commercial aviation are discussed. The six NASA programs are divided into three groups; Propulsion - engine component improvement, energy efficient engine, advanced turboprops; Aerodynamics - energy efficient transport, laminar flow control; and Structures - composite primary structures. Schedules, phases, and applications of these programs are considered. (Paper: In International Air Transportation Conference, Washington, DC April 4 - 6, 1977, Proceedings, New York, American Society of Civil Engineers, 1977, p. 127 - 171)

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B.3.2.20 78A43357*# Jul 1978
NASA, Washington, DC
Kramer, J.J.
Title: Planning a New Era in Air Transport Efficiency

ABSTRACT

The current status of the NASA Aircraft Energy Efficiency (ACEE) program is briefly reviewed with reference to CTOL aircraft. Attention is given to four basic technologies: turboprop, advanced aerodynamics and active controls, laminar flow control, and composites. (Paper: In Astronautics and Aeronautics, vol. 16, Jul - Aug 1978)

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B.3.2.21 N77 23072/OST Jun 76
Douglas Aircraft Co., Inc. Long Beach, CA
Kraus, E.F.
Title: Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System. Volume 1: Technical Analysis

ABSTRACT

The effectiveness of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state-of-the-art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. (Final Report)

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B.3.2.22 77A12192*# May 1976
NASA, Ames Research Center, Moffett Field, CA
Williams, L.J.
Title: Air Transportation Energy Efficiency - Alternatives and Implications

ABSTRACT

Results from recent studies of air transportation energy efficiency alternatives are discussed. Included are aircraft operation, aircraft modification, derivative aircraft, and new aircraft. In order to obtain significant improvements in energy efficiency, new aircraft must truly exploit advanced technology in such areas as aerodynamics, composite structures, active controls, and advanced propulsion. (Paper: In Society

of Allied Weight Engineers, Annual C. 35th, Phila., PA May 24 - 26, 1976)

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B.3.2.23 AD-A039 597 Dec 76
Rand corp., Santa Monica, CA
Gebman, J.R.
Title: The Potential Role of Technological Modifications and Alternative Fuels in Alleviating Air Force Energy Problems

ABSTRACT

Short- and long-term measures to reduce the consumption of petroleum jet fuels by the Air Force. Engine retrofits and aerodynamic modifications to existing aircraft can save significant quantities of jet fuel. Synthetic JP fuels derived from oil shale or coal appear to be the most attractive future alternatives to petroleum jet fuels. (Report)

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B.3.2.24 78A18022 Oct 1977
Unknown
Walsh, B.
Title: Advances in Aircraft Efficiency

ABSTRACT

Paper surveys NASA's Aircraft Energy Efficiency program. Six major elements: (1) engine component improvement, aimed at a 5 percent reduction in annual fuel consumption, (2) the energy efficient engine program, (3) the development of advanced turboprop propulsion systems, (4) the creation of advanced aerodynamics and active control technology applicable to transport aircraft, (5) the development of the alternative laminar flow designs, and (6) the study of potential composite primary structures for weight reduction and fuel economy. (Paper: In Aviation Engineering and Maintenace, vol. 1, Oct 1977)

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B.3.2.25 AD-C019 324L Jun 79
Rockwell International, El Segundo, CA, North American Aircraft Div.
Wiler, C.D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase II.

ABSTRACT

This study dealt with technologies and concepts for 1990 and 2000 IOC manned penetrating bombers. Two concepts were selected from the phase I study for in-depth examination of structures, aerodynamics, propulsion and various subsystems. (Final Report (Secret))

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B.3.2.26 AD-C016 293L Jun 78
Rockwell International, Los Angeles, Calif., Los Angeles Aircraft Div.
Raymer, D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase I.

ABSTRACT

Study dealt with technologies and concepts for post-1995 manned penetrating strategic bomber. Technologies were assessed in areas of aerodynamics, propulsion, structures, controls, and stealth, and were found to offer up to 50 percent reductions in cost and weight over current technologies. (Final Report)

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B.3.2.27 75N16979 Dec 1974
Department of the Air Force, Washington, DC
Yarymovych, M.I.
Title: Energy-Related Research and Development in the United States Air Force

ABSTRACT

Methods of reducing fuel consumption by aircraft design and structural modification are proposed. The effectiveness of a campaign to reduce energy requirements and expenditures is documented. (Paper: In AGARD The 1974 AGARD Ann. Meeting)

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B.3.2.28 N75-16557/1ST Feb 75
Lockheed Aircraft Corp., Burbank, CA
Sweet, H.S.
Title: Evaluation of Advanced Lift Concepts and Potential Fuel Conservation for Short-Haul Aircraft

ABSTRACT

The effect of different field lengths, cruise requirements, noise level, and engine cycle characteristics on minimizing fuel consumption and minimizing operating cost at high fuel prices were evaluated for some aircraft using the upper surface-internally blown jet flap, the augmentor wing, and the mechanical flap lift systems. Advanced conceptual STOL engines were evaluated as well as a near-term turbofan and turboprop engine. (Report)

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B.3.2.29 77N17032# Feb 1976
Committee on Aeronautical and Space Sciences (U.S. Senate)
Unknown
Title: Aircraft Fuel Efficiency Program

ABSTRACT

A technology plan is described for developing fuel-efficient aircraft. Inputs were obtained from industry, NASA research centers, and other governmental agencies. Six major programs are defined: engine component improvement, composite primary structures, turboprops, laminar flow control, fuel conservative transport, and the fuel conservative engine. Funding requirements and benefits are discussed. (GPO Rept. for Comm. on Aeronautical and Space Sci., 94th Cong., 2nd Sess., 17 Feb 1976)

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B.3.2.30 SSIE: ZQF 140800 2 1/77 to 3/79
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, OH 45433
Hertz, T.J.
Title: Improved Aeroelastic Tailoring and Structural Optimization

ABSTRACT

Through the application of aeroelastic tailoring of advanced composite structures, it has been shown feasible to aeroelastically deform the lifting surfaces of advanced fighter aircraft to provide improved performance of these aircraft. Prevention of flutter in thin wings has

been achievable analytically while providing minimum drag and maneuver load relief. (Plan)

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B.3.2.31 N79-25024/7ST Jun 78
Douglas Aircraft Co., Inc., Long Beach, CA
Welge, H.R.
Title: Simulated Propeller Slipstream Effects on a Supercritical Wing

ABSTRACT

To quantify the installed performance of high speed (M = 0.8) turboprop propulsion systems, an experimental program designed to assess the magnitude of the aerodynamic interference of a propeller slipstream on a supercritical wing has been conducted. The force results indicated that the interference drag amounted to an increase of ten counts or about 3 percent of the wing-body drag for a two engine configuration at the nominal propeller operating conditions. However, at the higher swirl angles (11 deg vs. 7 deg nominally) the interference drag was favorable by about the same magnitude. (Report)

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B.3.2.32 N78-24116/3ST May 78
NASA, Washington, DC
Wortmann, F.X.
Title: Drag Reduction for Gliders

ABSTRACT

The article discusses the causes of drag in gliders. The importance of maintaining laminar flow is emphasized. The problems of surface (or lack of) smoothness are outlined. (Translated into English from AERO-Revue)

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B.3.2.33 SSIE: GSE 7512 9/79 to 2/82
Georgia Inst. of Technology, School of Aerospace Engineering, Atlanta, Georgia, 30332
Wu, J.C.
Title: A Generalized Wake-Integral Approach for Drag Determination in Three-Dimensional Flows

ABSTRACT

This is joint project between Georgia Institute of Technology and Lockheed-Georgia Company on determination of drag, its nature and its distribution from measurements made in the wakes of finite bodies, including lifting cases. Emphasis on energy conservation has sharpened the need to understand the drag producing mechanisms. This project could well lead to new ideas concerning low drag or energy efficient configurations for both future aircraft as well as land based vehicles. (Plan)

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B.3.2.34 SSIE: CQF 141060 1 10/77 to 4/79
Rockwell International Corp., International Airport, Los Angeles, CA
Wykes, J.H.
Title: Active Flutter Suppression on Aeroelastically Tailored HIMAT Vehicle

ABSTRACT

The HIMAT vehicle has aeroelastically tailored wings for improved maneuverability. The aeroelastic twist control design approach resulted in low flutter speeds. The objective of this effort is to define the feasibility and potential benefits of an active flutter suppression system on aeroelastically tailored composite wings. An active flutter suppression system may provide a more efficient, weight-saving approach. (Plan)

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B.3.2.35 AD-A056 124/1ST Mar 76 - Feb 77
Boeing Commercial Airplane Co, Seattle Washington
Kulfan, Robert M.
Title: Wing Planform Geometry Effects on Large Subsonic Military Transport

ABSTRACT

A Preliminary design study of large turbulent flow military transport aircraft has been made. Study tasks included: Wing geometry/cruise speed optimization of a large cantilever wing military transport airplane; Preliminary design and performance evaluation of a strut-braced wing transport airplane; and Structural analyses of large-span cantilever and strut-braced wings of graphite/epoxy sandwich construction (1985 technology). The best cantilever wing planform for minimum takeoff gross weight, and minimum fuel requirements, as determined using statistical weight evaluations, has a high aspect ratio, low sweep, low thickness/chord ratio, and a cruise Mach number of 0.76. A near optimum wing planform with greater speed capability (M = 0.78) has an aspect ratio = 12, quarter chord sweep = 20 deg, and thickness/chord ratio of 0.14/0.08 (inboard/outboard). (Final Report)

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B.3.2.36 SSIE: ZH 870142 1 10/77 to N/A
NASA, Adm. Office of Aeronautics and Space Technology, Langley Research Center, Hampton, VA 23665
Unknown
Title: Energy Efficient Transport

ABSTRACT

The objective of this RTOP is to expedite industry acceptance and application of advanced aerodynamics and active controls technology in an integrated manner to achieve significant energy, economic, and aircraft sales benefits. In-house and industry experimental and analytical efforts will be continued in the areas of supercritical aerodynamics, high-lift systems, propulsion/airframe integration, and wing/empennage/flight control systems. (Plan)

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B.3.2.37 78A15020 Jun 1977
Societe Nationale Industrielle Aerospatiale, Div. Helicopteres, Paris, France
Petit, G.
Title: Helicopters and Energy Savings

ABSTRACT

The article discusses various means to economize helicopter fuel consumtion noting possible modifications in engine specific fuel consumption, rotor aerodynamic quality, parasitic drag of the fuselage, helicopter empty weight, and flight path optimization. Improvements in specific fuel consumption (30 percent reduction predicted) and in structural characteristics (15 percent reduction predicted). (Paper in Congres International Aeronautique, 13th, Paris, France, June 2, 3, 1977. L'Aeronautique et l'Astronautique, no. 66, 1977, In French)

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B.3.2.38 79A31911 Dec 1978
Royal Aircraft Establishment, Farnborough, Hants., England
Pope, G.G.
Title: Prospects for Reducing the Fuel Consumption of Civil Aircraft

ABSTRACT

Outline of technological advances that contribute to the reduction of fuel consumption. Attention concentrated on advances being made in the UK. Advances in powerplants are examined along with developments in aerodynamics, taking into account advances in design techniques, experimental facilities, wing tip design, drag reduction, and laminar flow control. Attention is also given to materials and structures, active control technology, and operational considerations. (Paper: In Energy and Aerospace: Proceedings of the Anglo/American Conference, London, England, December 5 - 7, 1978)

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B.3.2.39 76A19593*# Feb 1976
NASA, Off. of Aeronautics and Space Technology, Aircraft Energy Efficiency Office
Povinelli, F.P.
Title: Improving Aircraft Energy Efficiency

ABSTRACT

Investigations by NASA task force concerning fuel-conservation technology are considered. The task force estimated fuel savings potential, prospects for implementation in the civil air-transport fleet, and the impact of the technology on fuel use. Propulsion advances are related to existing engines in the fleet, to new production of current engine types and to new engine designs. Studies aimed at the evolutionary improvement of aerodynamic design and a laminar flow control program are discussed and possibilities concerning the use of composite structural materials are examined. (Paper: In Astronautics and Aeronautics, vol. 14, Feb 1976)

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B.3.2.40 N77-11055/9ST 10 Sep 75
NASA, Washington, DC
Unknown
Title: Aircraft Fuel Conservation Technology. Task Force Report, September 10, 1975

ABSTRACT

An advanced technology program is described for reduced fuel consumption in air transport. Cost benefits and estimates are given for improved engine design and components, turboprop propulsion systems, active control systems, laminar flow control, and composite primary structures. (Report)

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B.3.2.41 77A14563 Nov 1976
ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France
Wanner, J.C.
Title: Air Transportation and Fuel Consumption

ABSTRACT

Various options in present technology for reducing fuel consumption are examined. Improvements in thermodynamic efficiency by altering specific fuel consumption and bypass ratio, and two ways of raising the temperature upstream of the turbine, are considered. Advantages of the

delta sweepback wing and supercritical airfoils are outlined, in addition to possible weight reduction through the use of new advanced materials (more Ti, less steel, more composites) and optimized dimensional design of aircraft by finite element methods. Control configured vehicle approaches to aeronautical design are outlined briefly, and outlook for reliance on liquid hydrogen as fuel is sketched. (Paper: In Sciences et Techniques, Nov 1976, In French)

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B.3.2.42 78A43358*# Jul 1978
NASA, Langley Research Center, Langley Station, VA
Conner, D.W.
Title: CTOL Concepts and Technology Development

ABSTRACT

Various developments in the Aircraft Energy Efficiency (ACEE) program are discussed. Terminal-area operations are considered with emphasis on the Terminal Configured Vehicle program. Consideration is also given to aircraft systems studies and economics (including noise reduction programs), coal-derived fuels for aviation systems (including LH2-fueled aircraft), and transport-aircraft concepts (including laminar flow control). (Paper: In Astronautics and Aeronatuics, vol. 16, July - Aug 1978)

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B.3.2.43 78A31305# Oct 1977
Canadair, Ltd., Montreal, Canada
Bernstein, S.
Title: Improved Energy Efficiency For Small CTOL Transport Aircraft

ABSTRACT

Potential improvements in fuel efficiency by application of new airframe and propulsion system technologies (supercritical wings, advanced composite materials, high aspect ratio wings, advanced propulsion systems, wing tip winglets active controls, and laminar flow) to the smaller CTOL transport aircraft. Fuel savings of up to 12% are possible by increasing aspect ratio alone. Incorporation of supercritical airfoils and advanced composites with the higher aspect ratios can save a further 5%. Advanced propulsion system technology offers similar or higher potentials for fuel savings: 15-20% with new turbofans and a further 15-20% with prop-fans. Total cumulative fuel savings of 40-45% are possible with incorporation of all the new technologies investigated. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977)

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B.3.2.44 78A12031 June 1977
Avions Marcel Dassault-Breguet Aviation, Vaucresson, Hauts-de-Seine, France
Amblard, P.
Title: Energy Savings - The Viewpoint of an Aircraft Manufacturer

ABSTRACT

Technological developments leading to the design of aircraft which consume less fuel than present models are reviewed. In particular, high bypass ratio engines, supercritical wingspans, active control, and the use of light-weight composite materials for both secondary and primary aircraft structures are considered. Advanced techniques in aerodynamic analysis, especially in the field of boundary layer control, are also mentioned. (Paper in French)

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B.3.2.45 78A31307# 1978
Lockheed-California Co., Burbank, Calif.
Hopps, R. H.
Title: Fuel Efficiency - Where We Are Heading In The Design of Future Jet Transports

ABSTRACT

Three potential technologies for the 1990s are discussed: laminar flow control, advanced turboprops and liquid hydrogen. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977, Proceedings)

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B.3.2.46 EI#00100331 Sep 1979
Case Western Reserve Univ., Cleveland, Ohio
Reshotko, Eli
Title: Drag Reduction By Cooling In Hydrogen-Fueled Aircraft

ABSTRACT

Drag reductions are possible for cryo-fueled aircraft by using fuel to cool selected aerodynamic surfaces on its way to the engines. Calculations for hydrogen-fueled transport show that drag reductions in cruise of about 20% are within reason. Hydrogen fueled aircraft employing

surface cooling is attractive as an energy conservative aircraft and warrants more detailed study. (Paper: Journal of Aircraft Vol 16, No. 9, Sept 1979)

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B.3.2.47 N76-29218/4ST May 1976
NASA, Langley Research Center, Langley Station, Va
Schrader, O. E.
Title: Application of Advanced Technology to Future Long-Range Aircraft

ABSTRACT

An assessment is presented of three separate programs that have incorporated advanced technology into the design of long-range passenger and cargo aircraft. The first technology centers around the use of a span-loaded cargo aircraft with the payload distributed along the wing. The second technology is the application of laminar flow control to the aircraft to reduce the aerodynamic drag. The last program evaluates the production of alternate aircraft fuels from coal and the use of liquid hydrogen as an aircraft fuel. (Paper: 35th Ann. Conf. of the Soc. Of Allied Weight Engr., Inc., Philadelphia, 24-26 May 1976)

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B.3.2.48 AD-B023 760L Mar 76 - Jun 77
McDonnell Aircraft Co., St. Louis, Mo.
Woods, John, Jr.
Title: Aerodynamic Configuration Drivers for Advanced Airbreathing Concepts

ABSTRACT

The potential for improved aerodynamic performance based on favorable flow interference phenomena was investigated. Four concepts were developed and evaluated. These were two M=4.5 Caret Wing Waverider configurations that used differing propulsion concepts, a M=4.5 Parasol Wing configuration, and a M=6.0 Switchblade Wing configuration. An initial evaluation of a M=6.0 Biplane configuration showed no favorable aerodynamic efects and it was dropped from the analysis. (Final Report)

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B.3.2.49 SSIE: ZR 870159 10/77 to 9/78
NASA, Office of Aeronautics and Space Technology, Langley Research Center, Hampton, Virginia, 23665
Unknown
Title: SCAR - Aerodynamic Performance Technology

ABSTRACT

The objectives of this program are to advance the state of the art in supersonic aerodynamics through the generation of comprehensive data bases on promising advanced supersonic configuration concepts, through the development of better tools for aerodynamic design and analysis, and through continued research on important sonic boom phenomena. Aerodynamic advances resulting from this program will be studied, in concert with technology advances in the related disciplinary areas of propulsion, structures and materials, and controls, through detailed systems integration and technology studies of representative supersonic cruise aircraft concepts. (Plan)

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B.3.2.50 SSIE: ZQF 131400 5 10/73 to 9/84
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio 45433
Terry, J. L.
Title: Aerodynamic Configuration Development

ABSTRACT

The objective of this effort is to define aerodynamic configurations incorporating advanced technologies to establish a firm data base for the purpose of transitioning technology into future military aerospace vehicles. The technical areas of aerodynamics, heating, propulsion, materials, stability and control and cockpit visibility will be evaluated during generation of conceptual configurations. The feasibility of applying new technologies will be assessed continually. A prime consideration for all facets of this effort will be fuel economy in application to new designs as well as existing systems. (Plan)

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B.3.2.51 N78-22087/5ST Sep 78
Vought Corp., Technical Center, Hampton, VA
Turriziani, R. V.
Title: Preliminary Design Characteristics of a Subsonic Business Jet Concept Employing Laminar Flow Control

ABSTRACT

Aircraft configurations were developed with laminar flow control (LFC) and without LFC The LFC configuration had approximately eleven percent less parasite drag and a seven percent increase in the maximum lift-to-drag ratio. Although partially offset by the additional weight of the LFC system, the LFC aircraft burned from six to eight percent less fuel for comparable missions. (Report)

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B.3.2.52 77A42784*# Aug 1977
NASA, Langley Research Center, Hampton, Va
Hood, R.V., Jr.
Title: The Aircraft Energy Efficiency Active Controls Technology Program

ABSTRACT

Broad outlines of the NASA Aircraft Energy Efficiency Program for expediting the application of active controls technology to civil transport aircraft are presented. Advances in propulsion and airframe technology to cut down on fuel consumption and fuel costs, a program for an energy-efficient transport, aerodynamics, structures, and active controls are envisaged. (Paper: Guidance and Control Conference, Hollywood, Fla., August 8-10. 1977)

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B.3.2.53 N77-15008/4ST Nov 1974 - Mar 1976
Lockheed-California Co., Burbank
Hopkins, J. P.
Title: Study of the Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System

ABSTRACT

Practical means assessed for achieving reduced fuel consumption in commercial air transportation. Five areas were investigated: current aircraft types, revised operational procedures, modifications to current aircraft, derivatives of current aircraft and new near-term fuel

conservative aircraft (Summary of Final Report, Vol. I. See also N77-15007/6ST, Vol. II)

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B.3.2.54 DF487016 1976
Boeing Company, Wichita Division
Heilman, J. H.
Title: KC-135 Modernization Study

ABSTRACT

Assess modern developments in engine and wing technology applicable to potential modifications of the KC-135 which may result in performance improvements, increased load capability, reduced energy consumption and reduced O/M costs. Five different combinations of propulsion (TF33-P7, CFM-56, JT-10D) and wing (Existing, 707/220B, Supercritical) improvements. (Final Report, 2 Volumes)

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B.3.2.55 75A41698*# Aug 1975
Boeing Commercial Airplane Co., Seattle, Wash.
Hanks, G. W.
Title: Fuel Conservation Possibilities for Terminal Area Compatible Transport Aircraft

ABSTRACT

Design characteristics that would reduce mission fuel consumption and improve terminal-area operations for advanced transports are discussed. Sensitivity studies of the effects of cruise speed, wing geometry, propulsion cycle, operational procedures, and payload on fuel usage are presented. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Los Angeles, Calif., Aug 4-7, 1975)

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B.3.2.56 76A32649 May 1976
NASA
Geddes, J. P.
Title: Civil Transport Technology up to 2000 - NASA Believes Fuel Consumption is the Major Consideration

ABSTRACT

Recommendations of a NASA task force to establish goals in a program for fuel conservation technology compared with typical industry views of developments that are feasible in the near future. Improved engine components for JT8D, JT9D, and CF6, including mechanical mixers to mix the core and duct stream before discharge through a common nozzle, clearance control to improve compressor and turbine efficiency, and improved blade shapes. Four aerodynamic approaches to fuel consumption selected for future study: drag clean-up, improved aerodynamic design, laminar flow control, and the use of small vertical end-plates on wing-tips to augment thrust. Accelerated effort in the development of composite structures is urged. Fuel savings of 79% predicted for the year 2005. (Article: Interavia, Vol 31, May 1976)

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B.3.2.57 77A20713# 1976
American Airlines, Inc., New York, NY
Linn, R. J.
Title: Future Aircraft Requirements - A Notebook of Airline Thoughts

ABSTRACT

Future technologies applied to next generation of commercial transports hold promise for increasing productivity while keeping a lid on operating costs. Technologies considered are those of composite structures, supercritical aerodynamics, winglets, active controls, turboprop technology and laminar flow. The work of NASA on fuel conservative turbofan engines and on regenerative turbofan engines is briefly discussed. (Paper: Air Transportation for the 1980°s, College Park, Md., University of Maryland, 1976)

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B.3.2.58 N79-200069/7ST 1979
NASA; Lewis Research Center, Cleveland, Ohio
Jeracki, R. J.
Title: Wind Tunnel Performance of Four Energy Efficient Propellers Designed for Mach 0.8 Cruise

ABSTRACT

Several advanced aerodynamic concepts were investigated in recent wind tunnel tests performed in the NASA-Lewis Research Center 8x6 foot wind tunnel. These concepts included aerodynamically integrated propeller/nacelles, area-ruling, blade sweep, reduced blade thickness and power (disk) loadings several times higher than conventional designs. Four eight-bladed propeller models were tested to determine aero- dynamic performance. (Report)

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B.3.2.59 78A24034# Feb 1978
Douglas Aircraft Co., Long Beach, Calif.
Hage, R. E.
Title: The Challenge of Advanced Fuel-Conservative Aircraft - A Manufacturer's View

ABSTRACT

Costs and technological problems associated with advanced fuel-conservative aircraft are discussed, with particular attention given to the current NASA Aircraft Energy Efficiency (ACEE) program which focuses on engine component improvement, turboprops, laminar flow control, and composites. (Paper: American Institute of Aeronautics and Astronautics, Annual Meeting ard Technical Display, 14th Washington, D.C., Feb 7-9, 1978)

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B.3.2.60 SSIE: ZQF142370 2 2/78 to 12/79
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio, 45433
Sherrer, V. C.
Title: Forward Swept Wing Aeroelastic Studies

ABSTRACT

Recent analytical studies have shown that forward swept wings offer the performance advantages of reduced drag and increased maneuverability over aft swept wings. Until recently, designs with large forward sweeps proved to be impractical because prohibitive weight increases in the wing

structure were necessary to overcome divergence. Use of aeroelastic tailoring of advanced composite wing skins can eliminate the divergence problem without a significant weight penalty. Objective of this work unit is to provide experimental verification of the ability of advanced composites to eliminate divergence in forward swept wings. (Plan)

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B.3.2.61 AD-A053 691/2ST Mar 78
Massachusetts Inst. of Tech., Aerophysics Lab., Cambridge
Solomon, Marshall D.
Title: A Study of the Lift-To-Drag Ratio Capability of Caret Wing Waveriders

ABSTRACT

A simple model of the off design caret wing flow field which includes the effects of an upper expansion surface, skin friction and base drag is proposed. Based on this approximate model, calculations of the lift coefficient, drag coefficient and lift-to-drag ratio as functions of body geometry, incidence, Mach number and Reynolds number are made, and the dependence of the aerodynamic coefficients on these variables is identified. Significantly higher caret wing lift-to-drag ratios could be achieved by replacing the blunt base with an afterbody, thereby reducing the base drag. (Master's Thesis)

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B.3.2.62 EI800208955 Jul 1979
Cranfield Inst of Technol, Engl
Spillman, J. J.
Title: Flight Experiments to Evaluate the Effect of Wing-Tip Sails on Fuel Consumption and Handling Characteristics

ABSTRACT

The total drag of the Paris flying type at lift coefficients above 0.22 can be reduced by fitting three sails to each tip tank, bacause the lift-dependent drag is reduced by 27%. The fuel saving resulting from this change is about 4.5% at a typical cruise lift coefficient of 0.35, rising to almost 11% at a lift coefficientt of 0.8. The pilots who regularly fly the Paris aircraft commented upon the more rapid lift-off and initial climb at take-off. While the increase in overall span with sails increased the roll damping, no significant change in aileron feel was reported. (Paper: Aeronaut J V 83 n 823 Jul 1979)

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B.3.2.63 DIP0031789 Sept 1978
Northrop Corp., Hawthorne, Calif
Stalony-Dobrzanski, Janusz
Title: Improvement of Fighter Aircraft Maneuverability Through Employment Of Control Configured Vehicle Technology

ABSTRACT

The control configured vehicle (CCV) design concept employing concurrently the traditional disciplines as well as full authority automatic control system design, is shown to offer a very large combat performance improvement over conventional design approach. This improvement is due primarily to the freedom, under CCV concept, of designing statically longitudinally unstable configurations. The configuration selected for the evaluation is a tailless clipped delta employing advanced structure and engine technologies. The performance gains are achieved simultaneously with decreased aircraft and fuel weight for the same mission. (Paper: Agard Conf. Proc N 260, Paper presented at the Flight Mech. Panel Symp. on Stab. and Control, Ottawa, Ont, Sep 25-28 1978)

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B.3.2.64 SSIE: GQF13990 1 5/77
Boeing Co, 7555 E. Marginal Way S., Seattle, Washington, 98124
Yoshirhara, H.
Title: Supersonic Favorable Aerodynamic Interference Applications

ABSTRACT

The objective of this effort is to judiciously apply the concepts of favorable aerodynamic interference to produce an airframe, compatible with pilot/canopy, engine and fuel requirements, and capable of sustained supersonic cruise at efficient power settings. (Plan)

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B.3.2.65 SSIE: CQF136030 2 3/76
Boeing Co., 7555 E. Marginal Way S., Seattle, Washington, 98124
Vachal, J.
Title: Boundary Layer Control

ABSTRACT

An assessment of the myriad of aerodynamic methods for reducing the fuel consumption of transport aircraft has shown that laminar flow control by suction offers the greatest potential for achieving long-range or high-endurance aircraft designs with significantly reduced fuel usage. A military transport design study will be performed to assess the merit of advances in technology in relation to producing a reliable laminar flow control aircraft. (Plan)

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B.3.2.66 SSIE: GQF 51710 2 6/78
Michigan State University, School of Engineering, Dept. of Aerospace Engineering, East Lansing, Michigan, 48824
Vinh, N. X.
Title: Optimum Singular Aerodynamics and Thrust Magnitude Matching In Supercruiser Fighter

ABSTRACT

Objective of this proposal is to investigate the optimum aerodynamics of a supercruiser and its matching with the singular thrust control to minimize the fuel consumption over a prescribed range under a certain time constraint. (Plan)

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B.3.2.67 SSIE: GQF 539560 1 12/78 to 2/80
Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics and Astronautics, 77 Massachusetts Ave., Cambridge, Massachusetts 02139
Landahl, MT
Title: Turbulent Boundary Layer Structure and Drag Reduction

ABSTRACT

Investigate the unsteady boundary layer phenomena induced on a fixed, stationary, two dimensional airfoil. Data obtained from this effort will be directly applicable to the design of future aerospace vehicles. (Plan)

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B.3.2.68 78A43359*# July 1978
NASA, Langley Res. Cent., Langley Station, VA
Leonard, R.W.
Title: Airframes and Aerodynamics --- Aircraft Design in NASA Energy Efficient Transport Program

ABSTRACT

The first part of the paper discusses the Energy Efficient Transport Program of the Aircraft Energy Efficiency (ACEE) program, giving attention to the development of active aerodynamics and active controls. The second part of the paper deals with two other portions of the ACEE program: Composite Primary Structures and Laminar Flow Control. (Paper in Astronautics and Aeronautics, vol. 16, July-Aug 1978)

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B.3.2.69 77A28234* Nov 1976
NASA, Langley Res. Cent. Hampton, VA
Leonard, R.W.
Title: Airframe Technology for Energy Efficient Transport Aircraft

ABSTRACT

A review is presented of the airframe technologies selected for emphasis in the NASA ACEE program, taking into account an evaluation of their potential for fuel efficiency, the impact of advanced technology, advanced composite structures, the NASA composite primary structures program, advanced aerodynamics and active controls, supercritical wing geometry, active load and flutter control, and aspects of laminar flow control. (Paper in Society of Automotive Engineers, Aerospace Engineering and Manufacturing Meeting, San Diego, CA, Nov 29 - Dec 2, 1976)

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B.3.2.70 AD-A068 324/3ST Jun 75 - Oct 77
Air Force Flight Dynamics Lab., Wright-Patterson, AFB, OH
Loptien, George W.
Title: The Effect of Winglets on the KC-135A Aircraft

ABSTRACT

To investigate the effects of winglets on the aerodynamic characteristics of the KC-135 aircraft. At cruise conditions, the full-span tests indicated a total drag reduction of 5.3 percent for the model with the Boeing and NASA upper plus lower winglet configurations and 6.5 percent for the model with the NASA upper winglet configuration. A wing-tip-extension on the semispan model had a drag reduction of about 3 percent compared to about 5 to 7 percent for the winglet configurations; however, the tip extension was not optimized for drag reduction. At cruise flight conditions, winglets on the KC-135A aircraft were estimated to reduce the drag about 8.2 percent and increase the maximum lift-drag ratio about 9.5 percent. (Report)

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B.3.2.71 SSIE: CQF 141350 2 5/78 to 9/80
Lockheed Georgia Co., 86 S. Cobb Dr., Marietta, Georgia 30060
Lores, M.E.
Title: Advanced Transonic W/b Design Methodology

ABSTRACT

The objective of this effort is to develop more efficient transport and fighter configurations than possible in the past and at a lesser cost. This work will contribute to more fuel efficient transports and more maneuverable fighters at transonic speeds as well as reducing the cost of designing these aircraft. (Plan)

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B.3.2.72 SSIE: CQF 133980 2 4/75 to 79
Grumman Corp., Grumman Aerospace Corp., S. Oyster Bay Rd., Bethpage, New York 11714
Mackenzie, DJ
Title: Advanced Wing-Body Aerodynamic Analysis and Design Program

ABSTRACT

The objective of this effort is to develop a computer program for theoretical predictions of surface pressure lift, drag, and pitching moments of arbitrary aircraft configurations throughout the subsonic,

transonic, and supersonic flight regime. This program will be used to supplement wind tunnel test programs and will result in reduced development costs, in addition to improving cruise and maneuver performance of military aircraft. (Plan)

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B.3.2.73 N76-20124/3ST 1 Apr 76
NASA, Langley Res. Cent., Langley Station, VA
Maddalon, D.V.
Title: Energy and Economic Trade-offs for Advanced Technology Subsonic Aircraft

ABSTRACT

Changes in future aircraft technology which conserve energy are studied. New technologies considered are laminar-flow control, composite materials with and without laminar-flow control, and advanced airfoils. Aircraft design features include high-aspect-ratio wings, thickness ratio and range. It is concluded that wing aspect ratios of future aircraft are likely to significantly increase as a result of new technology and the push of higher fuel prices. Composite materials may raise aspect ratio to about 11 to 12 and practical laminar flow-control systems may further increase aspect ratio to 14 or more. (Report)

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B.3.2.74 N79-28136/6ST Jul 79
New York Univ., NY, Courant Mathematics and Computing Lab.
McFadden, G.B.
Title: An Artifical Viscosity Method for the Design of Supercritical Airfoils

ABSTRACT

A numerical technique is presented for the design of two-dimensional supercritical wing sections with low wave drag. Topics covered include the partial differential equations of transonic flow, the computational procedure and results; the design procedure; a convergence theorem; and description of the code. (Report)

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B.3.2.75 SSIE: DZ 421 7/79 to 6/80
New York Univer. NY, Courant Mathematics and Computing Lab.
McFadden, GB
Title: Mathematical Sciences Postdoctral Research Fellowship

ABSTRACT

The research will involve the area of applied mathematics, particularly the computer design of 3-dimensional swept wing configurations with low wave drag. (Plan)

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B.3.2.76 SSIE: CQF 140620 8/77 to N/A
McDonnell Douglas Astronautics Co., E. 411 St., St. Louis, Missouri 63166
McGrew, JA
Title: Supercritical Wing Flutter

ABSTRACT

Supercritical wings provide increased aerodynamic efficiency by delaying the drag rise, thus allowing the aircraft to cruise efficiently at a higher Mach number. The objective of this effort is to evaluate and improve flutter prediction methods for supercritical wings. Improved prediction methods will assure flight safety. (Plan)

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B.3.2.77 N77-24062/OST May 77
NASA, Langley Res. Cent., Langley Station, VA
McLaughlin, M.D.
Title: Calculations, and Comparison with an Ideal Minimum, of Trimmed Drag for Conventional and Canard Configurations Having Various Levels of Static Stability

ABSTRACT

Classical drag equations were used to calculate total and induced drag and ratios of stabilizer lift to wing lift for a variety of conventional and canard configurations. The flight efficiencies of such configurations that are trimmed in pitch and have various values of static margin are evaluated. Classical calculation methods are compared with more modern lifting surface theory. (Report)

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B.3.2.78 USGE: GH 17586 1 1/73 to 12/99
US Dept. of Commerce, National Bureau of Standards, Washington, DC 20228
McMichael, JM
Title: Drag Reduction

ABSTRACT

To determine the merits of the compliant surface as an effective method for achieving drag reduction in air and water. (Plan)

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B.3.2.79 N74-20654/1 20 Dec 78
NASA, Langley Res. Cent., Langley Station, VA
Braslow, A.L.
Title: Aeronautical Fuel Conservation Possibilities for Advanced Subsonic Transports

ABSTRACT

Fuel-conservation possibilities attainable through the application of advances in aeronautical technology to aircraft design are identified with the intent of stimulating NASA R and D and systems-study activities in the various disciplinary areas. The material includes: drag reduction; weight reduction; increased efficiency of main and auxiliary power systems; unconventional air transport of cargo; and operational changes. (Report)

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B.3.2.80 75A40502* May 1975
Lockheed-Georgia Co., Marietta, GA
Bowden, M.K.
Title: Design of Short Haul Aircraft for Fuel Conservation

ABSTRACT

Jet fuel prices have significantly changed the characteristics of airplane design for best economy. Interaction of airfoil technology and desirable engine characteristics is important. The supercritical airfoil permits higher aspect ratio wings with lower sweep; these, in turn, lower the cruise thrust requirements so that engines with higher bypass ratios are better matched in terms of lapse rate. Lower cruise speeds (which are also better for fuel and operating cost economy) push the desired bypass ratio up further. (Paper in Society of Automotive Engineers, Air Transportation Meeting, Hartford, Conn., May 6-8, 1975)

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B.3.2.81 DF143740 31 Dec 79
Vought Aeronautics Div., LTV,
Nagaraja, KS
Title: Ejector Wing Designs

ABSTRACT

The objective of this effort is to develop new designs such as an ejector-wing which provide significantly advantageous lift and thrust augmentations. This will provide the Air Force with aircraft that can be energy saving and maneuverable in the low flight speeds. (Plan)

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B.3.2.82 SSIE: CQF 140640 3 2/77 to N/A
Univ. of Bristol, Bristol, England, United Kingdom
Nangia, RK
Title: Leading Edge Design Study of Swept-Back Slender Wings With or Without Separation

ABSTRACT

In the design of high performance fighter aircraft, careful design of the leading edge geometry can lead to significantly improved wing performance (lift-drag ratio) in both speed regimes. The object of the study is to provide guidelines to be used in designing leading edges of high-sweep wings in order to achieve the maximum aerodynamic efficiency. (Plan)

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B.3.2.83 SSIE: ZH 6444 4 10/77 to N/A
NASA, Ames Research Center, Moffett Field, CA 94035
Unknown
Title: General Aviation Aerodynamic Performance Technology

ABSTRACT

Development of advanced techniques and design data to improve aerodynamic performance, stability and control, and handling qualitites. Develop techniques for reducing aerodynamic drag associated with engine cooling. (Plan)

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B.3.2.84 SSIE: ZH 870022 2 10/77 to N/A
NASA, Langley Research Center, Hampton, VA 23665
Unknown
Title: Propulsion System Integration

ABSTRACT

Fundamental studies will be conducted to develop an improved understanding of the flow phenomena associated with the integration of the propulsion system into advanced aircraft concepts. Propulsion system integration concepts will be studied that are designed to exploit favorable interference effects which may enhance the wing life, performance efficiency, reduce drag or permit thrust reversing of the exhaust system to improve performance of the aircraft. (Plan)

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B.3.2.85 SSIE: ZH 870137 1 10/77 to N/A
NASA, Office of Aeronautics and Space Technology, Langley Research Center, Hampton, VA 23665
Unknown
Title: Laminar Flow Control Technology

ABSTRACT

The broad objective of this laminar flow control (LFC) element of the NASA aircraft energy efficiency (ACEE) program is to demonstrate that predicted reductions in fuel consumption are attainable for new-design commercial transports through the application of laminar flow control. (Plan)

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B.3.2.86 SSIE: ZH 870143 1 10/77 to N/A
NASA, Office of Aeronautics and Space Technology, Hugh L. Dryden Flight Research Center, P.O. Box 273, Edwards, CA 93523
Unknown
Title: Energy Efficient Transport Flight Research

ABSTRACT

This RTOP covers three separate elements as follows: (1) flight tests of Whitcomb Winglets on a KC-135 aircraft. (2) development of system integration technique resulting in the design of an active control system that will provide gust alleviation, maneuver load control and flutter suppression for the Aeroelastic Research Wing Vehicle (ARW-2) and (3) determination of the extent of natural laminar flow that can be achieved

in a flight environment over the upper surface of a subsonic cruise airfoil. (Plan)

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B.3.2.87 SSIE: ZH 970142 1 0/79 to N/A
NASA, Hugh L. Dryden Flight Res. Cen., P.O. Box 273, Edwards, CA 93523
Unknown
Title: Laminar Flow Control Flight Research

ABSTRACT

The overall objective of this RTOP is to improve the aerodynamic efficiency of cruise aircraft through viscous drag reduction by maintaining laminar flow over significant portions of an aircraft's lifting surfaces. (Plan)

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B.3.2.88 SSIE: ZH 970146 0/79 to N/A
NASA, Ames Res. Cent., Moffett Field, CA 94035
Unknown
Title: Aircraft Energy Efficient Project (ACEE) Assistance and Testing

ABSTRACT

Technical assistance, consultive services and support, through the use of NASA-Ames Facilities, will be provided to NASA Langley for the aircraft energy efficient project (ACEE). Support tests will be primarily conducted in the Ames 11- by 11-foot transonic and 12-foot pressure wind tunnels. Specific ACEE programs for which support is planned during FY-1979 are energy efficient transport (EET) and laminar flow control (LFC). (Plan)

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B.3.2.89 N78-17002/4ST Feb 78
Kansas Univ. Center for Research, Inc., Lawrence Flight Research Lab.
Pao, J.L.
Title: Minimum Induced Drag Configurations with Jet Interaction

ABSTRACT

A theoretical method is presented for determining the optimum camber shape and twist distribution for the minimum induced drag in the wing-alone case without prescribing the span loading shape. (Report)

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B.3.2.90 AD-832 104/4ST May 68
Arnold Engineering Development Center, Arnold Air Force Station, Tenn
Pfaff, Larry J.
Title: Lift-to-Drag Ratios of Semispan Delta Wing Configurations at Supersonic and Hypersonic Mach Numbers

ABSTRACT

Tests conducted in the supersonic and hypersonic tunnels of the von Karman Gas Dynamics Facility (VKF) to determine the maximum lift-to-drag ratios of a series of blunt leading edge, semispan delta wings have a 70-deg leading-edge sweep angle. Selected results presented showing the effect of forward panel bluntness and deflection, and Mach number of the wing lift-to-drag ratios. (Report)

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B.3.2.91 74A27610 1970
Unknown
Pivko, S.
Title: On the Efficiency of Air Inlets for Supersonic Aircraft

ABSTRACT

The performance of various supersonic air inlet designs is analyzed in an attempt to enhance the air intake efficiency in terms of kinetic energy conversion into pressure head. (Paper in Srpska Akademija Nauka i Umetnosti, Clas, Cdeljenje Tekhnichkikh Nauka, no. 10, 1973, in Serbian)

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B.3.2.92 79A11572 Oct 1978
ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France
Poisson-Quinton, P.
Title: Energy Conservation Aircraft Design and Operational Procedures

ABSTRACT

Paper reviews studies associated with improved fuel efficiency. Design concepts are described including: (1) increases in aerodynamic efficiency through decreased friction drag, parasitic drag, and drag due to lift. (2) structural efficiency and the implementation of composite materials, (3) active control technology, (4) the optimization of airframe-engine integration, and (5) VTOL and STOL concepts. Consideration is also given to operational procedures. (Paper in NATO, AGARD, Lecture Series on Energy Conservation in Aircraft Propulsion, Munich, West Germany, Oct. 26, 27, 1978)

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B.3.2.93 SSID: GQA 53783 2 8/77 to 1/80
Summa Corp., Hughes Helicopters Div., Centinela Ave. and Teale St., Culver City, CA 90230
Prouty, RW
Title: Wind Tunnel Test of Large Scale Rotor Hubs (Analytics and Experimental Investigation of the Airflow and Drag of Helicopter Hubs and Pylons)

ABSTRACT

To improve the complex, turbulent airflow around helicopter rotor hubs and pylons, which causes localized drag and vibration, and which generates a turbulent, energetic wake which strikes the tail rotor, fin and tail boom, causing further aerodynamic problems. (Plan)

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B.3.2.94 EI760421676 Nov 1975
Pratt and Whitney Aircraft
Herrick, Paul W.
Title: Predicting Propulsion Related Drag of Jet Aftbodies

ABSTRACT

Two propulsion related drag correlation parameters have been developed. The propulsion related drags of single, twin, and two-dimensional jet installations, and convergent, convergent-divergent, and plug nozzles are shown to correlate with the two parameters. (Paper

in SAE meeting, November 17-20, 1975)

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B.3.2.95 AD-A081 182 Sep 79
Federal Aviation Administration Washington DC Office of Environment and Energy
UNK
Title: Energy Conservation Potential of General Aviation Activity

ABSTRACT

Three approaches for reducing energy consumption were investigated: hardware modification, pilot education, and air traffic control. It is recommended that research into new aircraft engine designs, automatic mixture controls, conventional engine fuel saving improvements, composite materials development, and aerodynamic drag reduction continue. (Report)

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B.3.2.96 78A35893 Jun 1977
Societe Nationale Industrielle Aerospatiale, Toulouse, France
Cormery, G.
Title: Supersonic Transport in Terms of Energy Savings

ABSTRACT

The utilization of petroleum-based fuel for civil aviation is considered within the framework of total energy consumption. Attention is given to developments in the United States and France, both currently and over the near-term future (through the 1980s). Various improvements in engine and aerodynamic design are discussed, inlcuding use of composite materials, supercritical wings, high bypass engines, and improved engine geometries. (Paper in L°Aeronautique et l°Astronautique, no. 69, 1978, in French)

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B.3.2.97 N76-23249/5ST 6 Oct 75
ECON, Inc., Princeton, NJ
Unknown
Title: An Assessment of the Benefits of the Use of NASA Developed Fuel Conservative Technology in the US Commercial Aircraft Fleet

ABSTRACT

Cost and benefits of a fuel conservative aircraft technology program proposed by NASA are estimated. NASA defined six separate technology elements for the proposed program: (a) engine component improvement (b) composite structures (c) turboprops (d) laminar flow control (e) fuel conservative engine and (f) fuel conservation transport. (Report)

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B.3.2.98 SSIE: CQF 139760 1 5/77 to N/A
Raytheon Co., Hartwell Rd., Bedford, Massachusetts 02172
Greco, J.
Title: Hinge Moments of an Optimized Control Surface Design

ABSTRACT

The split tail concept to be investigated will optimize the tail design, yielding greater aerodynamic and control system efficiency. Also will result in a significant reduction of hinge moments which will allow utilization of lighter weight, smaller size, and lower cost actuators. (Plan)

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B.3.2.99 SSIE: GQF 140070 1 4/77 to N/A
Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical and Astronaut. Engin., 190 N. Oval Dr., Columbus, Ohio 43210
Gregorek, GM
Title: Compressible Airfoil Design Methodology

ABSTRACT

This work effort is the development of a compressible subcritical airfoil design method which will be used to configure airfoils for future USAF aircraft. Use of these new technology airfoils will permit flight envelope expansion on future military high-altitude, long-endurance air vehicles. (Plan)

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B.3.2.100 SSIE: GOF 141270 2 1/78 to 1/80
Ohio State University Research Foundation, 1314 Kinnear Rd., Columbus, Ohio 43212
Gregorek, GM
Title: Compressible Subcritical Airfoil Design and Test

ABSTRACT

This work effort is the design and wind tunnel test of compressible subcritical airfoils for future USAF aircraft, using a previously developed airfoil methodology. Use of these advanced technology airfoils will permit flight envelope expansion on future military high altitude long endurance air vehicles. (Plan)

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B.3.2.101 EI770637334 Jul 1976
Aircr. Res. Assoc., Bedford, England
Haines, A.B.
Title: Aerodynamics

ABSTRACT

Possible radical advances in aerodynamics that may be introduced by 1990-1995 include the introduction of the waverider to attain higher supersonic speeds, the use of suction to maintain laminar flow over sweptback wings of subsonic aircraft in the interests of fuel conservation, and the reintroduction of propeller-driven aircraft also to conserve fuel. Possibilities of evolutionary aerodynamic advances are noted in wing design for subsonic transports, improved high-lift devices, engine nacelles with reduced interference drag and improved noise shielding, and finally, improved supersonic transports with variable wing geometry. (Paper in Aeronaut J v 80 n 787 Jul 1976)

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B.3.2.102 77N32092*# Mar 1977
NASA, Langley Res. Cent., Hampton, VA
Hefner, Jerry N.
Title: Overview of Concepts for Aircraft Drag Reduction

ABSTRACT

Overview is presented of aerodynamic drag reduction concepts which have potential for reducing aircraft fuel consumption. Attention focused on aerodynamic improvements; concepts for reducing pressure drag (i.e., roughness, wave interference, and separation drag), drag due to lift/induced drag, and skin-friction drag at subsonic and supersonic

speeds are emphasized. (Paper in AGARD rep n 654, Spec Course on Concepts for Drag Reduct, Von Karman Inst., Rhode-St-Genese, Belg., Mar 28 - Apr 1, 1977)

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B.3.2.103 SSIE: GQF 136160 3 5/76 to N/A
McDonnell Douglas Corp., P.O. Box 516, St. Louis, Missouri, 63166
Hiley, PE
Title: Experimental Evaluation of Non-Axisymmetric Exhaust Nozzles

ABSTRACT

Effort to increase the range and/or decrease the fuel requirements of military aircraft. Objective of program is to experimentally investigate several non-axisymmetric exhaust nozzle concepts to determine what range improvement and/or maneuver enhancement may be obtained when the nozzles are designed into a particular airframe. (Plan)

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B.3.2.104 N79-14024/OST Jan 79
NASA, Ames Res. Cent., Moffett Field, CA
Hicks, R.M.
Title: Effects of Upper Surface Modification on the Aerodynamic Characteristics of the NASA 63 Sub 2-215 Airfoil Section

ABSTRACT

An upper surface modification designed to increase the maximum lift coefficient of a 63 sub 2 - 215 airfoil section was tested at Mach numbers of 0.2, 0.3, and 0.4 Reynolds numbers of 1.3 x 1 million, 2 x 1 million, and 2.5 x 1 million. The upper surface modification increased the maximum lift coefficient of the airfoil significantly at all conditions. (Report)

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B.3.2.105 AD-A054 093/6ST 1 Sep 72 - 31 Dec 77
North Carolina State Univ., Raleigh, Dept. of Mechanical and Aerospace Engineering
DeJarnette, Fred R.
Title: Investigation of Wing-Rotor Interaction System for Helicopters

ABSTRACT

This research includes experimental and analytical investigations to determine if favorable interference effects could be obtained from a wing-rotor interaction system. Lift and drag forces were measured on a wing, mounted in a cantilever fashion from the wall, and on a proprotor positioned above the wing on a shaft which ran through the ceiling of the test section. Test results showed significant increases in lift and decreases in drag for both the wing and the proprotor due to favorable interference effects. (Report)

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B.3.2.106 AD-A029 345/6ST 16 Jun - 25 Nov 75
Boeing Commercial Airplane Co., Seattle, Washington
Ishimitsu, K.K.
Title: Design and Analysis of Winglets for Military Aircraft

ABSTRACT

A study of the design and analysis of winglets for military aircraft has been completed. The analysis of the winglets showed a 14 percent reduction in induced drag for the KC-135 and a 11 percent reduction for the C-141. The structural design study of the KC-135A winglet installation estimated a 592 lb weight increase. An 8.4 percent improvement was estimated in M(L/D) sub MAX and an 8.1 percent improvement in range factor for the KC-135A. (Final Report)

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B.3.2.107 AD-A046 152/5ST Jun-Nov 76
Boeing Commercial Airplane Co., Seattle, Washington
Ishimitsu, K.K.
Title: Design and Analysis of Winglets for Military Aircraft. Phase II

ABSTRACT

A study of the design and analysis of winglets for military aircraft has been completed. A preliminary plan for a KC-135A winglet retrofit program was developed and its cost estimated. Based on a 1979 program start, the retrofit costs would be recovered by the start of 1984. (Final Report)

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B.3.2.108 N78-20064/9ST Jun 77
NASA, Langley Res. Cent., Langley Station, VA
Jacobs, P.F.
Title: Effects of Winglets on a First-Generation Jet Transport Wing. I: Longitudinal Aerodynamic Characteristics of a Semispan Model at Subsonic Speeds

ABSTRACT

The effects of winglets and a simple wing-tip extension on the aerodynamic forces and moments and the flow-field cross flow velocity vectors behind the wing tip of a first generation jet transport wing were investigated in the Langley 8-foot transonic pressure tunnel using a semi-span model. The test was conducted at Mach numbers of 0.30, 0.70, 0.75, 0.78, and 0.80. At a Mach number of 0.30, the configurations were tested with combinations of leading- and trailing-edge flaps. (Report)

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B.3.2.109 N79-17871/1ST Jan 79
National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
Coe, P. L. Jr.
Title: Theoretical and Experimental Investigation of Ground Induced Effects for a Low-Aspect-Ratio Highly Swept Arrow-Wing Configuration

ABSTRACT

Investigation conducted in the Langley V/STOL tunnel to determine the influence of ground proximity on the aerodynamic characteristics of a low

aspect ratio highly swept arrow wing configuration. The experimental results show that as the height above the ground decreases, the configuration experiences substantial increases in lift and reductions in induced drag. The tests also show that decreasing ground height results in a marked increase in the tail downwash factor, and therefore, results in a substantial increase in the horizontal tail contribution to longitudinal stability. Comparison of the experimental results with results predicted by a planar vortex lattice theoretical model shows that the theoretical model provides a good estimate of the ground induced effect on lift, drag, and longitudinal stability for the wing-body combination. (Report)

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B.3.2.110 GQF 515202 1/78 to 12/79
University of Tennessee, Central Office, Space Inst., Tullahoma, Tennessee, 37388
Collins, F.G.
Title: Flow Visualization Study Of Secondary Flow In A Corner

ABSTRACT

Develop methods for modeling the interfering flow which occurs at the wing-fuselage juncture of an aircraft. Providing more accurate drag prediction, such a method would lead to the design of more aerodynamically efficient aircraft. (Plan)

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B.3.2.111 N77-15978/8ST Dec 76
National Aeronautics and Space Administration. Langley Research Center, Langley Station, VA.
Compton, W.B. III
Title: Jet Exhaust and Support Interference Effects on the Transonic Aerodynamic Characteristics of a Fighter Model with Two Widely Spaced Engines

ABSTRACT

Jet exhaust, nozzle installation, and model support interference effects on the longitudinal aerodynamic characteristics of a twin-engine fighter model were determined. The jet exhaust affected drag more than it affected lift and pitching moment. The largest effects occurred at a Mach number of 0.9 and for the afterburning mode of exhaust nozzle operation. (Report)

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B.3.2.112 AD-A024 940/7ST Dec 76
Air Force Inst of Tech., Wright-Patterson AFB, Ohio, School of Engineering
Crenshaw, Kent R.
Title: Stability and Control Characteristics of the Wright Configured KC-135A

ABSTRACT

Using the Boeing FLEXSTAB digital computer system, rigid and elastic models of the winglet configured KC-135A are made. With a rigid analysis, the winglets reduced total drag from 2 to almost 8% with improvements both laterally and longitudinally in static stability. Dynamically, the rigid winglet model is more stable laterally but slightly more oscillatory longitudinally. No significant detrimental effects due to winglets are found. (Master's Thesis)

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B.3.2.113 SSIE: GQF1354902 6/75 to N/A
Boeing Co., 7555 E. Marginal Way S., Seattle, Washington, 98124
Dacosta, A.L.
Title: Design And Analysis Of Winglets For Military Aircraft

ABSTRACT

The recently developed winglets appear to offer significant gains in aerodynamic performance by reducing aircraft drag. Potential benefits include improved range and/or reduced fuel requirements for military and commercial aircraft. (Plan)

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B.3.2.114 SSIE: GQA 441121 4/77 to N/A
Analytical Methods Inc., 110 116th Ave. S.E., Bellevue, Washington, 98004,
Dvorak, F.A.
Title: Helicopter Flow Field Analysis

ABSTRACT

Current helicopters have parasite drag levels of up to ten times as great as fixed wing aircraft. This problem is primarily due to bluff body flow separation. The objective of this contract is to improve helicopter drag prediction by developing an analytical method for predicting pressure distributions in separated flow regions behind bluff bodies. The method,

if successful, will allow greatly improved drag predictions for a particular design. (Plan)

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B.3.2.115 SSIE: ZQF1401702 4/76 to 6/79
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio 45433
Dyer, R.D.
Title: Aircraft/Weapon System Optimization

ABSTRACT

The objective of this effort is to develop prediction techniques and design criteria for external and internal carriage of weapons on current and future tactical aircraft to minimize the clean aircraft performance degradation and to reduce operating costs through fuel savings (Plan)

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B.3.2.116 77A45925 1977
EXXON Corp.
unk
Title: Fuel Conservation Through Airplane Maintenance

ABSTRACT

Maintenance (or restoration) of an aerodynamically clean aircraft surface and its payoff in minimizing drag, are discussed. The "top ten" drag-enhancing and fuel-penalty problems are listed. (Article in Exxon Air World, Vol.29, No. 3, 1977)

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B.3.2.117 78A31304*# Oct 1977
De Havilland Aircraft Co. Ltd., Downsview (Ontario)
Farbridge, J.E.
Title: Some Aspects of Power Plant Airframe Integration Affecting Fuel Conservation

ABSTRACT

Constraints on engineering design, which become even more severe with the introduction of powered-lift for turbofan aircraft. The drag polars of various powered lift concepts are analyzed to determine the installed thrust/weight required and a simple method of relating this to fuel efficiency is suggested. Special consideration is given to recent Canadian research in the realm of supercritical airfoil technology.

(Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3-4, 1977)

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B.3.2.118 SSIC: GQF 429004 1/76 to N/A
Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics and Astronautics, 77 Massachusetts Ave. Cambridge, Massachusetts, 02139
Finston, M.
Title: Wake Studies Related To Waverider Aerodynamic Shapes

ABSTRACT

Obtain preliminary aerodynamically configured vehicles and reentry bodies. Map the near wake pressure and temperature characteristics and obtain lift-to-drag data of aerodynamically configured shapes to enable designers and developers to predict possible uses for these new shapes. (Plan)

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B.3.2.119 N79-18917/1ST Mar 79
Kansas Univ. Center for Research, Inc., Lawrence Flight Research Lab.
Fillman, C. L.
Title: Analysis of Some Aerodynamic Characteristics Due to Wing-Jet Interaction

ABSTRACT

The results of two separate theoretical investigations are presented predicting the aerodynamic characteristics of both upper-surface blowing (USB) and over-wing blowing (OWB) configurations. Experiments showed net drag reductions associated with the well known lift enhancement due to over-wing blowing. The mechanisms through which this drag reduction is brought about are presented. (Report)

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B.3.2.120 AD-A044 805/0ST Jun 77
Advisory Group for Aerospace Research and Development Paris (France)
Unknown
Title: Special Course on Concepts for Drag Reduction

ABSTRACT

Research effort is being mounted in a number of countries into investigations of ideas for drag reduction, some novel and some that were looked at in the past. Ideas include means for reducing skin friction drag (e.g. compliant walls, boundary layer control, etc.), induced drag (e.g. winglets), interference drag, transonic shock wave drag (supercritical wings) and supersonic wave drag. In addition the internal aerodynamics of ducting, especially diffusers is receiving attention to improve the performance of engines. AGARD Special Course at the von Karman Inst., 28 Mar-1 Apr 77, Rhode-St-Genese, Belgium

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B.3.2.121 SSIE GQF 138210 2 12/77 to 9/81
General Dynamics Corp., P.O. Box 748, Fort Worth, TX 76101
Allis, A.E.
Title: Validation of Aeroelastic Tailoring by Static Aeroelastic and Flutter Tests

ABSTRACT

Work supports the functional area of aircraft aeroelastic design involving improved aerodynamic performance. Aeroelastic tailoring of composites offers the potential of designing aircraft lifting surfaces to provide the required strength margins and improve certain aerodynamic qualities such as improved lift or reduced drag. The work unit will address the validation and quantification of the benefits obtainable through aeroelastic tailoring. (Plan)

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B.3.2.122 N77-24100/8ST May 77
NASA, Hugh L. Dryden Flight Research Center, Edwards, CA
Arnaiz, H.H.
Title: Flight-Measured Lift and Drag Characteristics of a Large, Flexible, High Supersonic Cruise Airplane

ABSTRACT

Flight measurements of lift, drag, and angle of attack were obtained for the XB-70 airplane, a large, flexible, high supersonic cruise airplane. Such performance characteristics as drag polars, lift-curve slopes, and maximum lift-to-drag ratios were derived from the flight data. The base drag of the airplane, changes in airplane drag with changes in engine power setting at transonic speeds, and the magnitude of the drag components of the propulsion system are discussed. (Report)

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B.3.2.123 SSIE GQF 38980 6 4/74 to 5/80
Stanford University, School of Engineering, Dept. of Aeronautics and Astronautics, Stanford, CA 94305
Ashley, H.
Title: Unsteady Gasdynamics Problems Related to Flight Vehicles

ABSTRACT

Opportunity - remove penalties in performance and airframe weight present in many Air Force aircraft because of limitations imposed by aeroelastic instability and response. Objective - improvement in the theoretical understanding of unsteady aerodynamic loads related to flight vehicles, as well as of aeroelastic phenomena in which they are involved. How work contributes - by providing the design analysts of fixed and rotary - wing aircraft with improved totals, whereby aeroelastic penalties in performance and aircraft weight can be reduced. (Plan)

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B.3.2.124 DTIC: VN070162 9 Apr 79
NASA Hugh L. Dryden Flight Research Center, Edwards, Cal.
Barber, M.R.
Title: Energy Efficient Transport Flight Research

ABSTRACT

Technical objective: Three separate elements are covered as follows: Flight tests of Whitcomb winglets on a KC-135 aircraft; development of system integration technique resulting in the design of an active control system that will provide gust alleviation, maneuver load control and flutter suppression for the aeroelastic research wing vehicle (ARW-2); and determination of the extent of natural laminar flow that can be obtained with promising consistency on a subsonic cruise airfoil designed for favorable pressure gradients. (Plan)

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B.3.2.125 N78-30064/7ST 1978
Liverpool Univ. (England)
Barsby, J.E.
Title: Calculations of the Effects of Blowing from the Leading Edges of a Cambered Delta Wing

ABSTRACT

The thin jet model applied to the study of the jet flap is combined with the vortex sheet model applied to the study of leading-edge separation, to study the effect of blowing from the leading-edges of a cambered wing. The drag for a given lift when blowing is introduced is greatly reduced, and in some cases a negative drag is predicted. (Report)

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B.3.2.126 SSIE ZQF282150 1 2/77 to 9/78
Air Force Academy, Aeronautics Dept., Colorado Springs, Colorado 80840
Batill, S.M.
Title: Productive Applications of Aeroelasticity

ABSTRACT

A study will be made of low-speed airfoils to determine how applications of aeroelasticity such as time-varying camber, thickness, and twist could increase the efficiency of flight, will result in feasible methods of improving endurance, range, fuel economy, etc., through aeroelasticity. (Plan)

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B.3.2.127 N78-10023/7ST Oct 77
NASA, Langley Research Center, Langley Station, VA
Beasley, W.D.
Title: An Exploratory Investigation of the Effects of a Thin Plastic Film Cover on the Profile Drag of an Aircraft Wing Panel

ABSTRACT

Exploratory wind tunnel tests were conducted on a large chord aircraft wing panel to evaluate the potential for drag reduction resulting from the application of a thin plastic film cover. (Report)

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B.3.2.128 N78-15056/2ST Dec 77
NASA, Ames Research Center, Moffett Field, CA
Boltz, F.W.
Title: Aerodynamic Characteristics of an F-8 Aircraft Configuration with a Variable Camber Wing at Mach Numbers from 0.70 to 1.15

ABSTRACT

A 0.1-scale model of an F-8 aircraft was tested in the Ames 14-foot Transonic Wind Tunnel at Mach numbers from 0.7 to 1.15. The model was configured with a wing designed to simulate the downward deflection of the leading and trailing edges of an advanced-technology-conformal-variable camber wing also equipped with conventional (simple hinge) flaps. In general, at all Mach numbers the use of conformal flap deflections at both the leading edge and trailing edge resulted in slightly higher maximum lift coefficients and lower drag coefficients than with the use of simple hinge flaps. (Report)

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B.3.2.129 78N13042 Oct 1977
NASA, Langley Research Center, Langley Station, VA
Bonner, T.F., Jr.
Title: Aircraft Energy Efficiency Laminar Flow Control Wing Design Study

ABSTRACT

Engineering design study performed in which laminar flow control (LFC) was integrated into the wing of a commercial passenger transport aircraft. The LFC system, with suction slots, ducting, and suction pumps was integrated with the wing structure. The use of standard aluminum technology and advanced superplastic formed diffusion bonded titanium technology was evaluated. Results show that the LFC system can be integrated with the wing structure to provide a structurally and aerodynamically efficient wing for a commercial transport aircraft. (Report)

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B.3.2.130 SSIE ZQF 138570 4 3/76 to n/a
Air Force Flight Dynamics Lab., Wright-Patterson AFB, Dayton, Ohio 45433
Calarese, W.
Title: Aerodynamic Analysis on Cavities, 2-D and Axisymmetric Bodies

ABSTRACT

A significant problem area of high performance military tactical and strategic aircraft are the range and performance losses due to airframe-exhaust nozzle flow interactions. These losses are more significant in the transonic regime where nonlinear effects produce drag forces beyond tolerable limits. High drag and turbulence are also produced by open port turrets necessary for the use of such equipment as telescopes. The objective of this investigation is to develop a theoretical approach capable of analyzing the transonic and supersonic flow field over 2-D airfoils and bodies of revolution including jet plume, Reynolds number effects, shock-boundary layer interactions, boattail injection, and viscous mixing in separated regions, to provide quiet environment behind an open port, to minimize optical distortion and attenuation along a line of sight through the open port to some external point, to study laser exhaust flow and to obtain an overall drag reduction. (Plan)

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B.3.2.131 N78-30039/9ST Aug 78
NASA, Langley Research Center, Langley Station, VA
Capone, F.J.
Title: Aerodynamic Characteristics Induced on a Supercritical Wing Due to Vectoring Twin Nozzles at Mach Numbers from 0.40 to 0.95

ABSTRACT

Induced lift characteristics are studied for a vectored-thrust concept in which jet-exhaust nozzles were located in the fuselage at the wing trailing edge. The wing had a supercritical airfoil section. The results show that the configuration with the supercritical wing generally had a better performance with respect to both lift augmentation and drag reduction than the same configuration with a 64 series airfoil. (Report)

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B.3.2.132 N79-26024/6ST May 79
Low Energy Transport Systems, Capistrano Beach, CA
Carmichael, B.H.
Title: Summary of Past Experience in Natural Laminar Flow and Experimental Program for Resilient Leading Edge

ABSTRACT

The potential of natural laminar flow for significant drag reduction and improved efficiency for aircraft is assessed. Past experience with natural laminar flow as reported in published and unpublished data and personal observations of various researchers is summarized. Aspects discussed include surface contour, waviness, and smoothness requirements; noise and vibration effects on boundary layer transition; boundary layer stability criteria; flight experience with natural laminar flow; and suction stabilized boundary layers. (Report)

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B.3.2.133 EI780207739 Mar 1977
NASA, Langley Res. Center, Hampton, VA
Cary, A.M., Jr.
Title: Slot Injection for Skin-Friction Drag Reduction

ABSTRACT

Description and analysis of slot injection in low-speed flow, slot injection in high-speed flow, a discussion of aircraft applications, and possibilities for future improvements of slot drag reduction capability. It is shown that slot injection can consistently provide large local

skin-friction reductions which are predictable with present-day numerical technology. (Paper+ AGARD Rep n 654, Spec Course on Concepts for Drag Reduct., Von Karman Inst., Rhode-St-Genese, Belg. Mar 28-Apr 1 1977. Publ by AGARD, Neuilly sur Seine, Fr. Jun 1977)

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B.3.2.134 AD-A024 944/9ST Dec 76
Air Force Inst. of Tech, Wright-Patterson AFB, Ohio, School of Engineering
Cary, Mitchell D.
Title: A Parametric Analysis of Winglet Effects

ABSTRACT

Two part study: First part: Winglet effects were examined on a variety of wing planforms. A nonplaner lifting surface computer program was used to calculate aerodynamic coefficients including lift, induced drag, wing pitching moment, and wing root bending moment coefficients. The percentage induced drag reduction was found to be the greatest on the wing with the highest aspect ratio and wing sweep angle (27.5 percent for an aspect ratio 7, 45 degree swept wing). The greatest incremental drag reduction occurred with the lowest aspect ratio, highest swept wing. The second study examined the effects of winglet cant angle on induced drag reduction. Leading edge inboard yielded the greatest reductions in induced drag. (Master's Thesis)

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B.3.2.135 SSTE:GQF143230 1 5/79 to 5/80
Ohio State University Research Foundation, 1314 Kinnear Rd., Columbus, Ohio, 43212
Lee, J. D.
Title: Thermally Controlled Boundary Layer Technology

ABSTRACT

The Air Force function for this effort is the design of future large aircraft, transports and bombers. The problem this effort addresses is the need to reduce the drag on these aircraft so that either the range can be extended or fuel required for a given mission reduced. The objective is to demonstrate the ability of cryogenic cooling of an airfoil surface to delay transition of the boundary layer and thereby reduce drag. (Plan)

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## B.4 STRUCTURES AND MATERIALS TECHNOLOGY

### B.4.1 NAVY FUNDED

B.4.1.1 SSIE: GON[illegible] 12/78
Massachusetts Inst. of Technology, Di.. of Sponsored Research, 77 Massachusetts Ave., Cambridge, Massachusetts, 02139
Louis, J. F.
Title: Energy Conversion: Studies of Transonic Turbines With Film-Cooled Blades

ABSTRACT

The effort is aimed at reducing the amount of cooling required per unit of work extracted. The research will contribute to increased performance of gas turbine engines needed particularly for naval aircraft propulsion. (Plan)

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B.4.1.2 AD-A030 074/0ST Apr 76
TRW Inc., Cleveland Ohio
Brentnall, William D.
Title: Metal Matrix Composites for High Temperature Turbine Blades

ABSTRACT

The continued development and evaluation of the refractory wire reinforced FeCrAlY composites designed for application in advanced gas turbine engines is described. Investigations of 1000-hour creep and stress rupture properties in the temperature range 1037-1148C. Preliminary burner rig tests indicated no significant problems for W/FeCrAlY composites exposed to this type of environment. (Report)

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B.4.1.3 AD-A067 970/4ST Feb-Apr 78
AiResearch Mfg. Co of Arizona, Phoenix
Arenare, J. A.
Title: Ceramic Gas Turbine Engine Demonstration Program

ABSTRACT

The objective of the 36-month "Ceramic Gas Turbine Engine Demonstration Program" is to design, fabricate, develop and conduct demonstration tests with ceramic hot-flow-path components for the Airesearch Model TSE331C-1 Engine operating at an average turbine inlet temperature of 2200 F with a peak turbine inlet temperature of approximately 2500 F. Performance improvement goals projected for the engine with the uncooled, high-temperature ceramic components include a

40-percent increase in output power and a 10-percent reduction in specific fuel consumption. (Interim Report)

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B.4.1.4 FE-1765-4 June - September 1975
General Electric Co., Schenectady, N.Y.
Flynt, F. V.
Title: High Temperature Gas Turbine Engine Component Materials Testing Program. Quarterly Progress Report No. 1

ABSTRACT

Report describes progress of test program for turbine components using coal-derived liquid fuels. (Progress Report)

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B.4.1.5 SSIE: GQN5810674 6/74 to 10/78
Rockwell International Corp., Columbus Aircraft Division, 4300 E. 5th Ave., Columbus, Ohio, 43216
Gehring, R.
Title: Preliminary Design of a Composite Wing for Navy V/STOL Prototype

ABSTRACT

Advance fibrous composite aerospace structures technology by the preliminary design of a major structural component representative of new fighter aircraft and to provide the basis for advanced development efforts to demonstate the practicality of such structures. Design a lightweight highly reliable wing assembly. (Plan)

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B.4.1.6 SSIE: GQN8900621 1/78 to 2/79
General Dynamics Corp., Convair Division, P.O. Box 1950, San Diego. California, 92112
Unknown
Title: Design Study of Thermoplastic Wing

ABSTRACT

Identify fiber reinforced thermoplastic wing design approaches compatible with manufacturing/quality assurance capabilities for these materials and their associated weight/cost attributes. Conduct design and analysis trade studies to identify weight, cost and other functional

characteristics of alternative wing designs. Build and test critical subelements to support the analyses. (Plan)

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B.4.1.7 SSIE: ZON4810245 10/73
Naval Air Development Center, Aircraft and Crew Systems Tech Directorate, Warminster, Pennsylvaia, 18974
Hess, T. E.
Title: Advanced Composite High Temperature Structure

ABSTRACT

Analytically synthesize and design an optimal advanced composite primary structural component suitable for the high temperature environment of a high performance vehicle. Assess design alternatives and exploit advantageous properties of boron-aluminum material to meet established design requirements. Laboratory evaluation and flight demonstration of potential weight and performance improvements. (Plan)

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B.4.1.8 SSIE: GQN8751631 12/77
University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, 200 W. 21st, Austin, Texas, 78712
Marcus, H. L.
Title: Navy Vehicle Design And Construction: High Performance Metal-Matrix Composites

ABSTRACT

Metal-matrix composites offer promise for use in Navy airframe structures and turbine engines. This research effort is directed toward understanding the structure property relationships in graphite-reinforced aluminum composites which have demonstated high strength-to-density properties but suffer from low transverse strength. (Plan)

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B.4.1.9 SSIE:GQN875788 8/78 to Cont
United Technologies Corp., United Technologies Research Center, 400 Main St., East Hartford, Connecticut, 06108
Brennan, J.J.
Title: Materials Support Technology - SIC Fiber Reinforced Class Matrix Composites

ABSTRACT

The use of fiber reinforced composite materials in Naval aircraft is increasing because of their low density, strength, and stiffness. Present materials are limited to use at relatively low temperatures. However, composites with higher temperature capabilities are needed. The objective of this task is to study composite systems that appear to offer potential for use at higher temperatures. Study of composites composed of SIC monofilament and SIC yarn incorporated into high temperature glass or glass-ceramic matrices will be conducted. (Plan)

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B.4.1.10 SSIE:GQN975393 0/79 to Cont
Avco Corp., Specialty Materials Division, Lowell Industrial Park, Lowell Massachusetts, 01851
Cornie, J. A.
Title: Materials Support Technology: Silicon Carbide Metal-Matrix Composites

ABSTRACT

The Navy has a need for improved high performance materials in aircraft structures, jet engines and missiles. This program will examine the use of silicon carbide filaments to reinforce metal alloys, thereby providing high specific strength and stiffness in the resulting metal-matrix composite. Metal-matrix composites have potential for reducing weight of structural components and increasing allowable temperatures. (Plan)

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B.4 STRUCTURES AND MATERIALS TECHNOLOGY

B.4.2 NON NAVY FUNDED

B.4.2.1 75A11426 Oct 1974
Article: Aviation Week and Space Technology
Unknown
Title: Next Generation Transports Will Emphasize Fuel Savings

ABSTRACT

Technology for the minimum energy airplane is reviewed. Special attention is given to an advanced medium-range aircraft that is being developed to lower fuel economics and twin-engine airplanes are considered that will incorporate new wing and structures technology. Improvements in aircraft design include (1) a long duct and thin wall nacelles. (2) the use of aluminum and titanium alloys for reduced stress corrosion and weight and high fatigue life, and (3) advanced airfoils andhigh lift devices. New concepts for the minimum energy airplane that would embody composities or improve skin and stringer techniques are included.

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B.4.2.2 75A47509 May 1975
Boeing Commercial Airplane Co., Seattle, WA
Hanks, G.W.
Title: Weight Contribution to Fuel Conservation for Terminal Area Compatible Aircraft

ABSTRACT

Reductions in fuel consumption by weight characteristics of advanced aircraft are considered, and trades between weight reduction versus increased aerodynamic and operating efficiency are discussed. Direct reductions in fuel use may be obtained by application of advanced technology in structure and airfoils, proper engine choice, and revised environmental control features. Weight penalties involved in wing planform optimization are countered by increased aerodynamic efficiency. Results of studies incorporating advanced structure, airfoils, and propulsion show 21.6 percent reductions in operational empty weight and takeoff gross weight compared to a conventional design. Implementation of the described fuel reduction approaches will yield an estimated 25 percent reduction in fuel consumption. (Paper: Society of Allied Weight Engineers, Annual Conference, 34th, Seattle, WA, May 5 - 7, 1975)

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B.4.2.3 76A42426 July 1975
McDonnell Douglas Corp., St. Louis, MO
Kawai, R.T.
Title: Advanced Integration Technology to Improve Installed Propulsion Efficiency

ABSTRACT

Past major improvements in transport aircraft productivity from advances in propulsive engines are reviewed, followed by an assessment of areas for future advancements. Different trades will exist between weight, maintainability, and fuel consumption. Past design approaches and concepts are re-evaluated because of the need to increase emphasis on reducing fuel consumption. Recent studies have identified improvement possibilities through advancements in engine/airframe integration. Current McDonnell Douglas advanced propulsion technology programs which are exploring these possibilities and can lead to significant fuel savings are described. The barriers to utilization of this fuel conservative technology are discussed. (Paper: AIAA and SAE, Propulsion Conference, 12th, Palo Alto, CA, July 26 - 29, 1976)

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B.4.2.4 76A30916 Apr 1976
Unknown
Staszek, J.
Title: Technical Progress in the Design of Aircraft from the Standpoint of Fuel Economy

ABSTRACT

Reliance on supercritical airfoil profiles, vortex diffusers, boundary layer suction, active control (of control surfaces), and new materials to reduce the size and weight of passenger airliners and cargo aircraft without penalties in performance is reviewed. Supercritical profiles bring about greater L/D ratios which, with increased wing span, are more effective in reducing induced drag than is the use of vortex diffusers. But vortex diffusers mean a smaller moment arm at the wing root, and only 0.5 percent increase in bending moment as against 8.5 percent caused by increased wing span. Boundary layer control through air suction by slits add up to 30 percent fuel savings. Properly selected flexible elastic BLC coating can reduce drag friction by 50 percent. Active control of control surfaces means less static stability, bu. greater indifference to gusts and flutter. Fiber (glass, boron, graphite) reinforced materials (resins, metals) add strength while reducing weight. Fuel savings up to 35 percent are predicted for the next generation of airliners, and as much as 55 percent for the next generation of cargo aircraft. (Paper: Technika Lotnicza i Astronautyczna, vol. 31, Apr 1976.

In Polish)

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B.4.2.5 AIAA: 80-0914 May 1980
NASA, Lewis Research Center, Cleveland, Ohio 44135
Weber, R.
Title: Aeropropulsion in Year 2000

ABSTRACT

Many advances can be anticipated in propulsion systems for aircraft in the next 20 years. This paper presents a sampling of probable future engine types such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports. This is followed by a brief review of related technology improvements in propellers, materials, noise suppression, etc. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8 1980, Baltimore, MD)

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B.4.2.6 AIAA: 79-1651 Aug 1979
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Overview of Technology Advancements for Energy Efficient Transports

ABSTRACT

Several research activities, conducted under NASA contract and directed toward improved fuel efficiency of commercial transports, are described. Emphasis is placed on advancements in aerodynamics and avionics/controls. Aerodynamic advancements include wing geometry variations and the winglet concept for improved lift/drag ratio, improved high-lift design, evaluation of natural laminar flow for drag reduction, and improved surfact coatings for reduced drag and surface erosion. Application of active controls; closed-loop flight path control using direct computer control of autopilot and autothrottle during ascent, cruise and descent; and the use of delayed flap operation and precise flight path control in the terminal area are included as potential improvements that rely on advanced avionics/controls. Evaluation of potential application is provided. (Paper: AIAA Atomospheric Flight Mechanics Conference and Special Session: Energy Efficient Aircraft Design, August 7 - 8 1979, Boulder, Colorado)

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B.4.2.7 AIAA: 80-0906 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Technology Advancements for Energy Efficient Transports

ABSTRACT

Ongoing government and industry supported research activities pertaining to improved fuel efficiency of commercial transports are described with particular attention to advancements in aerodynamics, avionics, and controls technologies. Emphasis is placed on the interaction of these technologies with the structure, propulsion, and other technologies involved in transport configuration design, as well as the impact on airline operation they could imply. The potential benefits offered by these technologies and the research activities required to support their commitment to future models are discussed. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.4.2.8 76A36606 May 1976
Unknown
Stern, J.
Title: Aircraft Propulsion - A Key to Fuel Conservation: An Aircraft Manufacturer's View

ABSTRACT

A range of possible approaches to fuel conservation is examined. The fuel contributions to direct operating costs, aircraft operations and maneuvers designed to conserve fuel, aircraft design variants, modifications, and refittings capable of aiding fuel conservation are discussed. Advantages of turbofan and turboprop derivatives of basic aircraft designs are examined. The RECAT (Reducing Energy Consumption of Commercial Air Transportation) program is outlined. The possible impact of recent technological advances in aircraft design (supercritical airfoils, optimized wing geometry, longitudinal stability augmentation, composites, new metallic structures) on fuel conservation is examined. (Paper: Society of Automotive Engineers, Air Transportation Meeting, New York, NY, May 18 - 20, 1976)

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B.4.2.9 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the Forum, Detroit, Michigan, October 15, 1975)

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B.4.2.10 78A47905 Aug 1978
Unknown
Park, P. H.
Title: The Effect on Block Fuel Consumption of a Strutted Versus Cantilever Wing for a Short-Haul Transport Including Strut Aeroelastic Considerations

ABSTRACT

A preliminary design of a short-haul aircraft using a strut-braced wing was made to study the possibility of block fuel savings due to the decrease in wing weight allowed by the use of a strut. A computer-aided wing loads and stress analysis was performed to determine the wing weight savings. It was found that the wing weight savings are not large in this aircraft and the induced drag decrease is offset by the strut parasite drag. The final cantilever and strutted configurations have essentially equal block fuel consumptions. A calculated strut flutter velocity was close enough to the flight envelope to warrant design consideration. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, CA, Aug 21 - 23, 1978)

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B.4.2.11 77A20719 1976
Lockheed-Georgia Co., Marietta, GA
Lange, R.H.
Title: Effects of Artificial Stability on Configuration Design

ABSTRACT

The use of active controls for maneuver load alleviation in the development of transport aircraft in the 1980s is considered. As part of the NASA Advanced Transport Technology Program, Lockheed conducted a relaxed static stability analysis including an assessment of the benefits to be derived from the application of advanced technologies such as low noise level propulsion systems, supercritical wing, advanced filamentary composite materials, and active controls. Attention is also given to the JetStar redesign study, taking account of wing optimization, geometry constraints, and loads analysis. (Paper: Air Transportation for the 1980's, University of Maryland, College Park, Maryland, 1976).

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B.4.2.12 74A34985 Apr 1974
Unknown
Kelly, D.L.
Title: Application of Hydrogen to Commercial Transports

ABSTRACT

A design analysis of the conversion of an in-production wide-bodied transport to hydrogen fuel is presented. Comparisons are drawn between storage of hydrogen in the fuselage and storage in wing-external tanks. Required structural modifications are defined and costed, and a preferred configuration is selected on the basis of direct operating cost. It is shown that a conversion of a jet fueled, wide-bodied transport to hydrogen fuel is technically and economically feasible, provided that it is preceded by a long-life tankage and insulation development. The preferred configuration has the hydrogen stored in pylon-mounted tanks above the wings. Flyaway cost of the hydrogen fueled conversion is 8 percent greater than that of the baseline jet fueled transport. (Paper: Society of Automotive Engineers, Air Transportation Meeting, Dallas, TX, Apr 30 - May 2, 1974)

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B.4.2.13 N76-18536/2ST Feb 76
McDonnell-Douglas Corp., St. Louis, Mo.
Pirrello, C.J.
Title: A Fuselage/Tank Structure Study for Actively Cooled Hypersonic Cruise Vehicles, Summary

ABSTPACT

Detailed analytical study made to investigate the effects of fuselage cross section and the structure arrangement (integral and non integral tanks) on aircraft performance of liquid hydrogen fueled Mach 6 transport. Trade studies conducted in the area of configuration arrangement, structural design, and active cooling design. The result shows that the blended body integral tank aircraft weighs the least and has the greatest range capability. However, producibility and maintainability factors favor non-integral tank concepts. (Final Report)

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B.4.2.14 SSIE: GQF 141060 1 10/77 to 4/79
Rockwell International Corp., International Airport, Los Angeles, CA
Wykes, J.H.
Title: Active Flutter Suppression on Aeroelastically Tailored HIMAT Vehicle

ABSTRACT

The HIMAT vehicle has aeroelastically tailored wings for improved maneuverability. The aeroelastic twist control design approach resulted in low flutter speeds. The objective of this effort is to define the feasibility and potential benefits of an active flutter suppression system on aeroelastically tailored composite wings. An active flutter suppression system may provide a more efficient, weight-saving approach. (Plan)

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B.4.2.15 SSIE: ZOF 140800 2 1/77 to 3/79
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, OH 45433
Hertz, T.J.
Title: Improved Aeroelastic Tailoring and Structural Optimization

ABSTRACT

Through the application of aeroelastic tailoring of advanced composite structures, it has been shown feasible to aeroelastically deform the lifting surfaces of advanced fighter aircraft to provide improved performance of these aircraft. Prevention of flutter in thin wings has been achievable analytically while providing minimum drag and maneuver load relief. (Plan)

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B.4.2.16 SSIE: GQF 49610 2 7/77 to 11/79
Cornell University, Ithaca Campus School of Engineering, Dept. of Chemical Engineering, 242 Carpenter Hall, Ithaca, NY 14853
Merrill, R.P.
Title: Fundamental Studies of the Structure and Chemistry of Solid Surfaces

ABSTRACT

Propulsion and power generation systems for future AF weapon systems may depend upon synthetic fuels and surface induced combustion. Heterogeneous catalysis is an essential element for the synthesis of fuels and for the decomposition of propellants used to generate power and/or thrust. Physical degradation of catalyst particles in monopropellant thrustors has become a limiting factor in engine life. This research has two major objectives. One is directed toward the theoretical and experimental studies of oxidation and hydrazine decompositions occurring on noble metal surfaces such as iridium. An equally important and collateral objective is to understand how oxide layers on aluminum and titanium surfaces withstand corrosive attack. (Plan)

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B.4.2.17 EI760957614 1974
Inst Fuer Werkstoff-Forschung, Lindder Hoehe, Ger
Bunk, W.
Title: Artificial and Natural High-Temperature Composites

ABSTRACT

Composites will probably replace conventional superalloys as turbine blades in jet engines allowing higher temperatures of combustion and therefore resulting in higher efficiency. Examples of such composites as materials for engine design are discussed. (Paper: Inst Counc of the Aeronaut Sci (ICAS), 9th Congr. Proc Haifa, Isr, Aug 25-30 1974)

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B.4.2.18 AD-A037 349/8ST 1 May 73 - 30 June 76
Battelle Pacific Northwest Labs, Richland, Wash.
Busch, R.
Title: Application of Sputter-Deposited Lamellar Composite Technology to the Development of High Temperature Turbine Blade Materials and Airfoil Fabrication

ABSTRACT

Data and results from the third year's work on application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication is presented and discussed. (Final Report)

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B.4.2.19 ERDA/NASA-0067/77/1 Feb 77
United Technologies Corp., South Windsor, Conn., Power Systems Div.; Pratt and Whitney Aircraft Group, East Hartford, Conn.; Department of Energy
Carlson, N.
Title: Thermal Barrier Coating On High Temperature Industrial Gas Turbine Engines

ABSTRACT

Study program identified significant benefits from applying thermal barrier coatings to hot section components of high temperature industrial gas turbine engines. The thermal barrier coating used in this study was a yttria-stabilized zirconia material with a NiCrAly undercoat and the base engine used to establish improvements was the P and WA FT50A-4 industrial gas turbine engine. Cooling flow reductions and improved heating rates achieved with thermal barrier coating result in improved performance.

Economic benefits include reduced consumption. Fuel savings equivalent to $5 million are projected and specific power (megawatts/mass of engine airflow) improvements on the order of 13 percent are estimated. (Report)

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B.4.2.20 SSIE: GQF 479003 2/77 to 4/80
General Electric Co., 1 Jimson Rd., Cincinnati, Ohio 45215
Carlson, R. G.
Title: Effect of Bonding Characteristics on Metal Matrix Composite Properties

ABSTRACT

Air Force Propulsion systems of the future are expected to contain metal matrix composites because of their attractive mechanical properties at substantially reduced weight. A better technical understanding is required for design and application of this class of materials. Objective - this research will develop an understanding of the metal matrix composites to effect a balanced increase in mechanical properties, placing specific emphasis on increased impact resistance. (Plan)

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B.4.2.21 AD-AC52 669/9ST Jul 77
Army Armament Research and Development Command, Watervliet NY, Benet Weapons Lab
Ahmad, I.
Title: Reinforced Cobalt Alloy Composite For Turbine Blade Application

ABSTRACT

A composite of 0.42 V(f)-27 ThO2 filament reinforced cobalt base alloy has been developed. It can be fabricated by conventional investment casting process, has a 1093 C (2000 F), 100 hr. stress-to-rupture of 206 MN/sq M (30Ksi), and a charpy impact strength of 280.0 in-lb at 835 C as compared with 20.6 in-lb for the unreinforced alloy. Also the feasibility of casting a prototype first stage blade of JT9D engine has been demonstrated. (Report)

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B.4.2.22 SSIE: ZQA 57812 1 10/77 to N/A
Army Aviation Research and Development Command, Applied Technology Lab., Fort Eustis, Newport News, VA 23604
Lane, J.
Title: Ceramic Component Definition and Screening -- Army Aircraft

ABSTRACT

Conduct an investigation to assess applicability of ceramics for use in the helicopter gas turbine engine components. Use of ceramics offers the potential of a 10 percent decrease in fuel consumption and a 30-40 percent increase in horsepower while reducing engine weight and cost over advanced technology engines for use in future army helicopters. (Plan)

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B.4.2.23 78A41924 Jul 1978
Bell Aerospace Co., Buffalo, NY
Sharpe, E.L.
Title: Durability of Foam Insulation for LH2 Fuel Tanks of Future Subsonic Transports

ABSTRACT

A description is presented of an experimental study regarding the suitability of commercially available organic foams as cryogenic insulation for liquid hydrogen tanks under extensive thermal cycling typical of subsonic airline type operation. Fourteen commercially available organic foam insulations were tested. Two unreinforced polyurethane foams survived over 4200 thermal cycles (representative of approximately 15 years of airline service) without evidence of structural deterioration. The polyurethane foam insulations also exhibited excellent thermal performance. (Paper: International Cryogenic Materials Conference on Nonmetallic Materials and Composites at Low Temperatures, Munich, West Germany, July 10, 11, 1978)

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B.4.2.24 75A41951 1974
Nederlandse Vereniging voor Luchtvaarttechniek
Sterk, F.J.
Title: Nederlandse Vereniging voor Luchtvaarttechniek, Yearbook 1974

ABSTRACT

Some selected topics in recent developments in the design of new aeronautical systems are discussed including nuclear-propelled aircraft. (Book, Dutch and English)

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B.4.2.25 SSIE: ZQF142370 2 2/78 to 12/79
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio, 45433
Sherrer, V. C.
Title: Forward Swept Wing Aeroelastic Studies

ABSTRACT

Recent analytical studies have shown that forward swept wings offer the performance advantages of reduced drag and increased maneuverability over aft swept wings. Until recently, designs with large forward sweeps proved to be impractical because prohibitive weight increases in the wing structure were necessary to overcome divergence. Use of aeroelastic tailoring of advanced composite wing skins can eliminate the divergence problem without a significant weight penalty. Objective of this work unit is to provide experimental verification of the ability of advanced composites to eliminate divergence in forward swept wings. (Plan)

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B.4.2.26 FE-2664-6 10 Apr 78
AiResearch Mfg. Co. of Arizona, Phoenix
Unknown
Title: Ceramic Technology Readiness Program. Sixth Monthly Technical Progress Report, February 27 - April 2, 1978

ABSTRACT

Research on ceramic turbine components for use with coal-derived fuels. (Progress Report)

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B.4.2.27 78A24024# Feb 1978
Douglas Aircraft Co., Long Beach, Calif
Hage, R. E.
Title: The Challenge of Advanced Fuel-Conservative Aircraft - A Manufacturer's View

ABSTRACT

Costs and technological problems associated with advanced fuel-conservative aircraft are discussed, with particular attention given to the current NASA Aircraft Energy Efficiency (ACEE) program which focuses on engine component improvement turboprops, laminar flow control and composites. (Paper: American Institute of Aeronautics and Astonautics, Annual Meeting and Technical Display, 14th, Washington, D.C., Feb 7-9, 1978)

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B.4.2.28 76A32649 May 1976
NASA
Geddes, J. P.
Title: Civil Transport Technology up to 2000 - NASA Believes Fuel Consumption is the Major Consideration

ABSTRACT

Recommendations of a NASA task force to establish goals in a program for fuel conservation technology compared with typical industry views of developments that are feasible in the near future. Improved engine components for JT8D, JT9D, and CF6, including mechanical mixers to mix the core and duct stream before discharge through a common nozzle, clearance control to improve compressor and turbine efficiency, and improved blade shapes. Four aerodynamic approaches to fuel consumption selected for future study: drag clean-up, improved aerodynamic design, laminar flow control, and the use of small vertical end-plates on wing-tips to augment thrust. Accelerated effort in the development of composite structures is urged. Fuel savings of 79% is predicted for the year 2005. (Article: Interavia, Vol. 31, May 1976)

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B.4.2.29 77A42784*# Aug 1977
NASA, Langley Research Center, Hampton, Va.
Hood, R. V., Jr.
Title: The Aircraft Energy Efficiency Active Controls Technology Program

ABSTRACT

Broad outlines of the NASA Aircraft Energy Efficiency Program for expediting the application of active controls technology to civil transport aircraft are presented. Advances in propulsion and airframe technology to cut down on fuel consumption and fuel costs, a program for an energy efficient transport; and integrated analysis and design technology in aerodynamics, structures and active controls are envisaged. (Paper: Guidance and Control Conference, Hollywood, Fla., August 8-10, 1977)

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B.4.2.30 78A31305# Oct 1977
Canadair, Ltd., Montreal, Canada
Bernstein, S.
Title: Improved Energy Efficiency for Small CTOL Transport Aircraft

ABSTRACT

Potential improvements in fuel efficiency by application of new airframe and propulsion system technologies (supercritical wings, advanced composite materials, high aspect ratio wings, advanced propulsion systems, wing tip winglets, active controls and laminar flow) to the smaller CTOL transport aircraft. Fuel savings up to 12% are possible by increasing aspect ratio alone. Incorporation of supercritical airfoils and advanced composites with the higher aspect ratios can save a further 5%. Advanced propulsion system technology offers similar or higher potentials for fuel savings - 15-20% with new turbofans and a further 15-20% with prop-fans. Total cumulative fuel savings of 40-45% are possible with incorporation of all the new technologies investigated. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977)

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B.4.2.31 78A12031 June 1977
Avions Marcel Dassault-Breguet Aviation, Vaucresson, Hauts-de-Seine, France
Amblard, P.
Title: Energy Savings - The Viewpoint of an Aircraft Manufacturer

ABSTRACT

Technological developments leading to the design of aircraft which consume less fuel than present models are reviewed. In particular, high bypass ratio engines, supercritical wingspans, active control, and the use of light-weight composite materials for both secondary and primary aircraft structures are considered. Advanced techniques in aerodynamic analysis, especially in the field of boundary layer control, are also mentioned. (Paper: French)

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B.4.2.32 79A11572 Oct 1978
ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France
Poisson-Quinton, P.
Title: Energy Conservation Aircraft Design and Operational Procedures

ABSTRACT

Paper reviews studies associated with improved fuel efficiency. Design concepts are described including: (1) increase in aerodynamic efficiency through decrease friction drag, parasitic drag, and drag due to lift, (2) structural efficiency and the implementation of composite materials, (3) active control technology, (4) the optimization of airframe-engine integration and (5) VTOL and STOL concepts. Consideration is also given to operational procedures. (Paper: NATO, AGARD Lecture Series on Energy Conservation in Aircraft Propulsion, Munich, West Germany, Oct. 26, 27, 1978)

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B.4.2.33 78A25893 Jun 1977
Societe Nationale Industrielle Aerospatiale, Toulouse, France
Cormery, G.
Title: Supersonic Transport in Terms of Energy Savings

ABSTRACT

The utilization of petroleum-based fuel for civil aviation is considered within the framework of total energy consumption. Attention is given to developments in the United States and France both currently and over the near-term future (through the 1980s). Various improvements in engine and aerodynamic design are discusssed, including use of composite materials, supercritical wings, high bypass engines and improved engine geometries. (Paper: L°Aeronautique et l°Astronautique, no. 69, 1978, In French)

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B.4.2.34 79N13192# Oct 1978
Advisory Group for Aerospace Research and Development, Paris France
unk
Title: Aircraft Engine Future Fuels and Energy Conservation

ABSTRACT

Current and forecasted world energy demands, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs. The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal, oil shale, and tar sands) and techniques for reducing energy consumption in refining processes are examined. Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems. An assessment is made as to what technology advancements are currently under way and what other advancements are needed with reference to engine components, engine systems, aircraft designs, and operational procedures to help conserve fuel resources. (Paper: AGARD Lectures in Munich and London, Oct 1978)

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B.4.2.35 SSIE: ZQF141540 2 11/77
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio, 45433
Watts, R. W.
Title: Closed Environmental Control System Evaluation

ABSTRACT

Reduction of significant mission take-off-gross-weight (TOGW) penalties is possible through development of a closed-loop ECS. This ECS concept can reduce engine bleed air and ram air penalties by approximately 80 percent. The objective of this effort is to develop criteria for the most important elements of the closed-loop ECS (The air cycle machine (ACM), drive system, expansion devices). (Plan)

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B.4.2.36 EI770320634 Nov 1976
NASA, Langlley Res Cent. Hampton, VA
Williams, Jerry G.
Title: Buckling Behavior and Structural Efficiency of Open-Section Stiffened Composite Compression Panels

ABSTRACT

Several exploratory experiments with J- and blade-stiffened graphite/epoxy panels were conducted. Results are presented from two design studies using a minimum-weight design synthesis program. Both studies indicate that graphite/epoxy open-section stiffened panels can be designed so that weight savings of 30% to 50% are possible compared with the most efficient aluminum designs. (Paper: AIAA J v 14 n 11 Nov 1976)

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B.4.2.37 SSIE: GQF136220 2 3/76
Rockwell International Corp., International Airport, Los Angeles, California
Wilson, V. L.
Title: New Concepts In Advanced Materials Applications to Landing Gear for Military Aircraft - Concepts/Criteria

ABSTRACT

The objective of this work unit is to extend the AFFDL-developed technology in composite material landing gear hardware to the conceptual design study of complete composite material landing gear systems. This study will establish the cost and weight saving benefits that are possible

through the maximum praactical use of composite material landing gear hardware in complete landing gear systems. Composite material has excellent potential to save up to 40 percent weight for some landing gear hardware components. (Plan)

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B.4.2.38 N74-20654/1 20 Dec 73
NASA, Langley Research Center, Langley Station, Va
Braslow, A. L.
Title: Aeronautical Fuel Conservation Possibilities for Advanced Subsonic Transports

ABSTRACT

Fuel-conservation possibilities attainable through the application of advances in aeronautical technology to aircraft design are identified with the intent of stimulating NASA R and D and systems study activities in the various disciplinary areas. The material includes: drag reduction; weight reduction; increased efficiency of main and auxiliary power systems; unconventional air transport of cargo; and operational changes. (Report)

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B.4.2.39 77A28234* Nov 1976
NASA, Langley Research Center, Langley Station, Va
Leonard, R. W.
Title: Airframe Technology for Energy Efficient Transport Aircraft

ABSTRACT

A review is presented of the airframe technologies selected for emphasis in the NASA ACEE program, taking into account an evaluation of their potential for fuel efficiency. Attention given to fuel efficiency, impact of advanced technology, advanced composite structures, the NASA composite primary structures program, advanced aerodynamics and active controls, supercritical wing geometry, active load and flutter control, and aspects of laminar flow control. (Paper: Society of Automotive Engineers, Aerospace Engineering and Manufacturing Meeting, San Diego, Calif, Nov. 29 - Dec. 2, 1976)

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B.4.2.40 78A43259*# Jul 1978
NASA, Langley Research Center, Langley Station, Va
Leonard, R. W.
Title: Airframes and Aerodynamics Aircraft Design in NASA Energy Efficient Transport Program

ABSTRACT

The first part of the paper discusses the Energy Efficient Transport program of the Aircraft Energy Efficiency (ACEE) program, giving attention to the development of active aerodynamics and active controls. The second part of the paper deals with two other portions of the ACEE program: Composite Primary Structures and Laminar Flow Control. (Paper: Astronautics and Aeronautics, Vol. 16, July-Aug 1978)

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B.4.2.41 N76-23249/5ST 6 Oct 75
ECON, Inc., Princeton, NJ
Unknown
Title: An Assessment of the Benefits of the Use of NASA Developed Fuel Conservative Technology in the US Commercial Aircraft Fleet

ABSTRACT

Cost and benefits of a fuel conservative aircraft technology program proposed by NASA are estimated. NASA defined six separate technology elements for the proposed program: (a) engine component improvement (b) composite structures (c) turboprops (d) laminar flow control (e) fuel conservative engine and (f) fuel conservative transport. (Report)

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B.4.2.42 AD-C016 293L Jun 78
Rockwell International, Los Angeles, Calif., Los Angeles Aircraft Div.
Raymer, D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase 1

ABSTRACT

Study dealt with technologies and concepts for post-1995 manned penetrating strategic bomber. Technologies were assessed in areas of aerodynamics, propulsion, structures, controls, and stealth, and were found to offer up to 50 percent reductions in cost and weight over current technologies. (Final Report)

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B.4.2.43 77N17022# Feb 1976
Committee on Aeronautical and Space Sciences (U.S. Senate).
Unknown
Title: Aircraft Fuel Efficiency Program

ABSTRACT

A technology plan is described for developing fuel-efficient aircraft. Inputs were obtained from industry, NASA research centers, and other governmental agencies. Six major programs are defined: engine component improvement, composite primary structures, turboprops, laminar flow control, fuel conservative transport, and the fuel conservative engine. Funding requirements and benefits are discussed. (Paper: GPO Rept. for Comm. on Aeronautical and Space Sci. 94th Congr., 2d Ses., 17 Feb 1976)

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B.4.2.44 AD-C019 324L Jun 79
Rockwell International, El Segundo, CA, North American Aircraft Div.
Wiler, C. D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase II

ABSTRACT

This study dealt with technologies and concepts for 1990 and 2000 IOC manned penetrating bombers. Two concepts were selected from the phase I study for in-depth examination of structures, aerodynamics, propulsion, and various subsystems. (Final Report) (Secret)

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B.4.2.45 78A18022 Oct 1977
Unknown
Walsh, B.
Title: Advances in Aircraft Efficiency

ABSTRACT

The paper surveys NASA's Aircraft Energy Efficiency program. Six major elements: (1) engine component improvement, aimed at a 5% reduction in annual fuel consumption, (2) the energy efficient engine program, (3) the development of advanced turboprop propulsion systems, (4) the creation of advanced aerodynamics and active control technology applicable to

transport aircraft, (5) the development of alternative laminar flow designs, and (6) the study of potential composite primary structures for weight reduction and fuel economy. (Paper: Aviation Engineering and Maintenance, Vol. 1 Oct 1977.)

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B.4.2.46 77A12102*# May 1976
NASA, Ames Research Center, Moffett Field, Calif
Williams, L. J.
Title: Air Transportation Energy Efficiency - Alternatives and Implications

ABSTRACT

Results from recent studies of air transportation energy efficiency alternatives are discussed. Included are aircraft operation, aircraft modification, derivative aircraft, and new aircraft. In order to obtain significant improvements in energy efficiency, new aircraft must truly exploit advanced technology in such areas as aerodynamics, composite structures, active controls, and advanced propulsion. (Paper: Society of Allied Weight Engineers, Annual Conference, 35th, Philadelphia, Pa., May 24-26, 1976.)

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B.4.2.47 N77-23072/0ST Jun 76
Douglas Aircraft Co., Inc. Long Beach, Calif
Kraus, E. F.
Title: Cost Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System. Volume 1: Technical Analysis

ABSTRACT

The effectiveness of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state of the art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. (Final Report)

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B.4.2.48 78A43357*# July 1978
NASA, Washington, D.C.
Kramer, J. J.
Title: Planning a New Era in Air Transport Efficiency

ABSTRACT

The current status of the NASA Aircraft Energy Efficiency (ACEE) program is briefly reviewed with reference to CTOL aircraft. Attention is given to four basic technologies: turboprop, advanced aerodynamics and active controls, laminar flow control, and composites. (Paper: Astronautics and Aeronautics, Vol. 16, July-Aug. 1978)

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B.4.2.49 79A14136* Apr 1977
NASA, Washington, D.C.
Klineberg, J. M.
Title: Technology for Aircraft Energy Efficiency

ABSTRACT

Six technology programs for reducing fuel use in U.S. commercial aviation are discussed. The six NASA programs are divided into three groups: Propulsion - engine component improvement, energy efficient engine, advanced turboprop; Aerodynamics - energy efficient transport, laminar flow control; and Structures - composite primary structures, Schedules, phases, and applications of these programs are considered. (Paper: International Air Transportation Conference, Washington, D. C., April 4-6, 1977, Proceedings, New York, American Society of Civil Engineers, 1977, p. 127-171)

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B.4.2.50 79A31912*# Dec 1978
NASA, Washington, D.C.
Klineberg, J. M.
Title: The NASA Aircraft Energy Efficiency Program

ABSTRACT

A review is provided of the goals, objectives, and recent progress in each of six aircraft energy efficiency programs aimed at improved propulsive aerodynamic and structural efficiency for future transport aircraft. Attention is given to engine component improvement and energy efficient turbofan engine, advanced turboprops, revolutionary gains in aerodynamic efficiency for aircraft of the late 1990s, laminar flow control, and composite primary aircraft structures. (Paper: Energy and

Aerospace; Proceedings of the Anglo/American Conference, London, England, December 5-7, 1978, (A79-31908 12-44) London, Royal Aeronautical Society, 1979.)

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B.4.2.51 N7715045/6ST 1976
NASA, Langley Research Center, Langley Station, Va
Cuy, R. W.
Title: Thermal Design and Analysis of a Hydrogen-Burning Wind Tunnel Model of an Airframe-Integrated Scramjet

ABSTRACT

An aerodynamic model of a hydrogen burning, airframe integrated scramjet engine has been designed, fabricated, and instrumented. This model is to be tested in an electric arc heated wind tunnel. (Report)

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B.4.2.52 75N16979 Dec 1974
Department of the Air Force, Washington, D.C.
Yarymovych, M. I.
Title: Energy Related Research and Development in the United States Air Force

ABSTRACT

Methods of reducing fuel consumption by aircraft design and structural modification are proposed. The effectiveness of a campaign to reduce energy requirememnts and expenditures is documented. (Paper: AGARD The 1974 AGARD Ann. Meeting)

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B.4.2.53 77A14563 Nov 1976
Chatillon-sous-Bagneux Hauts-de-Seine, France
Wanner, J. C.
Title: Air Transportation and Fuel Consumption

ABSTRACT

Various options in present technology for reducing fuel consumption are examined. Improvements in thermodynamic efficiency by altering specific fuel consumption and bypass ratio, and two ways of raising the temperature upstream of the turbine, are considered. Advantages of the delta sweepback wing and supercritical airfoils are outlined in addition to possible weight reduction through the use of new advanced materials

(more Ti, less steel, more composites) and optimized dimensional design of aircraft by finite element methods. Control configured vehicle approaches to aeronautical design are outlined briefly, and outlook for reliance on liquid hydrogen as fuel is sketched. (Paper: Sciences et Techniques, Nov. 1976, In French)

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B.4.2.54 N77-11055/9ST 10 Sep 75
NASA, Washington, D.C.
Unknown
Title: Aircraft Fuel Conservation Technology. Task Force Report, September 10, 1975

ABSTRACT

An advanced technology program is described for reduced fuel consumption in air transport. Cost benefits and estimates are given for improved engine design and components, turboprop propulsion systems, active control systems, laminar flow control, and composite primary structures. (Report)

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B.4.2.55 76A19593*# Feb 1976
NASA, Office of Aeronautics and Space Technology, Aircraft Energy Efficiency Office
Povinelli, F. P.
Title: Improving Aircraft Energy Efficiency

ABSTRACT

Investigations by NASA task force concerning fuel conservation technology are considered. The task force estimated fuel savings potential prospects for implementation in the civil air transport fleet, and the impact of the technology on fuel use. Propulsion advances are related to existing engines in the fleet, to new production of curent engine types, and to new engine designs. Studies aimed at the evolutionary improvement of aerodynamic design and a laminar flow control program are discussed and possibilities concerning the use of composite structural materials are examined. (Paper: Astronautics and Aeronautics, Vol. 14, Feb. 1976)

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B.4.2.56 79A21911 Dec 1978
Royal Aircraft Establishment, Farnborough, Hants., England
Pope, G. G.
Title: Prospects for Reducing the Fuel Consumption of Civil Aircraft

ABSTRACT

Outline of technological advances that contribute to the reduction of fuel consumption. Attention concentrated on advances being made in the UK. Advances in powerplants are examined along with developments in aerodynamics, taking into account advances in design techniques, experimental facilities, wing tip design, drag reduction, and laminar flow control. Attention is also given to materials and structures, active control technology, and operational considerations. (Paper: Energy and Aerospace; Proceedings of the Anglo/American Conference, London, England, December 5-7, 1978.)

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B.4.2.57 78A15020 Jun 1977
Societe Nationale Industrielle Aerospatiale, Division Helicopteres, Paris, France
Petit, G.
Title: Helicopters and Energy Savings

ABSTRACT

The article discusses various means to economize helicopter fuel consumption noting possible modifications in engine specific fuel consumption, rotor aeroynamic quality, parasitic drag of the fuselage, helicopter empty weight, and flight path optimization. Improvements in specific fuel consumption (30 percent reduction predicted) and in structural characteristics (15 percent reduction predicted). (Paper: Congress International Aeronautique, 13th Paris, France, June 2,3 1977, L°Aeronautique et l°Astronautique, No. 66, 1977. In French)

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B.4.2.58 EI730417119 Jan 1973
AVCO Corp Systems Div, Lowell, Mass
Roy, Paul A.
Title: Development of Lightweight Aluminum Compression Panels Reinforced by Boron-Epoxy Infiltrated Extrusions

ABSTRACT

Studies performed to evaluate the structural efficiencies afforded by the selective reinforcement of conventional aluminum compression panels with unidirectional boron epoxy composite materials. Technique uses extruded metal sections with preformed hollow voids into which unidirectional boron filaments are drawn and subsequently infiltrated with resin to form an integral part. Results indicate that high structural efficiencies, superior to 7075-T6 aluminum can be realized by reinforcing grades of aluminum not normally considered aerospace structural materials. Selectively reinforced 6005-T5 aluminum sections exhibited weight savings ranging from a low of 6% over equivalent all 7075-T6 aluminum panels to greater than 26% when compared to equivalent 2024 aluminum designs. (Report)

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B.4.2.59 EI770963621 Jun 1977
Grumman Aerospace Corp., Bethpage, NY
Tang, S.
Title: Advanced Composites: Design Technology Transfer from Aerospace

ABSTRACT

Article briefly surveys the advanced composite materials, summarizing the past, present, and future applications in aircraft. Composite materials and components discussed: fiberglass-epoxy, boron-epoxy, graphite-epoxy, and boron-aluminum. Dupont developed polymeric filaments PRD-49 III and IV. Their properties are comparable to glass fibers. and aluminum. They also have the lowest density of all the fibers Their strength-to-density ratio is about 10 times that of aluminum and steel, and eight times that of the titanium alloy, Ti-6Al-4V. (Paper: Mech Eng V 99 N 6 Jun 1977)

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B.4.2.60 AD-C065376 Feb 1976
Rand Corp., Santa Monica, Calif
Harris, E. D.
Title: Potential for Advanced Technology to Reduce Military Aircraft Energy Consumption for 1975-2000

ABSTRACT

Technological options for reducing peacetime USAF jet fuel consumption in this century are evaluated. Half the projected reduction comes from changing to the 5-1 with hypothetical energy-efficient tanker, and another 30% from new energy-efficient fighter/attack/reconnaissance planes. Lightweight airframe structural materials hold promise mainly for new designs. Variable cycle and turboprop engines do not offer substantial fuel savings. Re-engining the C-141S with TF-39 turbofan engines could start now. Also recommended: limiting military airlift to higher-value cargo, shifting more to the C-5, shorter mission legs, increased load factor, cutting training flights as far as practicable. RPVS would produce sizable savings only when replacing manned missions. (Secret Report)

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B.4.2.61 EI7501[illegible]0200 Sept 1974
Br Aircr Corp
Goldsmith, H. A.
Title: Development of Aircraft as Influenced by the Shortage of Materials and Fuel

ABSTRACT

Fuel shortages can be eased by the use of lighter materials, low specific thrust for engine cycles, reducing the design cruise speed and shortening field length. (Paper: Aeronaut J V 78 N 765 Sep 1974)

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B.4.2.62 SSIE: GQF 54940 1 4/79 to 5/80
McDonnell Douglas Corp., P.O. Box 516, St. Louis, Missouri, 63166
Sastry, S. M.
Title: Microstructure and Properties of Powder-Processed Aluminum-Lithium Alloys

ABSTRACT

Use of Al-Li alloys in aerospace structures provides the potential for weight and life-cycle-cost reductions, Additions of Li to Al, Al-Cu

and Al-Mg alloys have resulted in a considerable improvement of strength/weight and stiffness/ratios, with each per cent Li resulting in a 3 percent reduction in density and a 6 per cent increase in Young's modulus. Alloys based on the Al-Li system are thus capable of developing unique and attractive combinations of high specific strength (10 percent increase) and high specific modulus (10 per cent increase), thereby enabling potential weight savings in aircraft structural members. (Plan)

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B.4.2.63 75N16981 1974
National Aerospace Lab., Amsterdam (Netherlands).
Jaarsma, F.
Title: Impact of Future Fuels on Military Aero-Engines

ABSTRACT

The expected impact of the fossil fuel shortage on the design and operation of aircraft engines is discussed. Alternate fuels such as cryogenic fluids and synthetic fuels are proposed. Various aspects related to combustion of cryogenic and synthetic fuels are analyzed to examine the effects on seals, pumps, contamination, and engine operating procedures. (Paper: 1974 AGARD Ann Meeting)

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B.4.2.64 EI740524268 Oct 1973
NASA Langley Res Cent. Hampton, Va
Brooks, William A. Jr.
Title: Service Evaluation of Aircraft Composite Structural Components

ABSTRACT

Flight service programs are necessary to develop broader acceptance of, and confidence in, any new class of materials such as composites. Such flight programs, initiated by NASA Langley Research Center, are reviewed. These programs include the selectively reinforced metal and the all composite concepts applied to both secondary and primary aircraft structural components. (Paper: SAMPE Natl Tech Conf, 5th Kiamesha Lake, NY, Oct 9-11 1973)

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B.4.2.65 SSIE: ZQF 140890 3 5/77 to 12/79
Dynamics Lab, Wright Patterson AFB Dayton, Ohio, 45433
Brookman, B.J.
Title: Advanced Carbon Brakes For Fighter Aircraft

ABSTRACT

The objective of this program is to evaluate the potential of carbon-carbon composite materials used in aircraft brakes, and to develop standards and specifications for carbon brakes for future USAF aircraft. Potential advantages are lighter weight resulting in increased payload or lower fuel costs. (Plan)

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B.4.2.66 78A14285 1st Quarter, 1977
Societe Nationale Industrielle Aerospatiale, Direction Industrielle, Paris, France
Acker, C.
Title: Saving Raw Materials or Saving Energy In Aircraft Construction

ABSTRACT

Economic cost of the large amounts of scrap that are formed during the manufacture of aircraft whose light weight results from the use of alloys. An energy analysis shows that the apparent waste is justified in terms of the high amount of energy saved by flying a lighter plane. Factors could change this analysis - such as modification of material recycling costs or the increased use of nonmetallic materials. (Article in French in Revue Francaise De Mecanique - 1st Quarter 1977)

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B.4.2.67 SSIE: ZQA53835 2 10/77
U.S. Dept. of Defense, Army Aviation Research and Development Command, Applied Technology Lab., Fort Eustis, Newport News, Virginia, 23604
Unknown
Title: RPV Cost And Weight Reduction Investigation

ABSTRACT

The technical objective is to determine methods for reducing weight and cost of RPV structural components. Particular emphasis is to be placed on the capabilities of manufacturing structural shapes and attachment points in a cost effective manner. (Plan)

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B.4.2.68 79A43228 May 1979
Society for the Advancement of Material and Process Engineering, Azusa, Calif.,
Unknown
Title: The Enigma of the Eighties: Environment, Economics, Energy; Proceedings of the Twenty-Fourth National Symposium and Exhibition, San Francisco, Calif., May 8-10 1979

ABSTRACT

The proceedings focus on developments in materials technology for energy and environmental problems of the 1980s. Particular consideration is given to sandwich constructions for aircraft and communications, materials for airline safety and satellite applications of metal matrix composites. Papers on polyimide/graphite, aluminum/SiC and fiber reinforced titanium composites, adhesive bonding of sandwich stuctures. (Symposium Proceedings)

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B.4.2.69 SSIE: ZQF131230 5 9/73 to 12/78
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio 45433
Estill, G. T.
Title: Metallic Box Beam Design Concepts Evaluation

ABSTRACT

Investigate advanced low cost structural concepts in terms of weight savings, cost savings, and structural performance using box beam components designed and tested to the same aircraft design requirements. A weight savings of 22 percent and a cost savings of 25 percent compared to conventional baseline box beam should be validated. (Plan)

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B.4.2.70 SSIE: CQF141750 1 9/78 to 12/81
Grumman Aerospace Corp., S. Oyster Bay Rd. Bethpage, New York 11714
Forsch, H. H.
Title: Integral Composite Skin and Spar Design Studies

ABSTRACT

Advanced composite structures are beginning to be used in production military aircraft airframes since they offer a large potential for weight and cost savings. The amount of payoff realized by the use of composites will depend upon the efficiency of the design concepts used. A new concept dealing with integral composite skin and spars has a good potential for increasing the effficiency of composite wing structures. Therefore, the objective of this program is to obtain extensive design information on various integral skin and spar concepts so that these designs may be incorporated into future aircraft. (Plan)

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B.4.2.71 EI760743190 Mar 1976
NASA Langley Res Cent Hampton, Va
Wieting, Allan R.
Title: Thermal-Structural Design/analysis of an Airframe-Integrated Hydrogen-Cooled Scramjet

ABSTRACT

This paper presents the salient features of a preliminary thermal-structural design and analysis study of a hydrogen fueled, regeneratively cooled, airframe-integrated scramjet. State-of-the-art analytical methods consisting of lumped system and finite-difference steady-state thermal analyses and a finite-element structural analysis were used. The results of the study indicated that this scramjet concept is viable from both a structural mass and cooling requirement standpoint. (Paper: J Aircr V 13 n 3 Mar 1976)

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B.4.2.72 79N13026 Ja . 1977
General Dynamics Convair, San Diego, Calif.
Oman, B. H.
Title: Vehicle Design Evaluation Program (VDEP)

ABSTRACT

A computer program for weight sizing, eonomic performance, and mission analysis of fuel-conservative aircraft, multibodied aircraft and large cargo aircraft using both JP and alternative fuels.

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B.4.2.73 SSIE: ZH 770222 1 10/77 to 9/78
NASA Office of Aeronautics and Space Technology, Langley Research Center, Hampton, Virginia, 23665
Unknown
Title: Composite Wing (ACEE)

ABSTRACT

The composite wing is part of the ACEE composite structures program. The objective is to develop design and manufacturing technology to accelerate the introduction of composite structures in new and derivative commercial transport aircraft. (Plan)

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B.4.2.74 SSIE: ZH 870005 1 10/77
NASA Office of Aeronautics and Space Technology, Lewis Research center, 21000 Brookpark Rd., Cleveland, Ohio, 44135
Unknown
Title: Composites For Propulsion Components

ABSTRACT

Objective of this reseach is to develop metal matrix and polymer matrix composite materials for use in various aeronautical propulsion structural components. Use of fiber reinforced composites in turbofan engines can provide significantly improved performance resulting in reduced fuel consumption and operating costs. Composites being considered include resin matrices reinforced with boron, Kevlar, glass fiber, and graphite as well as aluminum matrices reinforced with boron and SiC fibers. (Plan)

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B.4.2.75 SSIE: ZH 870007 10/77 to 9/78
NASA Office of Aeronautics and Space Technology, Lewis Research Center 21000 Brookpark Rd., Cleveland, Ohio, 44135
Unknown
Title: Engine Composite Structures

ABSTRACT

Objective of this program is to develop the structures technology required to permit the timely introduction of composite materials into advanced turbine engine components such as fan blades, engine frames, blade containment systems and other structural components which can benefit from the unique strength, weight, and cost characteristics of composite materials. (Plan)

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B.4.2.76 SSIE: ZH 870008 1 10/77
NASA Office of Aeronautics and Space Technology, Langley Research Center, Hampton, Virginia, 23665
Unknown
Title: Advanced Aircraft Structures

ABSTRACT

The objective is to develop the technology required for obtaining improved efficiency and reduced costs in aircraft structures by the application of advanced composite materials and composite design concepts to commercial aircraft. (Plan)

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B.4.2.77 SSIE: ZH 970152 0/79
NASA, Office of Aeronautics and Space Technology, Langley Research Center, Hampton Virginia, 23665
Unknown
Title: SCR - Materials And Structures

ABSTRACT

The objective of this program is to establish a supersonic materials and structures technology base by developing capability in structural concepts and design, loads and aeroelasticity, and materials fatigue and manufacturing methods. The technology from this program will permit major reductions in structural weight, improved stuctural integrity, and lower cost for supersonic cruise aircraft (Plan)

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B.4.2.78 AD-A062 609/2ST Jul 78
Dynamics Research Corp., Systems Div., Wilmington, MA
Aggarwal, Romesh K.
Title: An Analysis of Fuel Conserving Operational Procedures and Design Modifications for Bomber/Transport Aircraft, Volume II

ABSTRACT

Various proposed improvements in the design and operational procedures of bomber/transpoft aircraft are evaluated. The evaluation is performed in terms of the stimated savings in fuel consumption and in Direct Operating Cost (Dc (Final Report)

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B.4.2.79 EI770214609 Oct 1976
Unknown
Parkinson. Gerald
Title: Off They Go (Advanced Composites, That Is) Into The Wild Blue Yonder

ABSTRACT

Paper reviews present uses of advanced composites in aircraft, both military and commercial, and gives a forecast for the future for these materials. By the early 1980°s they°ll account for 50% of the weight of fighter planes, by the 90°s for 70% of the structural weight of commercial craft. Technological aspect is also discussed. (Paper: Mod Plast V 53 n 10 Oct 1976)

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B.4.2.80 SSIE: CQF140000 1 9/77 To 2/79
University of Delaware, School of Engineering Dept., of Mechanical and Aerospace Engineering, Newark, Delaware, 19711
Pipes, R.
Title: Advanced Composites Design Program

ABSTRACT

Advanced composite structures offer the potential of saving weight and cost on future military airframe structures and will allow significant increases in aircraft performance (particularly range). Program will develop essential design information on concept, which features spar caps embedded in composite wing skins. (Plan)

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B.4.2.81 E1770529Q4 Mar 1977
Boeing Comm. Airplane Co., Seattle, Wash
Hyatt, Michael V.
Title: Improved Aluminum Alloys For Airframe Applications

ABSTRACT

In the immediate future, increases in the strength-to-weight ratios of aircraft structural members are most likely to derive from improvements in available materials. Efforts at Boeing are focusing on developing new 7000 and 2000-series alloys via composition modifications and the use of optimized ingot metallurgy and fabrication technology. (Paper: Met Prog V 111 n 3 Mar 1977)

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B.4.2.82 73N33393# Jun 1973
Sandia Labs., Albuquerque, N. Mex.
Scott, W. F.
Title: Feasibility Study On Fast-Acting Valves For Airborne Nuclear Containment Systems

ABSTRACT

The feasibility of developing fast-acting valves to seal the coolant lines emanating from a reactor used to power aircraft was studied. The valves must be made integral with the wall of a hardened containment sphere in such a way that the structural integrity of the sphere is unimpaired in the event of a crash. (Report)

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B.4.2.83 SSIE CQF 47770 2 4/77 to N/A
Univ. of Florida, School of Engineering, Dept. of Materials Science and Engin., 220 Black Hall, Gainesville, FL 32611
Hren J.J.
Title: Relationship Between Microstructure and Mechanical Properties of Intermetallics

ABSTRACT

A need exists for materials to operate at higher engine temperatures (to improve operating efficiency), and for lighter weight materials (to decrease engine weight, engine operating stresses due to heavy components, and fuel consumption). Titanium aluminides have exhibited great potential for such applications. Unfortunately, nearly all intermetallic compounds are brittle at low temperature, making their fabrication difficult and presenting potential hazards in service. Objective - This research will

determine the intrinsic mechanisms of deformation and the available means for their control in a wide class of intermetallic compounds. (Plan)

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B.4.2.84 SSIE: ZQF1C1620 6 10/73 to N/A
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio 45433
Gonsiska, A
Title: Preliminary Design of Advanced Wing Structure

ABSTRACT

A swing wing aircraft (B-1) will be used as the baseline for a preliminary design study to develop innovative structural concepts for advanced system form, fit and function requirements. New structural arrangements, materials and fabrication techniques will be exploited and integrated to establish potential cost and weight reductions. (Plan)

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B.4.2.85 N78-32186/6ST 1 Aug 78
Boeing Commercial Airplane Co., Seattle, Washington
Harvey, S.T.
Title: Advanced Composites Wing Study Program, Volume 2

ABSTRACT

The study on utilization of advanced composites in commercial aircraft wing structures was conducted as a part of the NASA Aircraft Energy Efficiency Program to establish, by the mid-1980's, the technology for the design of a subsonic commercial transport aircraft leading to a 40 percent fuel savings. (Final Report)

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B.4.2.86 N77-18130/3ST Dec 76
Boeing Vertol Co., Philadelphia, PA
Hoffstedt, D.J.
Title: Research Requirements to Reduce Empty Weight of Helicopters by Use of Advanced Materials

ABSTRACT

Utilization of the new, lightweight, high-strength, aerospace structural-composite (filament/matrix) materials, specifically designed into a new aircraft, promises reductions in structural empty weight of 12 percent. A structural empty-weight reduction of 12 percent was shown to

significantly reduce energy consumption in modern high-performance helicopters. (Report)

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B.4.2.87 EI7711f4386 May 1977
Royal Aircraft Establishment, Farnsborough, Hamps., England
Judd, Nigel C.W.
Title: Effect of Aviation Fluids on Carbon/Epoxy Composite Panels

ABSTRACT

Boron and carbon fiber reinforced plastics are being evaluated for use in aerospace applications, because they are light, stiff and strong. Prolonged contact with liquids such as jet fuel, hydraulic or lubricating fluids can occur in some applications. There is need to ascertain whether these fluids damage the composites or whether contamination of the fluid can arise by the interaction between fluid and reinforced plastic. Paper presents results of an investigation undertaken with the objectives of: (i) determining the effect of aviation fluids on carbon fiber composites, prepared from two epoxide resin systems preferred by the UK aircraft industry; and (ii) determining the effect of voids on the resistance of the composites to the fluids. Resistance of studied epoxide systems to all the fluids is good, even at elevated temperatures. (Paper in SAMPE J v 13 n 3 May-Jun 1977)

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B.4.2.88 SSIE: ZQA 44717 7 7/70 to CONT
Army Materiel Development and Readiness Command, Materials and Mechanics Research Center, Watertown, Massachusetts 02172
Levitt, AP
Title: Development of Metal Matrix Composites for Army Hardware-End Items

ABSTRACT

The technical objectives are (1) to develop and evaluate advanced, high strength lightweight metal matrix composites for structural applications in Army aircraft (2) develop superior composites employing chemical vapor deposition techniques and/or employ liquid alkali metals to induce better wetting and bonding (3) develop superior composites employing silicon carbide fibers and whiskers in aluminum, as well as alumina filaments in aluminum and magnesium (4) to evaluate the fatigue, fracture strength, composite failure modes, and soundness of the fiber/matrix bond, and to evaluate the effect of processing on the properties of gr/al fiber composites produced from gr/mg composites.

(Plan)

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B.4.2.89 SSIE: ZQF 140090 3 11/76 to 10/79
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio 45433
Monfort, JB
Title: Laminated Wing Structures

ABSTRACT

The objective of this effort is to evaluate innovative design and fabriction techniques wherein additional system advantage can be achieved through laminating aluminum sheet by adhesive bonding to reduce acquisition and life cycle costs concurrently with weight savings and increased damage tolerance of primary airframe structure. (Plan)

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## B.5 FLIGHT PERFORMANCE MANAGEMENT

### B.5.1 NAVY FUNDED

B.5.1.1 AD-877719L May 70
Autonetics, Anaheim, Calif
Unknown
Title: A Prototype Digital Control Concept for Aircraft Propulsion Systems

ABSTRACT

A flight type digital computer and analog to digital conversion equipment form the major portion of an electronic propulsion system. In addition to the control modes for speed, temperature and afterburner fuel metering, the computer program includes sensor detection routines and certain alternate modes which allow a continuation of engine operation. (Report)

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B.5 FLIGHT PERFORMANCE MANAGEMENT

B.5.2 NON NAVY FUNDED

B.5.2.1 74A38809 Mar 1974
New York, American Institute of Aeronautics and Astronautics, Inc.
Grey, J.
Title: Aircraft Fuel Conservation: An AIAA View: Proceedings of a Workshop Conference, Reston, VA, March 13 - 15, 1974

ABSTRACT

Aspects of aircraft fuel conservation are reviewed and discussed, and measures are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Principal measures included: increasing load factors, achieved by revised rerouting and scheduliing and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical °winglet° located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuels currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics.

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B.5.2.2 75A10259 Oct 1974
Unknown
Epstein, N.
Title: Powerplant Energy Management

ABSTRACT

Methods and developments aimed at improving the pilot°s ability to schedule and control engine thrust in accordance with aircraft power requirements during various flight regimes. Methods vary from normal manual control by the pilot°s throttle to a fully automated push-button system implemented by a combination of electronic and hydromechanical devices. Estimates of potential savings in fuel to result from optimum thrust management are presented. Also, modifications in current normal operational/airport practices are suggested, and their impact on fuel consumption is examined. (Paper: AIAA/SAE Propulsion Conference, 10th, San Diego, CA, Oct 21 - 23, 1974)

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B.5.2.3 AIAA: 80-0914 May 1980
NASA, Lewis Research Center, Cleveland, Ohio 44135
Weber, R.
Title: Aeropropulsion in Year 2000

ABSTRACT

Many advances can be anticipated in propulsion systems for aircraft in the next 20 years. This paper presents a sampling of probable future engine types such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports. This is followed by a brief review of related technology improvements in propellers, materials, noise suppression, etc. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8 1980, Baltimore, MD)

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B.5.2.4 AIAA: 79-1651 Aug 1979
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Overview of Technology Advancements for Energy Efficient Transports

ABSTRACT

Several research activities, conducted under NASA contract and directed toward improved fuel efficiency of commercial transports, are described. Emphasis is placed on advancements in aerodynamics and avionics/controls. Aerodynamic advancements include wing geometry variations and the winglet concept for improved lift/drag ratio, improved high-lift design, evaluation of natural laminar flow for drag reduction, and improved surfact coatings for reduced drag and surface erosion. Application of active controls; closed-loop flight path control using direct computer control of autopilot and autothrottle during ascent, cruise and descent; and the use of delayed flap operation and precise flight path control in the terminal area are included as potential improvements that rely on advanced avionics/controls. Evaluation of potential application is provided. (Paper: AIAA Atomospheric Flight Mechanics Conference and Special Session: Energy Efficient Aircraft Design, August 7 - 8 1979, Boulder, Colorado)

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B.5.2.5 AIAA: 80-0906 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Technology Advancements for Energy Efficient Transports

ABSTRACT

Ongoing government and industry supported research activities pertaining to improved fuel efficiency of commercial transports are described with particular attention to advancements in aerodynamics, avionics, and controls technologies. Emphasis is placed on the interaction of these technologies with the structure, propulsion, and other technologies involved in transport configuration design, as well as the impact on airline operation they could imply. The potential benefits offered by these technologies and the research activities required to support their commitment to future models are discussed. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.5.2.6 76A42740 Oct 1975
Unknown
Schott, G. J.
Title: Aircraft Energy Needs

ABSTRACT

Aviation accounts for only a small fraction of the total annual consumption of petroleum based fuels for transportation. Air transport fuels must be globally available, fluid at operational temperatures and pressures, and priced to allow profitable operations; and must have a high heating value, high density, and, preferably, a low vapor pressure. Of the potential replacements for petroleum based fuels (liquid methane, methanol, and synthetic kerosene), synthetic kerosene is judged most likely to satisfy these requirements. A number of technological improvements, such as automatic flight management, advanced aerodynamics, laminar flow control, advanced engines, and advanced structural materials, could lead to significant reductions in fuel requirements; the development of new technologies is, however, dependent on the economic health of the aviation industry. (Paper: Energy and Transportation; Proceedings of the Forum, Detroit, Michigan, October 15, 1975)

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B.5.2.7 AD-A015 927 Apr 75
Michigan Univ. Ann ... Dept. of Aerospace Engineering
Gilbert, Elmer C.
Title: Periodic ...trol of Vehicle Cruise: Improved Fuel Economy ...y High and Low Frequency Switching

ABSTRACT

It is shown that time-dependent periodic control can improve the fuel economy of vehicles in cruise. The time-dependent controls considered are relaxed steady-state (RSS) control, quasi-steady-state (QSS) control, and quasi-relaxed steady-state (QRSS) control. Examples are given which show that QRSS control may give better performance than either RSS or QSS control. (Interim Report)

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B.5.2.8 AD-A081 182 Sep 79
Federal Aviation Administration Washington DC Office of Environment and Energy
unk
Title: Energy Conservation Potential of General Aviation Activity

ABSTRACT

Three approaches for reducing energy consumption were investigated: hardware modification, pilot education, and air traffic control. It is recommended that research into new aircraft engine designs, automatic mixture controls, conventional engine fuel saving improvements, composite materials development, and aerodynamic drag reduction continue. (Report)

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B.5.2.9 78A43357*# July 1978
NASA, Washington, DC
Kramer, J. J.
Title: Planning a New Era in Air Transport Efficiency

ABSTRACT

The current status of the NASA Aircraft Energy Efficiency (ACEE) program is briefly reviewed with reference to CTOL aircraft. Attention is given to four basic technologies: turboprop, advanced aerodynamics and active controls, laminar flow control, and composites. (Paper: Astronautics and Aeronautics, Vol. 16, July-Aug 1978.)

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B.5.2.10 77A12192*# May 1976
NASA, Ames Research Center, Moffett Field, Calif
Williams, L. J.
Title: Air Transportation Energy Efficiency - Alternatives and Implications

ABSTRACT

Results from recent studies of air transportation energy efficiency alternatives are discussed. Included are aircraft operation, aircraft modification, derivative aircraft and new aircraft. In order to obtain significant improvements in energy efficiency, new aircraft must truly exploit advanced technology in such areas as aerodynamics, composite structures, active controls, and advanced propulsion. (Paper: Society of Allied Weight Engineers, Annual Conference, 35th, Philadelphia, Pa., May 24-26, 1976)

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B.5.2.11 79A12376 Oct 1977
Western Michigan University, Kalamazoo, Mich.
Behm, H. D.
Title: National Conference on Energy Conservation in General Aviation, 1st, Kalamazoo, Mich. October 10, 11, 1977, Proceedings

ABSTRACT

Topics discussed include alternative aviation turbine fuels, economy in flight operations, and efficiency through angle-of-attack monitoring. (Proceedings)

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B.5.2.12 AD-A063 793 Nov 78
Advisory Group for Aerospace Research and Development Neuilly-sur-Seine (France)
Kurzhals, P. R.
Title: Active Controls in Aircraft Design

ABSTRACT

Active controls offer the promise of significantly increased aircraft performance and operational capability. However, realization of these gains will require major changes in both the aircraft design approach and in the implementation of the flight control system. This AGARDograph addresses related control configured vehicle design and system considerations and summarizes representative applications of active

control for fighter and transport aircraft. (Report)

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B.5.2.13 N80-14114/6 Nov 79
NASA, Langley Station, Va. Langley Research Center
Knox, C. E.
Title: Preliminary Test Results of a Flight Management Algorithm for Fuel Conservative Descents in a Time Based Metered Traffic Environment

ABSTRACT

A flight management algorithm designed to improved the accuracy of delivering the airplane fuel efficiently to a metering fix at a time designated by air traffic control is discussed. The flight management descent algorithms and the results of the flight tests are discussed. (Report)

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B.5.2.14 79N16874# Nov 1978
Lockheed-California Co., Burbank, Structural and Material Div
Stauffer, W. A.
Title: Fuel Conservative Subsonic Transport Control Surfaces Activated by Computers

ABSTRACT

A fuel saving active control system being developed for commercial application of the L-1011 airplane in the early 1980s is described. Highlighted are features of the TriStar that permit an effective yet simple load relieving system to be adopted. A description of the active control system, which involves integrated movement of both the aileron and horizontal tail, is given. Thoughts on further application of active controls for future consideration. (Paper: AGARD Active Controls in Aircraft Design)

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B.5.2.15 AD-A022 527/5ST 6 Jan 75 - 6 Feb 76
Analytic Sciences Corp., Reading, Mass
Stengel, Robert F.
Title: Energy Management Techniques for Fuel Conservation in Military Transport Aircraft

ABSTRACT

This report presents the results of an investigation of energy management techniques for fuel conservation in a large transport aircraft, the USAF C-141A. Using the methods of optimal control theory and numerical simulation, fuel optimal flight paths are computed and compared with conventional vertical profiles for typical mission scenarios. Algorithms for on-board guidance to minimize fuel use are synthesized and evaluated, and functional requirements for system implementation are developed. Concepts for flight testing this throttle/energy management technique are presented. (Final Report)

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B.5.2.16 SSIE: GQF139730 1 9/77 to 11/79
AMBAC Industries Inc., 900 Old Country Rd., Garden City, New York 11530
Litman, B.
Title: Flight Evaluation of Throttle EM for Transport

ABSTRACT

It is planned to verify potential fuel savings of transport aircraft by incorporating fuel conserving control laws in an on-board computer system with an appropriate pilot control-display interface. Fuel savings will be validated by comparing fuel optimal flights against standard flight handbook operating procedures. In addition fuel optimal flights with autothrottle and autopilot engaged will be investigated. The flight test aircraft will be the C-135C aircraft. (Plan)

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B.5.2.17 AD-A079 320/8 Aug 78 - Sep 79
Nero and Associates Inc., Portland, OR,
Linstone, Harold A.,
Title: Technology Assessment of Low Energy Vehicles

ABSTRACT

Key suggested steps for U.S. Coast Guard energy savings include the LTAV, an energy monitoring system, computer-aided mission planning, and production facility to serve eastern and southeastern districts. Improved power plant and engine component design and remote sensing and communications systems offer other technological opportunities for energy savings. (Final Report)

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B.5.2.18 79A12384# Oct 1977
Teledyne Avionics, Charlottesville, Va.
Lange, D. E.
Title: Flying Angle of Attack

ABSTRACT

The posibilities for angle of attack reference in economic operation of turbojet aircraft are discussed. An angle of attack sensor and indicator system is briefly described, the proper use of which, it is claimed, will result in approximate maximum fuel economy. (Paper: National Conference on Energy Conservation in General Aviation, 1st, Kalamazoo, Mich., October 10, 11, 1977, Proceedings)

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B.5.2.19 N77-19066/8ST Aug 76
Boeing Commercial Airplane Co, Seattle, Wash.
Jackson, D. O.
Title: The 727 Approach Energy Management System Avionics Specification (Preliminary)

ABSTRACT

Hardware and software requirements for an approach energy management system (AEMS) consisting of an airborne digital computer and cockpit displays are presented. The displays provide the pilot with a visual indication of when to manually operate the gear, flaps, and throttles during a delayed flap approach so as to reduce aproach time and fuel consumption. The AEMS is an independent system that does not interact with other navigation or control systems, and is compatible with manually flown or autopilot coupled approaches. Operational use of the AEMS

requires a DME ground station colocated with the flight path reference. (Report)

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B.5.2.20 79A18521 July 1978
Compagnie Nationale Air France, Paris, France
Cathodeau, R.
Title: Rule of Fuel Management for Airlines

ABSTRACT

A procedure for calculating flight fuel requirements and optimizing fuel use is described. A slide rule-type device is used to correlate air distance and fuel use patterns. Nomograph representations of the calculations are presented. The changing weight of the unconsumed fuel is taken into account. Examples of the use of the procedure are reported. (Paper: Navigation (Paris), Vol. 26, July 1978, In French)

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B.6 SYSTEMS AND OPERATIONAL CONCEPTS

B.6.1 ADVANCED SYSTEMS CONCEPTS

B.6.1.1 NAVY FUNDED

B.6.1.1.1 AD-E044 603L Aug 76
David W. Taylor Naval Ship Research and Development Center, Bethesda, Md
Gallington, Roger
Title: Assessment of Wing-In-Ground Effect Vehicle Technology. Volume I

ABSTRACT

In many Navy missions there is a need to carry payload as far as possible, as fast as possible, and using as little fuel as possible. Any vehicle which can do any of these things better without compromising some other capability, certainly desrves study. This report investigates the Wing-In-Ground Effect Vehicle, which has a superior lift/drag ratio, and can possibly satisfy the three mentioned conditions. (Report)

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B.6.1.1.2 SSIE: CQN5753692 5/75
University of Rochester, School of Enginering and Applied Science, Dept. of Aerospace and Mech Science, 260 Crittenden Blvd., Rochester, New York, 14627
Lessen, M.
Title: The Influence of Compliant Surfaces on the Structure of Turbulent Flows

ABSTRACT

The proposed research will be a theoretical study of the coupling of the shear waves in a compliant surface with a turbulent boundary layer and the effects of the interaction on the Reynolds stresses, which are directly related to the skin friction. Research will examine a possible mechanism for explaining the drag reduction and, hopefully, lead to a better insight into material selection for maximizing the gains. (Plan)

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B.6.1.1.3 SSIE: CQN475202 5 1/74
General Dynamics Corp., Convair Aerospace Div., P.O. Box 1950, San Diego, California 92112
Levinsky, E.
Title: Navy Vehicle Design and Construction - Airfoil Optimization by Adaptive Control of Camber and Thickness

ABSTRACT

The objective of this investigation is to demonstrate the feasibility

of a self-optimizing flexible technology (SOFT) wing which changes its shape (span-wise and chord-wise distribution of camber and thickness) in such a manner as to optimize a given merit function. Such a wing will be able to automatically adapt itself to provide optimal performance throughout the whole flight envelope. (Plan)

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B.6.1.1.4 SSIE: GQN881476 1 9/77 to 10/78
Advanced Technology Center Inc., P.O. Box 6144, Dallas, Texas, 75222
Mask, R.
Title: Low Drag Airfoil Design Utilizing Passive Laminar Flow And Coupled Diffusion Control Techniques

ABSTRACT

To design a low drag airfoil utilizing passive laminar flow and coupled diffusion control techniques to obtain improved lift-to-drag ratios for advanced subsonic aircraft applications. (Plan)

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B.6.1.1.5 AD-862 843/0ST 18 Dec 68-15 Sep 69
Lockheed-California Co Burbank
Anderson, Arthur B.
Title: Propulsion Study for STOL Air-Sea Craft

ABSTRACT

Study to investigate aerodynamic-propulsion concepts applicable to the canard configuration STOL air-sea craft, and in particular to develop and use a methodology for optimizing combinations of direct lift and augmented wing lift. A computer program was developed that optimized the propulsion system by maximizing the airplane radius for a given mission and a fixed initial airplane weight. (Final Report)

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B.6.1.1.6 SSIE: CQM27123 6 12/71
University of California, Berkeley Campus, School of Letters and Science, Dept. of Mathematics, Berkeley, California, 94720
Chorin, A. J.
Title: Numerical Methods For Predicting High Reynolds Number Fluid Flows

ABSTRACT

The development of reliable procedures for solving the Navier-Stokes equations numerically, will lead to accurate predictions of the flows about aircraft, ships and missiles, and, consequently, to much better methods for optimizing their performance. (Plan)

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B.6.1.1.7 AD-675 332 Jul 68
Johns Hopkins Univ., Silver Spring, MD, Applied Physics Lab.
Rabenhorst, David W.
Title: The Turbo-Electric VTOL Aircraft

ABSTRACT

A unique aircraft propulsive/lift power distribution system is described that promises a great deal of flexibility in the design of VTOL aircraft. Its use would permit a significant improvement in many aspects of present and future VTOL designs, including performance, safety, cost, operability, noise, applicability, and operational economy. (Technical Memo)

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B.6.1.1.8 AD-A074 595 Nov 78-Aug 79
Martin Marietta Aerospace, Denver, Colo., Denver Div.
Marcy, William L.
Title: Propulsion Options for the HI SPOT Long Endurance Drone Airship

ABSTRACT

Airbreathing, monofueled, stored-energy, and solar-rechargeable propulsion systems have been studied for the HI SPOT Long Endurance Drone Airship, Providing constant-level electrical power as well as variable aerodynamic thrust to maintain position in winds varying from 15 to 100 knots at high altitude. A hydrogen fueled airbreathing engine is optimum for mission lengths up to 30 days or more. (Final Report)

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B.6.1.1.9 AD-A045 315/9ST May 77
Princeton Univ N.J. Dept of Aerospace and Mechanical Sciences
Putman, W. F.
Title: Aerodynamics and Hovering Control of LTA Vehicles

ABSTRACT

Navy interest in air vehicles for advnced naval missions has pointed out a need for technology development in certain areas. Technologies requiring study were the aerodynamics and precision hover control characteristics of Lighter-Than-Air (LTA) vehicles. LTA, or buoyant assisted lift, vehicles offer potentially significant increases in on-station endurance over conventional aircraft. Potential of boundary layer control for drag reduction in conventional airships is reviewed and the basic aspects of hovering control of LTA vehicles are developed. (Final Report)

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B.6.1.1.10 AD-902628 July 72
Naval Research Lab Washington, D.C.
Clements, E. W.
Title: The Navy Rigid Airship

ABSTRACT

Lighter-than-air (LTA) craft were used with great success by the Navy for some fifty years. Consideration of the unique capabilities of these craft, particularly rigid airships, suggests that they would be well suited to some present-day Navy missions. This memorandum presents a resume of past experience with rigid airships and outlines their performance characteristics. The most prominent of these include the ability to remain airborne for great lengths of time carrying large payloads, the ability to land and take off vertically and hover, and their apparent compatibility with nuclear propulsion. (Final Report)

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B.6 SYSTEMS AND OPERATIONAL CONCEPTS

B.6.1 ADVANCED SYSTEMS CONCEPTS

B.6.1.2 NON NAVY FUNDED

B.6.1.2.1 74A38898 Mar 1974
New York, American Institute of Aeronautics and Astronautics, Inc.
Grey, J.
Title: Aircraft Fuel Conservation: An AIAA View: Proceedings of a Workshop Conference, Reston, VA, March 13 - 15, 1974

ABSTRACT

Aspects of aircraft fuel conservation are reviewed and discussed, and measures are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Principal measures included: increasing load factors, achieved by revised rerouting and scheduling and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical "winglet" located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuels currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics.

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B.6.1.2.2 75A11426 Oct 1974
Article: Aviation Week and Space Technology
Unknown
Title: Next Generation Transports Will Emphasize Fuel Savings

ABSTRACT

Technology for the minimum energy airplane is reviewed. Special attention is given to an advanced medium-range aircraft that is being developed to lower fuel economics and twin-engine airplanes are considered that will incorporate new wing and structures technology. Improvements in aircraft design include (1) a long duct and thin wall nacelles. (2) the use of aluminum and titanium alloys for reduced stress corrosion and weight and high fatigue life, and (3) advanced airfoils andhigh lift devices. New concepts for the minimum energy airplane that would embody composities or improve skin and stringer techniques are included.

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B.6.1.2.3 74A38515 Jun 1974
Unknown
Cuesta Alvarez, M.
Title: The Energy Crisis of Fuel and the Procedures of Cruising Flight

ABSTRACT

The energy crisis has focused attention on questions concerning the aircraft type with the lowest operational fuel consumption. Other important questions are related to the flight procedures which have optimum characteristics with regard to fuel consumption and total operational costs. It has been found that aircraft equipped with turbojet engines require the least amount of fuel for their operation. Details of turbojet design and operation are discussed along with questions of cruising range, thrust, and velocity, taking into account conditions at various altitudes. The characteristics of cruising flight undertaken under conditions of constant Mach number and constant altitude and of constant thrust and constant altitude are considered. (Paper: Revista de Aeronautica y Astronautica, vol. 34, June 1974, in Spanish)

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B.6.1.2.4 75A47509 May 1975
Boeing Commercial Airplane Co., Seattle, WA
Hanks, G.W.
Title: Weight Contribution to Fuel Conservation for Terminal Area Compatible Aircraft

ABSTRACT

Reductions in fuel consumption by weight characteristics of advanced aircraft are considered, and trades between weight reduction versus increased aerodynamic and operating efficiency are discussed. Direct reductions in fuel use may be obtained by application of advanced technology in scructure and airfoils, proper engine choice, and revised environmental control features. Weight penalties involved in wing planform optimization are countered by increased aerodynamic efficiency. Results of studies incorporating advanced structure, airfoils, and propulsion show 21.6 percent reductions in operational empty weight and takeoff gross weight compared to a conventional design. Implementation of the described fuel reduction approaches will yield an estimated 25 percent reduction in fuel consumption. (Paper: Society of Allied Weight Engineers, Annual Conference, 34th, Seattle, WA, May 5 - 7, 1975)

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B.6.1.2.5 76A45400 Sept 1976
NASA, Ames Research Center, Moffett Field, CA
Harper, M.
Title: A Hybrid Airship Concept for Naval Missions

ABSTRACT

A preliminary analysis of a hybrid semibuoyant delta-planform airship was performed using a computer synthesis program. The delta-planform hull shape was studied parametrically to determine the effects on vehicle performance for two Navy antisubmarine missions. The effects of buoyancy ratio, design speed, and altitude were also studied. The results suggest that long-range mission vehicles require a near buoyant or fully buoyant design and that there is no special advantage to the use of a lifting-body hull shape. For shorter-range missions, hybrid vehicles may have merit, and optimum vehicle buoyancy varies depending on whether a minimum-weight or minimum-fuel-consumption design is desired. As compared with conventionally shaped airships, the benefits, if any, from a lifting-body configuration will be limited to missions requiring relatively higher flight speeds. (Paper: AIAA, Aircraft Systems and Technology Meeting, Dallas, TX, Sept 27 - 29, 1976)

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B.6.1.2.6 AD-A063 793 Nov 78
Advisory Group for
B.6.1.2.7
AIAA: 80-0894 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Kirchner, M. E.
Title: Aerodynamic Expectations Through the Year 2000

ABSTRACT

Envisioned aerodynamic technology development and refinement contributions to achieving air transportation economic expectations through the year 2000 are discussed. Cruise lift/drag ratios of current commercial transport airplanes are compared relative to a potential maximum level for fully turbulent flow. Ideas for improving aerodynamic cruise efficiency are then categorized as to their "evolutionary" or "revolutionary" potential. Advanced aerodynamic technologies currently being researched (e.g., laminar flow control, natural laminar flow, advanced transonic wing design) are reviewed. SST aerodynamic technology status is discussed along with an assessment of the chances of a U.S. SST within this time period. Advanced aerodynamic computing and testing techniques will play important roles in achieving the aerodynamic advances. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.6.1.2.8 78A24765 Feb 1978
Pratt and Whitney, East Hartford, CN
Wilson, M.
Title: The First Refan

ABSTRACT

The Pratt and Whitney JT8D-209 refan is evaluated, and compared with new generation commercial jet engines in terms of thrust and cost parameters. Attention is given to the DC-9-80 aircraft and its suitability for retro-fitting with the JT8D-209. When noise regulations and fuel economy considerations eventually force the first generation by-pass engines out of the air, the lower development, maintenance, and acquisition costs, and higher thrust (18,500 lbs.) of the JT8D-209, as compared with completely new engines, should prove an attractive alternative for commercial aviation. (Paper: Flight International, vol. 113, Feb 18, 1978)

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B.6.1.2.9 76A36606 May 1976
Unknown
Stern, J.
Title: Aircraft Propulsion - A Key to Fuel Conservation: An Aircraft Manufacturer's View

ABSTRACT

A range of possible approaches to fuel conservation is examined. The fuel contributions to direct operating costs, aircraft operations and maneuvers designed to conserve fuel, aircraft design variants, modifications, and refittings capable of aiding fuel conservation are discussed. Advantages of turbofan and turboprop derivatives of basic aircraft designs are examined. The RECAT (Reducing Energy Consumption of Commercial Air Transportation) program is outlined. The possible impact of recent technological advances in aircraft design (supercritical airfoils, optimized wing geometry, longitudinal stability augmentation, composites, new metallic structures) on fuel conservation is examined. (Paper: Society of Automotive Engineers, Air Transportation Meeting, New York, NY, May 18 - 20, 1976)

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B.6.1.2.10 78A47905 Aug 1978
Unknown
Park, P. H.
Title: The Effect on Block Fuel Consumption of a Strutted Versus Cantilever Wing for a Short-Haul Transport Including Strut Aeroelastic Considerations

ABSTRACT

A preliminary design of a short-haul aircraft using a strut-braced wing was made to study the possibility of block fuel savings due to the decrease in wing weight allowed by the use of a strut. A computer-aided wing loads and stress analysis was performed to determine the wing weight savings. It was found that the wing weight savings are not large in this aircraft and the induced drag decrease is offset by the strut parasite drag. The final cantilever and strutted configurations have essentially equal block fuel consumptions. A calculated strut flutter velocity was close enough to the flight envelope to warrant design consideration. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, CA, Aug 21 - 23, 1978)

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B.6.1.2.11 77A20719 1976
Lockheed-Georgia Co., Marietta, GA
Lange, R.H.
Title: Effects of Artificial Stability on Configuration Design

ABSTRACT

The use of active controls for maneuver load alleviation in the development of transport aircraft in the 1980s is considered. As part of the NASA Advanced Transport Technology Program, Lockheed conducted a relaxed static stability analysis including an assessment of the benefits to be derived from the application of advanced technologies such as low noise level propulsion systems, supercritical wing, advanced filamentary composite materials, and active controls. Attention is also given to the JetStar redesign study, taking account of wing optimization, geometry constraints, and loads analysis. (Paper: Air Transportation for the 1980's, University of Maryland, College Park, Maryland, 1976).

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B.6.1.2.12 74A34085 Apr 1974
Unknown
Kelly, D.L.
Title: Application of Hydrogen to Commercial Transports

ABSTRACT

A design analysis of the conversion of an in-production wide-bodied transport to hydrogen fuel is presented. Comparisons are drawn between storage of hydrogen in the fuselage and storage in wing-external tanks. Required structural modifications are defined and costed, and a preferred configuration is selected on the basis of direct operating cost. It is shown that a conversion of a jet fueled, wide-bodied transport to hydrogen fuel is technically and economically feasible, provided that it is preceded by a long-life tankage and insulation development. The preferred configuration has the hydrogen stored in pylon-mounted tanks above the wings. Flyaway cost of the hydrogen fueled conversion is 8 percent greater than that of the baseline jet fueled transport. (Paper: Society of Automotive Engineers, Air Transportation Meeting, Dallas, TX, Apr 30 - May 2, 1974)

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B.6.1.2.13 N7715045/6ST 1976
NASA, Langley Research Center, Langley Station, Va
Guy, R. W.
Title: Thermal Design and Analysis of a Hydrogen-Burning Wind Tunnel Model of an Airframe-Integrated Scramjet

ABSTRACT

An aerodynamic model of a hydrogen burning, airframe integrated scramjet engine has been designed, fabricated, and instrumented. This model is to be tested in an electric arc heated wind tunnel. (Report)

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B.6.1.2.14 79A45328# Aug 1979
Dynamics Research Corp., Wilmington, Mass
Aggarwal, R.
Title: An Analysis of Operational Procedures and Design Modifications for Aircraft Fuel Conservation

ABSTRACT

Two year study conducted to determine the effectiveness of fuel conservation measures as applied to Air Force bomber/transport type aircraft. The impacts of various potential design and operational procedure improvements are quantified. A major contribution of this study is the approach taken to geneate the effect of design changes on fuel consumption and direct operating cost (DOC). (Paper: Atmospheric Flight Mechanics Conference for Future Space Systems, Boulder, Colo., August 6-8, 1979)

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B.6.1.2.15 DF143740 31 Dec 79
Vought Aeronautics Div., LTV,
Nagaraja, KS
Title: Ejector Wing Designs

ABSTRACT

The objective of this effort is to develop new designs such as an ejector-wing which provide significantly advantageous lift and thrust augmentations. This will provide the Air Force with aircraft that can be energy saving and maneuverable in the low flight speeds. (Plan)

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B.6.1.2.16 79A11572 Oct 1978
ONERA, Chatillon-sous-Bagneaux, Hauts-de-Seine, France
Poisson-Quinton, P.
Title: Energy Conservation Aircraft Design and Operational Procedures

ABSTRACT

Paper reviews studies associated with improved fuel efficiency. Design concepts are described including: (1) increases in aerodynamic efficiency through decreased friction drag, parasitic drag, and drag due to lift. (2) structural efficiency and the implementation of composite materials, (3) active control technology, (4) the optimization of airframe-engine integration, and (5) VTOL and STOL concepts. Consideration is also given to operational procedures. (Paper in NATO, AGARD, Lecture Series on Energy Conservation in Aircraft Propulsion, Munich, West Germany, Oct. 26, 27, 1978)

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B.6.1.2.17 SSTE: CQF 139760 1 5/77 to N/A
Raytheon Co., Hartwell Rd., Bedford, Massachusetts 02172
Greco, J.
Title: Hinge Moments of an Optimized Control Surface Design

ABSTRACT

The split tail concept to be investigated will optimize the tail design, yielding greater aerodynamic and control system efficiency. Also will result in a significant reduction of hinge moments which will allow utilization of lighter weight, smaller size, and lower cost actuators. (Plan)

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B.6.1.2.18 AD-A029 345/6ST 16 Jun - 25 Nov 75
Boeing Commercial Airplane Co., Seattle, Washington
Ishimitsu, K.K.
Title: Design and Analysis of Winglets for Military Aircraft

ABSTRACT

A study of the design and analysis of winglets for military aircraft has been completed. The analysis of the winglets showed a 14 percent reduction in induced drag for the KC-135 and a 11 percent reduction for the C-141. The structural design study of the KC-135A winglet installation estimated a 592 lb weight increase. An 8.4 percent

improvement was estimated in M(L/D) sub MAX and an 8.1 percent improvement in range factor for the KC-135A. (Final Report)

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B.6.1.2.19 AD-A044 805/0ST Jun 77
Advisory Group for Aerospace Research and Development Paris (France)
Unknown
Title: Special Course on Concepts for Drag Reduction

ABSTRACT

Research effort is being mounted in a number of countries into investigations of ideas for drag reduction, some novel and some that were looked at in the past. Ideas include means for reducing skin friction drag (e.g. compliant walls, boundary layer control, etc.), induced drag (e.g. winglets), interference drag, transonic shock wave drag (supercritical wings) and supersonic wave drag. In addition the internal aerodynamics of ducting, especially diffusers is receiving attention to improve the performance of engines. ACARD Special Course at the von Karman Inst., 28 Mar-1 Apr 77, Rhode-St-Genese, Belgium

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B.6.1.2.20 N77-24100/8ST May 77
NASA, Hugh L. Dryden Flight Research Center, Edwards, CA
Arnaiz, H.H.
Title: Flight-Measured Lift and Drag Characteristics of a Large, Flexible, High Supersonic Cruise Airplane

ABSTRACT

Flight measurements of lift, drag, and angle of attack were obtained for the XB-70 airplane, a large, flexible, high supersonic cruise airplane. Such performance characteristics as drag polars, lift-curve slopes, and maximum lift-to-drag ratios were derived from the flight data. The base drag of the airplane, changes in airplane drag with changes in engine power setting at transonic speeds, and the magnitude of the drag components of the propulsion system are discussed. (Report)

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B.6.1.2.21 N78-30064/7ST 1978
Liverpool Univ. (England)
Barsby, J.E.
Title: Calculations of the Effects of Blowing from the Leading Edges of a Cambered Delta Wing

ABSTRACT

The thin jet model applied to the study of the jet flap is combined with the vortex sheet model applied to the study of leading-edge separation, to study the effect of blowing from the leading-edges of a cambered wing. The drag for a given lift when blowing is introduced is greatly reduced, and in some cases a negative drag is predicted. (Report)

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B.6.1.2.22 N78-15056/2ST Dec 77
NASA, Ames Research Center, Moffett Field, CA
Boltz, F.W.
Title: Aerodynamic Characteristics of an F-8 Aircraft Configuration with a Variable Camber Wing at Mach Numbers from 0.70 to 1.15

ABSTRACT

A 0.1-scale model of an F-8 aircraft was tested in the Ames 14-foot Transonic Wind Tunnel at Mach numbers from 0.7 to 1.15. The model was configured with a wing designed to simulate the downward deflection of the leading and trailing edges of an advanced-technology-conformal-variable camber wing also equipped with conventional (simple hinge) flaps. In general, at all Mach numbers the use of conformal flap deflections at both the leading edge and trailing edge resulted in slightly higher maximum lift coefficients and lower drag coefficients than with the use of simple hinge flaps. (Report)

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B.6.1.2.23 78N13042 Oct 1977
NASA, Langley Research Center, Langley Station, VA
Bonner, T.F., Jr.
Title: Aircraft Energy Efficiency Laminar Flow Control Wing Design Study

ABSTRACT

Engineering design study performed in which laminar flow control (LFC) was integrated into the wing of a commercial passenger transport aircraft. The LFC system, with suction slots, ducting, and suction pumps

was integrated with the wing structure. The use of standard aluminum technology and advanced superplastic formed diffusion bonded titanium technology was evaluated. Results show that the LFC system can be integrated with the wing structure to provide a structurally and aerodynamically efficient wing for a commercial transport aircraft. (Report)

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B.6.1.2.24 N76-18536/2ST Feb 76
McDonnell-Douglas Corp., St. Louis, Mo.
Pirrello, C.J.
Title: A Fuselage/Tank Structure Study for Actively Cooled Hypersonic Cruise Vehicles, Summary

ABSTRACT

Detailed analytical study made to investigate the effects of fuselage cross section and the structure arrangement (integral and non integral tanks) on aircraft performance of liquid hydrogen fueled Mach 6 transport. Trade studies conducted in the area of configuration arrangement, structural design, and active cooling design. The result shows that the blended body integral tank aircraft weighs the least and has the greatest range capability. However, producibility and maintainability factors favor non-integral tank concepts. (Final Report)

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B.6.1.2.25 ETS00317889 Sept 1978
Northrop Corp., Hawthorne, Calif
Stalony-Dobrazanski, Janusz
Title: Improvement of Fighter Aircraft Maneuverability Through Employment Of Control Configured Vehicle Technology

ABSTRACT

The control configured vehicle (CCV) design concept employing concurrently the traditional disciplines as well as full authority automatic control system design, is shown to offer a very large combat performance improvement over conventional design approach. This improvement is due primarily to the freedom, under CCV concept, of designing statically longitudinally unstable configurations. The configuration selected for the evaluation is a tailless clipped delta employing advanced structure and engine technologies. The performance gains are achieved simultaneously with decreased aircraft and fuel weight for the same mission. (Paper: Agard Conf. Proc N 260, Paper presented at the Flight Mech. Panel Symp. on Stab. and Control, Ottawa, Ont, Sep

25-28 1978)

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B.6.1.2.26 SSIE: CQF13990 1 5/77
Boeing Co, 7555 E. Marginal Way S., Seattle, Washington, 98124
Yoshirhara, H.
Title: Supersonic Favorable Aerodynamic Interference Applications

ABSTRACT

The objective of this effort is to judiciously apply the concepts of favorable aerodynamic interference to produce an airframe, compatible with pilot/canopy, engine and fuel requirements, and capable of sustained supersonic cruise at efficient power settings. (Plan)

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B.6.1.2.27 SSIE: CQF 51710 2 6/78
Michigan State University, School of Engineering, Dept. of Aerospace Engineering, East Lansing, Michigan, 48824
Vinh, N. X.
Title: Optimum Singular Aerodynamics and Thrust Magritude Matching In Supercruiser Fighter

ABSTRACT

Objective of this proposal is to investigate the optimum aerodynamics of a supercruiser and its matching with the singular thrust control to minimize the fuel consumption over a prescribed range under a certain time constraint. (Plan)

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B.6.1.2.28 SSIE: GH 17586 1 1/73 to 12/99
US Dept. of Commerce, National Bureau of Standards, Washington, DC 20228
McMichael, JM
Title: Drag Reduction

ABSTRACT

To determine the merits of the compliant surface as an effective method for achieving drag reduction in air and water. (Plan)

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B.6.1.2.29 SSTE: CQF 141060 1 10/77 to 4/79
Rockwell International Corp., International Airport, Los Angeles, CA
Wykes, J.H.
Title: Active Flutter Suppression on Aeroelastically Tailored HIMAT Vehicle

ABSTRACT

The HIMAT vehicle has aeroelastically tailored wings for improved maneuverability. The aeroelastic twist control design approach resulted in low flutter speeds. The objective of this effort is to define the feasibility and potential benefits of an active flutter suppression system on aeroelastically tailored composite wings. An active flutter suppression system may provide a more efficient, weight-saving approach. (Plan)

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B.6.1.2.30 AD-A056 124/1ST Mar 76 - Feb 77
Boeing Commercial Airplane Co, Seattle Washington
Kulfan, Robert M.
Title: Wing Planform Geometry Effects on Large Subsonic Military Transport

ABSTRACT

A Preliminary design study of large turbulent flow military transport aircraft has been made. Study tasks included: Wing geometry/cruise speed optimization of a large cantilever wing military transport airplane; Preliminary design and performance evaluation of a strut-braced wing transport airplane; and Structural analyses of large-span cantilever and strut-braced wings of graphite/epoxy sandwich construction (1985 technology). The best cantilever wing planform for minimum takeoff gross weight, and minimum fuel requirements, as determined using statistical weight evaluations, has a high aspect ratio, low sweep, low thickness/chord ratio, and a cruise Mach number of 0.76. A near optimum wing planform with greater speed capability (M = 0.78) has an aspect ratio = 12, quarter chord sweep = 20 deg, and thickness/chord ratio of 0.14/0.08 (inboard/outboard). (Final Report)

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B.6.1.2.31 N77-11055/9ST 10 Sep 75
NASA, Washington, DC
Unknown
Title: Aircraft Fuel Conservation Technology. Task Force Report, September 10, 1975

ABSTRACT

An advanced technology program is described for reduced fuel consumption in air transport. Cost benefits and estimates are given for improved engine design and components, turboprop propulsion systems, active control systems, laminar flow control, and composite primary structures. (Report)

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B.6.1.2.32 76A19593*# Feb 1976
NASA, Off. of Aeronautics and Space Technology, Aircraft Energy Efficiency Office
Povinelli, F.P.
Title: Improving Aircraft Energy Efficiency

ABSTRACT

Investigations by NASA task force concerning fuel-conservation technology are considered. The task force estimated fuel savings potential, prospects for implementation in the civil air-transport fleet, and the impact of the technology on fuel use. Propulsion advances are related to existing engines in the fleet, to new production of current engine types and to new engine designs. Studies aimed at the evolutionary improvement of aerodynamic design and a laminar flow control program are discussed and possibilities concerning the use of composite structural materials are examined. (Paper: In Astronautics and Aeronautics, vol. 14, Feb 1976)

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B.6.1.2.33 78A12031 June 1977
Avions Marcel Dassault-Breguet Aviation, Vaucresson, Hauts-de-Seine, France
Amblard, P.
Title: Energy Savings - The Viewpoint of an Aircraft Manufacturer

ABSTRACT

Technological developments leading to the design of aircraft which consume less fuel than present models are reviewed. In particular, high

bypass ratio engines, supercritical wingspans, active control, and the use of light-weight composite materials for both secondary and primary aircraft structures are considered. Advanced techniques in aerodynamic analysis, especially in the field of boundary layer control, are also mentioned. (Paper in French)

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B.6.1.2.34 EI800100331 Sep 1979
Case Western Reserve Univ., Cleveland, Ohio
Reshotko, Eli
Title: Drag Reduction By Cooling In Hydrogen-Fueled Aircraft

ABSTRACT

Drag reductions are possible for cryo-fueled aircraft by using fuel to cool selected aerodynamic surfaces on its way to the engines. Calculations for hydrogen-fueled transport show that drag reductions in cruise of about 20% are within reason. Hydrogen fueled aircraft employing surface cooling is attractive as an energy conservative aircraft and warrants more detailed study. (Paper: Journal of Aircraft Vol 16, No. 9, Sept 1979)

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B.6.1.2.35 AD-B023 760L Mar 76 - Jun 77
McDonnell Aircraft Co., St. Louis, Mo.
Woods, John, Jr.
Title: Aerodynamic Configuration Drivers for Advanced Airbreathing Concepts

ABSTRACT

The potential for improved aerodynamic performance based on favorable flow interference phenomena was investigated. Four concepts were developed and evaluated. These were two M=4.5 Caret Wing Waverider configurations that used differing propulsion concepts, a M=4.5 Parasol Wing configuration, and a M=6.0 Switchblade Wing configuration. An initial evaluation of a M=6.0 Biplane configuration showed no favorable aerodynamic efects and it was dropped from the analysis. (Final Report)

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B.6.1.2.36 SSIE: ZQF 131400 5 10/73 to 9/84
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio 45433
Terry, J. L.
Title: Aerodynamic Configuration Development

ABSTRACT

The objective of this effort is to define aerodynamic configurations incorporating advanced technologies to establish a firm data base for the purpose of transitioning technology into future military aerospace vehicles. The technical areas of aerodynamics, heating, propulsion, materials, stability and control and cockpit visibility will be evaluated during generation of conceptual configurations. The feasibility of applying new technologies will be assessed continually. A prime consideration for all facets of this effort will be fuel economy in application to new designs as well as existing systems. (Plan)

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B.6.1.2.37 N78-33087/5ST Sep 78
Vought Corp., Technical Center, Hampton, VA
Turriziani, R. V.
Title: Preliminary Design Characteristics of a Subsonic Business Jet Concept Employing Laminar Flow Control

ABSTRACT

Aircraft configurations were developed with laminar flow control (LFC) and without LFC. The LFC configuration had approximately eleven percent less parasite drag and a seven percent increase in the maximum lift-to-drag ratio. Although partially offset by the additional weight of the LFC system, the LFC aircraft burned from six to eight percent less fuel for comparable missions. (Report)

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B.6.1.2.38 78A24034# Feb 1978
Douglas Aircraft Co., Long Beach, Calif.
Hage, R. E.
Title: The Challenge of Advanced Fuel-Conservative Aircraft - A Manufacturer's View

ABSTRACT

Costs and technological problems associated with advanced fuel-conservative aircraft are discussed, with particular attention given to the current NASA Aircraft Energy Efficiency (ACEE) program which

focuses on engine component improvement, turboprops, laminar flow control, and composites. (Paper: American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th Washington, D.C., Feb 7-9, 1978)

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B.6.1.2.39 SSTE: ZQF14237C 2 2/78 to 12/79
Air Force Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio, 45433
Sherrer, V. C.
Title: Forward Swept Wing Aeroelastic Studies

ABSTRACT

Recent analytical studies have shown that forward swept wings offer the performance advantages of reduced drag and increased maneuverability over aft swept wings. Until recently, designs with large forward sweeps proved to be impractical because prohibitive weight increases in the wing structure were necessary to overcome divergence. Use of aeroelastic tailoring of advanced composite wing skins can eliminate the divergence problem without a significant weight penalty. Objective of this work unit is to provide experimental verification of the ability of advanced composites to eliminate divergence in forward swept wings. (Plan)

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B.6.1.2.40 AD-A053 691/2ST Mar 78
Massachusetts Inst. of Tech., Aerophysics Lab., Cambridge
Solomon, Marshall D.
Title: A Study of the Lift-To-Drag Ratio Capability of Caret Wing Waveriders

ABSTRACT

A simple model of the off design caret wing flow field which includes the effects of an upper expansion surface, skin friction and base drag is proposed. Based on this approximate model, calculations of the lift coefficient, drag coefficient and lift-to-drag ratio as functions of body geometry, incidence, Mach number and Reynolds number are made, and the dependence of the aerodynamic coefficients on these variables is identified. Significantly higher caret wing lift-to-drag ratios could be achieved by replacing the blunt base with an afterbody, thereby reducing the base drag. (Master's Thesis)

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B.6.1.2.41 AD-A039 597 Dec 76
Rand corp., Santa Monica, CA
Gebman, J.R.
Title: The Potential Role of Technological Modifications and Alternative Fuels in Alleviating Air Force Energy Problems

ABSTRACT

Short- and long-term measures to reduce the consumption of petroleum jet fuels by the Air Force. Engine retrofits and aerodynamic modifications to existing aircraft can save significant quantities of jet fuel. Synthetic JP fuels derived from oil shale or coal appear to be the most attractive future alternatives to petroleum jet fuels. (Report)

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B.6.1.2.42 AD-C019 324L Jun 79
Rockwell International, El Segundo, CA, North American Aircraft Div.
Wiler, C.D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase II.

ABSTRACT

This study dealt with technologies and concepts for 1990 and 2000 IOC manned penetrating bombers. Two concepts were selected from the phase I study for in-depth examination of structures, aerodynamics, propulsion and various subsystems. (Final Report (Secret))

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B.6.1.2.43 SSIE: ZQF 140800 2 1/77 to 3/79
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, OH 45433
Hertz, T.J.
Title: Improved Aeroelastic Tailoring and Structural Optimization

ABSTRACT

Through the application of aeroelastic tailoring of advanced composite structures, it has been shown feasible to aeroelastically deform the lifting surfaces of advanced fighter aircraft to provide improved performance of these aircraft. Prevention of flutter in thin wings has been achievable analytically while providing minimum drag and maneuver load relief. (Plan)

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B.6.1.2.44 78A23420# Feb 1978
Lockheed California Co., Burbank, CA
Hawkins, W.M.
Title: Where Aerospace Can Serve Afresh - Paths to Energy Independence

ABSTRACT

Feasibility of developing new energy technologies. Among the new technologies proposed are: using fusion explosions to generate superheated steam, nuclear-based conversion of seawater to hydrogen, methane production from plants and waste, ocean thermal energy conversion, and coal gasification. (Paper: Astronautics and Aeronautics, vol. 16, Feb 1978)

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B.6.1.2.45 77N17032# Feb 1976
Committee on Aeronautical and Space Sciences (U.S. Senate)
Unknown
Title: Aircraft Fuel Efficiency Program

ABSTRACT

A technology plan is described for developing fuel-efficient aircraft. Inputs were obtained from industry, NASA research centers, and other governmental agencies. Six major programs are defined: engine component improvement, composite primary structures, turboprops, laminar flow control, fuel conservative transport, and the fuel conservative engine. Funding requirements and benefits are discussed. (Paper: GPO Rept. for Comm. on Aeronautical and Space Sci., 94th Congr. 2d Sess. 17 Feb 1976)

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B.6.1.2.46 SSIE: CQF 140340 1 7/77 to Cont.
Boeing Co., 7555 E. Marginal Way S., Seattle, Washington 98124
Ball, W.H.
Title: Rapid Evaluation of Propulsion System Installation Effects

ABSTRACT

The objective of this effort is to improve the efficiency and accuracy of the current propulsion installation procedure program (PIPS).

With this method, more reliable estimates may be made of the performance characteristics of conceptual flight vehicles. (Plan)

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B.6.1.2.47 79A39011 Jun 1979
Continental Group, Inc., Palo Alto, CA
Galbraith, A.D.
Title: Electric Propulsion for High Performance Light Aircraft

ABSTRACT

An actual design example is presented for application to a representative light aircraft. Attention is given to concept description and analysis, derivation of requirements and design layout, lithium-aqueous electrolyte fuel cell, lithium recycling, metallic lithium as a fuel, propulsion motor and associated controls, and growth potential of the technology. (Paper: 15th AIAA, SAE, ASME Joint Propulsion Conf., Palo Alto, CA, June 18 - 20, 1979)

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B.6.1.2.48 79A35893 Jun 1977
Societe Nationale Industrielle Aerospatiale, Toulouse, France
Cormery, G.
Title: Supersonic Transport in Terms of Energy Savings

ABSTRACT

The Utilization of petroleum-based fuel for civil aviation is considered within the framework of total energy consumption. Attention is given to developments in the United States and France, both currently and over the near-term future (through the 1980°s). Various improvements in engine and aerodynamic design are discussed, including use of composite materials, supercritical wings, high bypass engines, and improved engine geometries. (Paper in L°Aeronautique et l°Astronautique, no. 69, 1978, in French)

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B.6.1.2.49 75A40502* May 1975
Lockheed-Georgia Co., Marietta, Ga.
Bowden, M. K.
Title: Design of Short Haul Aircraft For Fuel Conservation

ABSTRACT

Interaction of airfoil technology and desirable engine characteristics is important: the supercritical airfoil permits higher aspect ratio wings with lower sweep; these, in turn, lower the cruise thrust requirements so that engines with higher bypass ratios are better matched in terms of lapse rate. Lower cruise speeds (which are also better for fuel and operating cost economy) push the desired bypass ratio up further. Effects on fuel consumption of design field length, powered lift concepts and turboprop as well as turbofan propulsion are discussed. (Paper: Society of Automotive Engineers, Air Transportation Meeting, Hartford, Conn., May 6-8, 1975)

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B.6.1.2.50 N77-31155/2ST 1977
National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
Dugan, J.F.
Title: Advanced Turboprop Technology Development

ABSTRACT

The efficiency of high-speed turboprop propulsion systems is considered with emphasis on fuel savings. Specific topics discussed include: High efficiency and low noise of propeller design; engine-airframe integration. (Paper: Conf-Presented At Aircraft Systems And Technol. Meeting, Seattle, 22-24 Aug. 1977; sponsored by AIAA.)

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B.6.1.2.51 N76-19152/7ST Mar 76
National Aeronautics and Space Administration, Hugh L. Dryden Flight Research Center, Edwards, Calif.
Albers, J. A.
Title: Status Of The NASA YF-12 Propulsion Research Program

ABSTRACT

The YF-12 research program was initiated to establish a technology base for the design of an efficient propulsion system for supersonic cruise aircraft. The major technology areas under investigation in this program are inlet design analysis, propulsion system steady-state

performance, propulsion system dynamic performance, inlet and engine control systems, and airframe/propulsion system interactions. The objectives, technical approach, and status of the YF-12 propulsion program are discussed. Also the results obtained to date by the NASA Ames, Lewis, and Dryden research centers. The expected technical results and proposed future programs are given. Propulsion system configurations are shown. (Report)

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B.6.1.2.52 71A17694*# 1969
NASA, Lewis Research Center, Cleveland, OH
Rom, F.E.
Title: Status of the Nuclear Powered Airplane

ABSTRACT

NASA has been carrying out a low-level effort to determine and solve the problems facing practical, safe and economical nuclear aircraft. The key problem is safety. The prevention of fission product release after a major accident on land is difficult. Studies indicate in principle that fission products can be contained; however, much work needs to be done. Over-water flight minimizes the safety problem. Thermal reactors make possible the avoidance of nuclear excursions in accidents by minimizing the fuel inventory. Nuclear aircraft must weigh more than one million pounds in order that payloads of 15 percent of the gross weight or greater can be carried. (Paper: Journal of Aircraft, vol. 8)

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B.6.1.2.53 AD-B008 941 1 Mar 74 - 7 Feb 75
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio, School of Engineering
Amos, Michael W.
Title: Nuclear Aircraft Feasibility Study

ABSTRACT

Study to assess the feasibility of applying nuclear propulsion to aircraft in performance of the Air Force Mission. This was accomplished by using a systems approach divided into six areas: (1) Mission Selection, (2) Required Mission Avionics, (3) Aircraft Design, (4) Propulsion System Design, (5) Public Safety, and (6) Cost. (Master's Thesis, Executive Summary plus two volumes. See also AD-B008 942L and AD-B008 943L.)

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B.6.1.2.54 73X77604 Dec 1971 - Jul 1972
Westinghouse Electric Corp., Pittsburgh, PA
unknown
Title: Investigations of Containment Vessel Concepts for Airborne Nuclear Systems. Volume I: Reactor Safety Study for Nuclear Powered Aircraft

ABSTRACT

A computer program (ESATA II) was developed to analyze the transient temperature and pressure response of a liquid metal-cooled fast and a gas-cooled thermal reactor power plant following earth impact. This program considers (in addition to the standard modes of heat transfer) fission product decay and transport, metal-water reactions, lithium vaporization and condensation, dissociation of hydride materials, reactor and shield melting and displacement, internal pressure buildup, and containment vessel stress response. Rocket sled impact test results recommended shield design of a single tungsten layer surrounding the reactor followed by alternate layers of lithium hydride filled honeycomb structure and insulation such as zirconia and alumina. The use of this shielding configuration resulted in the containment vessel remaining intact for 2,000,000 seconds following impact (the time point at which the computations were terminated). (Report)

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B.6.1.2.55 AD-B017 795/6ST Apr 77
Lockheed-Georgia Co., Marietta, GA; and Westinghouse Electric Co., Advanced Energy Systems Div.
Muehlbauer, John C.
Title: Innovative Aircraft Design Study. Task II. Nuclear Aircraft Concepts

ABSTRACT

Parametric analyses and design refinement studies were performed for conventional, canard, and spanloader aircraft configurations to determine the lightest ramp weight configuration with a nuclear propulsion system. For mission ranges exceeding 9200 n. m, the nuclear aircraft will be lighter than a JP-fueled aircraft. The nuclear aircraft has less life cycle cost for a range exceeding 1200 n.m. This range lessens as conventional fuel prices increase. (Report)

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B.6.1.2.56 79A41913 Apr 1979
Lockheed-Georgia Co., Marietta, GA and Westinghouse Electric Corp., Advanced Energy Systems Div., Pittsburgh, PA
Muehlbauer, J.C.
Title: Nuclear Aircraft Innovations and Applications

ABSTRACT

Determination of the minimum weight nuclear propulsion cycle and aircraft configuration, identification of technologies and innovations for enhancing mission accomplishment, and evaluation of alternate mission applications in the framework of the Innovative Aircraft Design Study (IADS) program are discussed. While sea control, cruise missile carrier, tanker, and airborne command post are prospective alternate mission applications, the nuclear powered cruise missile carrier aircraft (NuCMCA) concept provides unique strategic capabilities. (Paper: American Institute of Aeronautics and Astronautics, Very Large Vehicle Conference, Arlington, VA, Apr 26, 27, 1979)

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B.6.1.2.57 75N13830 1974
Luftschifftechnik ALV, Graz (Austria)
Vonveress, E.
Title: The Nuclear Airship ALV-C/1 --- Helium Gas Turbines with High Temperature Nuclear Reactor

ABSTRACT

The design of an airship propelled by helium closed cycle gas turbines in combination with a high temperature nuclear reactor is discussed. (Article: DGLR Airships)

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B.6.1.2.58 72N12604 Dec 1971
NASA, Lewis Research Center, Cleveland, Ohio
Rom, F.E.
Title: Analysis of Cost Effectiveness of Cargo Transportation by Nuclear Propelled Aircraft and Impact Damage Tests of Nuclear Reactor Containment Vessels

ABSTRACT

Nuclear-powered air-cushion vehicles using lightweight aircraft-type nuclear powerplants show promise of carrying transoceanic cargo at cost-per-metric-ton-kilometer rates comparable to railroad rates. Cargo

rates for nonstop distances of 4000 n mi are expected to be less than one-half those for similar fossil-fueled air-cushion vehicles. There are no fundamental technical reasons why subsonic nuclear aircraft cannot be made to fly successfully if the gross weight is over 1 million lb. Idealized model containment vessels which have been impacted on reinforced concrete showed no leaks after impact at velocities to 400 mph. (Report)

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B.6.1.2.59 77A20713 1976
American Airlines, Inc., New York, NY
Linn, R.J.
Title: Future Aircraft Requirements - A Notebook of Airline Thoughts

ABSTRACT

Future technologies applied to next generation of commercial transports hold promise for increasing productivity while keeping a lid on operating costs. Technologies considered are those of composite structures, supercritical acrodynamics, winglets, active controls, turboprop technology, and laminar flow. The work of NASA on fuel conservative turbofan engines and on regenerative turbofan engines is briefly discussed. (Paper in Air transportation for the 1980's. College Park, MD, University of Maryland 1976)

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B.6.1.2.60 80A38905 Jun 1980
Douglas Aircraft Co., Inc. Long Beach, CA
Goldsmith, I.M.
Title: Potential Benefits for Propfan Technology on Derivatives of Future Short- to Medium-Range Transport Aircraft

ABSTRACT

Several NASA-sponsored studies have identified a substantial potential fuel savings for high subsonic speed aircraft utilizing the propfan concept compared to the equivalent technology turbofan aircraft. (Paper in AIAA, SAE, and ASME, Joint Propulsion Conference, 16th, Hartford, CT, June 30-July 2, 1980)

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B.6.1.2.61 75A41609*# Aug 1975
Boeing Commercial Airplane Co., Seattle, Wash.
Hanks, C. W.
Title: Fuel Conservation Possibilities for Terminal Area Compatible Transport Aircraft

ABSTRACT

Design characteristics that would reduce mission fuel consumption and improve terminal-area operations for advanced transports are discussed. Sensitivity studies of the effects of cruise speed, wing geometry, propulsion cycle, operational procedures, and payload on fuel usage are presented. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Los Angeles, Calif., Aug 4-7 1975)

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B.6.1.2.62 DF487016 1976
Boeing Company, Wichita Division
Heilman, J. J.
Title: KC-135 Modernization Study

ABSTRACT

Assess modern developments in engine and wing technology applicable to potential modifications of the KC-135 which may result in performance improvements, increased off load capability, reduced energy consumption and reduced O/M costs. Five different combinations of propulsion (TF33-P7, CFM-56, JT-10D) and wing (existing, 707/320B, supercritical) improvements. (Final Report in three volumes)

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B.6.1.2.63 77A42784*# Aug 1977
NASA, Langley Research Center, Hampton, Va.
Hood, R. V., Jr.
Title: The Aircraft Energy Efficiency Active Controls Technology Program

ABSTRACT

Broad outlines of the NASA Aircraft Energy Efficiency Program for expediting the application of active controls technology to civil transport aircraft are presented. Advances in propulsion and airframe technology to cut down on fuel consumption and fuel costs, a program for an energy-efficient transport, and integrated analysis and design technology in aerodynamics structures and active controls are envisaged.

(Paper: Guidance and Control Conference, Hollywood, Fla., August 8-10, 1977)

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B.6.1.2.64 78A21303 Oct 1977
De Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada
Eggleston, B.
Title: Prospects for Energy Conserving STOL Transports Using Prop-Fans

ABSTRACT

Study examined the application of the prop-fan type of advanced propeller design to a 1986 technology, 50 passenger, STOL transport aircraft. In a 1986 technology aircraft the greatest fuel savings were found at Mach 0.50. The energy efficiencies of a prop-fan aircraft designed for Mach 0.70 were found superior to 1977 technology STOL and jet-CTOL aircraft by 10 - 20 percent. (Paper in Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977 Proceedings)

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B.6.1.2.65 EI780530889 Feb 1978
NASA
Aronson, Robert B.
Title: Return of the Propeller

ABSTRACT

A new hybrid design combines features of the conventional prop and the fan section of a turbofan engine. Preliminary research indicates that the new "prop-fan" will use significantly less fuel than present turbofan engines. NASA says the new prop-fan could be flying by the 1990s. (Article in Machine Design Vol 50, No. 4, Feb 23, 1978)

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B.6.1.2.66 78A71305# Oct 1977
Canadair, Ltd., Montreal, Canada
Bernstein, S.
Title: Improved Energy Efficiency for Small CTOL Transport Aircraft

ABSTRACT

Potential improvements in fuel efficiency by application of new airframe and propulsion system technologies (supercritical wings, advanced composite materials, high aspect ratio wings, advanced propulsion systems, wing tip winglets, active controls and laminar flow) to the smaller CTOL transport aircraft. Fuel savings of up to 12% are possible by increasing aspect ratio alone. Incorporation of supercritical airfoils and advanced composites with the higher aspect ratios can save a further 5%. Advanced propulsion system technology offers similar or higher potentials for fuel savings: 15-20% with new turbofans and a further 15-20% with prop-fans. Total cumulative fuel savings of 40-45% are possible with incorporation of all the new technologies investigated. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3-4 1977)

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B.6.1.2.67 N78-32066/OST Sep 78
Hamilton Standard, Windsor Locks, Conn.
Black, D. M.
Title: Aerodynamic Design and Performance Testing of an Advanced 30 Deg Swept, Eight Bladed Propeller at Mach Numbers From 0.2 to 0.85

ABSTRACT

Emphasis on fuel conservation in the world has stimulated studies of both conventional and unconventional propulsion systems for commercial aircraft. Preliminary results indicate that a fuel saving of from 15 to 26 percent may be realized by the use of an advanced high speed turboprop. An advanced turboprop concept was wind tunnel tested. Results are presented which indicate propeller net efficiencies near 80 percent were obtained at high disk loadings at Mach 0.8. (Final Report)

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B.6.1.2.68 N76-32182/7ST 1976
Boeing Co., Wichita, Kans.
Pasley, L. H.
Title: Evaluation of Low Wing-Loading Fuel Conservative, Short-Haul Transports

ABSTRACT

Fuel conservation that could be attained with two technology advancements, a fan propulsion system and active control technology (ACT) was studied. (Report)

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B.6.1.2.69 EI750742662 Mar 1975
Univ. of Toledo, Ohio
Beans, E.W.
Title: Design Study of a Fan Augmented Ramjet

ABSTRACT

The characteristics of a hybrid propulsion system, which fills the gap between turbojets and ramjets, are presented. The hybrid system is a fan augmented ramjet and consists of a ramburner fed by an externally driven low pressure ratio fan. Cycle analyses, performance estimates and scaling relationships for subsonic and supersonic operation, and a preliminary design of a subsonic version are presented. A 50 to 100 percent improvement in cruise performance above that of a ramjet can be expected in the subsonic regime. (ASME paper n75-GT-57 Mar 2-6, 1975 meeting)

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B.6.1.2.70 EI790858352 Apr 1979
MIT, Cambridge, Mass
Larrabee, F. Eugene
Title: Practical Design of Minimum Induced Loss Propellers

ABSTRACT

An efficient procedure, adapted to pocket calculators, developed to determine the geometry of minimum induced loss propellers matched to a specified operating point characterized by disc loading, advance ratio, and number of blades. (Paper in SAE mtg. Apr 3-6, 1979)

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B.6.1.2.71 78N29061*# 1978
NASA, Ames Research Center, Moffett Field, CA
Williams, L.J.
Title: Short-Haul CTOL Aircraft Research --- On Reduced Energy for Commercial Air Transportation

ABSTRACT

The results of the reduced energy for commercial air transportation studies on air transportation energy efficiency improvement alternatives are reviewed along with subsequent design studies of advanced turboprop powered transport aircraft. The potential fuel savings and cost savings for advanced turboprop aircraft appear substantial, particularly at shorter ranges. (Paper: NASA, Langley Res. Center CTOL Transport Technol., 1978)

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B.6.1.2.72 N75-24739/5ST May 1975
NASA, Lewis Research Center, Cleveland, OH
Kraft, G.
Title: Preliminary Study of Advanced Turboprops for Low Energy Consumption

ABSTRACT

The fuel savings potential of advanced turboprops (operational about 1985) was calculated. Variable camber propellers were used with an efficiency of 85 percent. The study indicated a fuel savings of 33 percent, a takeoff gross weight reduction of 15 percent, and a direct operating cost reduction of 18 percent. Increasing overall pressure ratio from 25 to 50 saved little fuel and slightly increased takeoff gross weight. (Report)

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B.6.1.2.73 78A43357*# Jul 1978
NASA, Washington, DC
Kramer,J.J.
Title: Planning a New Era in Air Transport Efficiency

ABSTRACT

The current status of the NASA Aircraft Energy Efficiency (ACEE) program is briefly reviewed with reference to CTOL aircraft. Attention is given to four basic technologies: turboprop, advanced aerodynamics and active controls, laminar flow control, and composites. (Paper: Astronautics and Aeronautics, vol. 16, July - Aug 1978)

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B.6.1.2.74 N77-22072/0ST Jun 76
Douglas Aircraft Co., Inc., Long Beach, CA
Kraus, E.F.
Title: Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System. Volume I: Technical Analysis

ABSTRACT

The effectiveness of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state-of-the-art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. (Final Report)

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B.6.1.2.75 77A12192*# May 1976
NASA, Ames Research Center, Moffett Field, CA
Williams, L.J.
Title: Air Transportation Energy Efficiency - Alternatives and Implications

ABSTRACT

Results from recent studies of air transportation energy efficiency alternatives are discussed. Included are aircraft operation, aircraft modification, derivative aircraft, and new aircraft. In order to obtain significant improvements in energy efficiency, new aircraft must truly exploit advanced technology in such areas as aerodynamics, composite structures, active controls, and advanced propulsion. (Paper: Society of Allied Weight Engineers, Annual Conference, 35th, Philadelphia, PA, May 24 - 26, 1976)

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B.6.1.2.76 78A18022 Oct 1977
unknown
Walsh, D.
Title: Advances in Aircraft Efficiency

ABSTRACT

The paper surveys NASA's Aircraft Energy Efficiency program. Six major elements: (1) engine component improvement, aimed at a 5 percent reduction in annual fuel consumption. (2) the energy efficient engine program. (3) the development of advanced turboprop propulsion systems. (4) the creation of advanced aerodynamics and active control technology applicable to transport aircraft. (5) the development of alternative laminar flow designs, and (6) the study of potential composite primary structures for weight reduction and fuel economy. (Paper: Aviation Engineering and Maintenance, vol 1, Oct 1977)

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B.6.1.2.77 AD-C019 324L Jun 79
Rockwell International El Segundo CA, North American Aircraft Div.
Wiler, C.D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase II.

ABSTRACT

This study dealt with technologies and concepts for 1990 and 2000 IOC manned penetrating bombers. Two concepts were selected from the phase I study for in-depth examination of structures, aerodynamics, propulsion and various subsystems. (Final Report (SECRET))

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B.6.1.2.78 AD-C016 293L Jun 78
Rockwell International, Los Angeles, Calif, Los Angeles Aircraft Div
Raymer, D.
Title: Innovative Strategic Aircraft Design Study (ISADS) Phase I

ABSTRACT

Study dealt with technologies and concepts for post-1995 manned penetrating strategic bomber. Technologies were assessed in areas of aerodynamics, propulsion, structures, controls, and stealth, were found to offer up to 50 percent reductions in cost and weight over current

technologies. (Final Report)

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B.6.1.2.79 N78-21095/2ST Jan - Aug 1977
Lockheed California Co., Burbank, Commercial Advanced Design Div.
Revell, J. D.
Title: Fuel Conservation Merits of Advanced Turboprop Transport Aircraft

ABSTRACT

Advantages of a propfan powered aircraft for commercial air transportation were assessed by comparison with an equivalent turbofan transport. Comparisons on the basis of fuel utilization and operating costs, as well as aircraft weight and size. (Final Report)

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B.6.1.2.80 N75-16557/1ST Feb 75
Lockheed Aircraft Corp., Burbank, Calif.
Sweet, H. S.
Title: Evaluation of Advanced Lift Concepts and Potential Fuel Conservation for Short-Haul Aircraft

ABSTRACT

The effect of different field lengths, cruise requirements, noise level, and engine cycle characteristics on minimizing fuel consumption and minimizing operating cost at high fuel prices were evaluated for some aircraft using the upper surface, internally blown jet flap, the augmentor wing, and the mechanical flap lift systems. Advanced conceptual STOL engines were evaluated as well as a near-term turbofan and turboprop engine. (Report)

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B.6.1.2.81 75N16979 Dec 1974
Department of the Air Force, Washington, D.C.
Yarymovych, M. I.
Title: Energy-Related Research and Development in the United States Air Force

ABSTRACT

Methods of reducing fuel consumption by aircraft design and structural modification are proposed. The effectiveness of a campaign to reduce energy requirements and expenditures is documented. (Paper: In AGARD, The 1974 AGARD, Ann Meeting)

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B.6.1.2.82 SSIE: ZH 870142 1 10/77
NASA, Office of Aeronautics and Space Technology, Langley Research Center, Hampton, Virginia, 23665
unknown
Title: Energy Efficient Transport

ABSTRACT

The objective of this RTOP is to expedite industry acceptance and application of advanced aerodynamics and active controls technology in an integrated manner to achieve significant energy, economic, and aircraft sales benefits. In-house and industry experimental and analytical efforts will be continued in the areas of supercritical aerodynamics, high-lift systems, propulsion/airframe integration, and wing/empennage/flight control systems. (Plan)

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B.6.1.2.83 N78-22073/8ST Jun 1977
National Aeronautics and Space Administration, Washington, D.C.
Aiken, W.S.
Title: Alternate-Fueled Transport Aircraft Possibilities

ABSTRACT

(1) NASA's cryogenically fueled aircraft program; (2) LH2 subsonic and supersonic transport design possibilities (3) the fuel system and ground side problems associated with LH2 distribution; (4) a comparison of LCH4 with LH2; (5) the design possibilities for LCH4 fueled aircraft. (Paper: 13th Congr. Intern. Aeron., Paris, 2-3 Jun. 1977)

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B.6.1.2.84 N77-10033/7ST Sept 1976
Boeing Commercial Airplane Co., Seattle, Wash Dept. of Preliminary Design
unknown
Title: An Exploratory Study to Determine The Integrated Technological Air Transportation System Ground Requirements of Liquid Hydrogen Fueled Subsonic Long Haul Civil Air Transports

ABSTRACT

A baseline air terminal concept was developed which permitted airlines and the airport to operate JP or LH2 fueled aircraft at common terminal gates. The concept included installation of a hydrogen liquefaction and storage facility on airport property as well as the fuel distribution system. The capital investment and hydrogen related operating costs to the airlines were estimated. (Final Report)

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B.6.1.2.85 N77-22711*# 1972
NASA, Lewis Research Center, Cleveland, Ohio
Whitlow, John B., Jr.
Title: Preliminary Appraisal of Hydrogen and Methane Fuel in a Mach 2.7 Supersonic Transport

ABSTRACT

The higher heating value of hydrogen relative to JP fuel is estimated to reduce fuel weight by three fold and gross weight by 40 percent for comparable designed airplanes of equal payload and range. At current fuel prices, the DOC of a hydrogen airplane would be much higher than that of a JP airplane. A methane airplane could offer an 8.5 percent lower DOC than JP. Future shortages may escalate the prices of both JP and methane, whereas the price of hydrogen manufactured hydrolytically could be reduced from present levels. If in the future all three fuels are postulated to have equal costs per unit of energy, the DOC for hydrogen could be a much as 20 percent below that for JP on the reference 4000 nautical mile mission. Longer ranges would improve the advantage of hydrogen. (Report)

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B.6.1.2.86 N75-10945/4ST Oct 74
NASA, Lewis Research Center, Cleveland, Ohio
Civinskas, K.C.
Title: A Comparison of Optimum Jp and LH2 Turbofan Engines Designed for Two Subsonic Transport Missions

ABSTRACT

The use of liquid hydrogen fuel instead of JP fuel for two subsonic commercial transports was examined. The following determinations which are important to meeting noise reduction requirements were calculated: (1) take off gross weight, (2) energy consumption, and (3) direct operating costs. The optimum engine cycles were found to be the same for both fuels. (Report)

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B.6.1.2.87 N78-10306/6ST Sep 77
NASA, Langley Research Center, Langley Station, VA
Korycinski, P.F.
Title: The Liquid Hydrogen Option for the Subsonic Transport: A Status Report

ABSTRACT

Continued subsonic air transport design studies include the option for a liquid hydrogen fuel system as an aircraft fuel conservation measure. Elements of this option discussed include: (1) economical production of hydrogen; (2) efficient liquefaction of hydrogen; (3) materials for long service life LH2 fuel tanks; (4) insulation materials; (5) LH2 fuel service and installations at major air terminals; (6) assessment of LH2 hazards; and (7) the engineering definition of an LH2 fuel system for a large subsonic passenger air transport.

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B.6.1.2.88 73A38373 Aug 1973
NASA, Langley Research Center, Hampton, VA
Kirkham, F.S.
Title: Energy Supply and Its Effect on Aircraft of the Future. II - Liquid- Hydrogen-Fueled Aircraft: Prospects and Design Issues

ABSTRACT

The performance of hydrogen-fueled commercial aircraft is examined in the subsonic, supersonic, and hypersonic speed regime and compared with JP-fueled systems. Hydrogen aircraft are shown to provide substantial

improvements in range and payload fraction as well as to minimize or eliminate many environmental problems. The major elements of a development program required to make hydrogen-fueled aircraft a commercial reality are also outlined and the rationale for and characteristics of both a subsonic demonstrator and a high speed research airplane are described.

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B.6.1.2.89 77A48709 Sep 1977
Lockheed-California Co., Burbank
Brewer, G.D.
Title: Alternate Fuels for Future Aircraft

ABSTRACT

Compares liquid hydrogen fueled aircraft with synthetic Jet A fueled aircraft. Economics of fuel production considered. (Paper: 12th Intersociety Energy Conversion Engineering Conference, Washington, DC, Aug 28 - Sep 2, 1977)

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B.6.1.2.90 N77-10032/9ST Sep 1975 - Feb 1976
Lockheed-California Co.,Burbank
Brewer, G.D.
Title: LH2 Airport Requirements Study

ABSTRACT

Assessment of facilities and equipment required at airport so liquid hydrogen LH2 can be used as fuel in long range transport aircraft. Facility includes the liquefaction plant, LH2 storage capability, and LH2 fuel handling system. Requirements for ground support and maintenance for LH2 fueled aircraft analyzed. Estimate made of capital and operating costs expected for the facility. Recommendations made for design modifications to the reference aircraft reflecting analysis of airport fuel handling requirements. Program of technology development for air terminal related items. (Final Report)

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B.6.1.2.91 N74-32472/8SL 1 Aug 74
NASA, Langley Research Center, Langley Station, VA
Snow, D.B.
Title: A Study of Subsonic Transport Aircraft Configurations Using Hydrogen (H2) and Methane (CH4) as Fuel

ABSTRACT

The acceptability of alternate fuels for future commercial transport aircraft are discussed. Using both liquid hydrogen and methane, several aircraft configurations are developed and energy consumption, aircraft weights, range and payload are determined and compared to a conventional Boeing 747-100 aircraft. The results shown that liquid hydrogen can be used to reduce aircraft energy consumption and that methane offers no advantage over JP or hydrogen fuel. (Report)

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B.6.1.2.92 N79-32637/7 Sep 1979
NASA, Langley Research Center, Hampton, VA
Witcofski, R.D.
Title: Comparison of Alternate Fuels for Aircraft

ABSTRACT

Liquid hydrogen, liquid methane, and synthetic aviation kerosene were assessed as alternate fuels for aircraft in terms of cost, capital requirements, and energy resource utilization. Fuel transmission and airport storage and distribution facilities are considered. Environmental emissions and safety aspects of fuel selection are discussed and detailed descriptions of various fuel production and liquefaction processes are given. Technological deficiencies are identified. (Paper: Presented at the International Dglr/Dflr Symp. On Hydrogen in Air Transportation, Stuttgart, Germany, 11-14 Sep 1979)

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B.6.1.2.03 EI7607431?C Mar 1976
NASA, Langley Research Center, Hampton, VA
Wieting, Allan R.
Title: Thermal-Structural Design/Analysis of an Airframe-Integrated Hydrogen-Cooled Scramjet

ABSTRACT

This paper presents the salient features of a preliminary thermal-structural design and analysis study of a hydrogen-fueled, regeneratively cooled, airframe-integrated scramjet. State-of-the-art analytical methods consisting of lumped system and finite-difference steady-state thermal analyses and a finite-element structural analysis were used. The results of the study indicated that this scramjet concept is viable from both a structural mass and cooling requirement standpoint. (Paper: J Aircr v 13 n 3 Mar 1976)

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B.6.1.2.04 73A43490 Sep 1973
NASA, Langley Research Center, Hampton, VA
Small, W.J.
Title: Potential of Hydrogen Fuel for Future Air Transportation Systems

ABSTRACT

Recent studies have shown that hydrogen fuel can yield spectacular improvements in aircraft performance in addition to its more widely discussed environmental advantages. The characteristics of subsonic, supersonic, and hypersonic transport aircraft using hydrogen fuel are discussed, and their performance and environmental impact are compared to that of similar aircraft using conventional fuel. (Paper: Intersociety Conference on Transportation, 2nd, Denver, Colo., Sept 23-27, 1973)

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B.6.1.2.05 75A47405 May 1975
Lockheed-California Co., Burbank, CA
Jensen, R.
Title: Liquid Hydrogen - Fuel of the Future --- for Aircraft

ABSTRACT

Liquid hydrogen is compared to petroleum-based fuels for propulsion of various types of vehicles. Aircraft design, performance and cost are considered. Fuel production and handling are discussed. (Paper: 24th

Ann. Conf. Soc. of Allied Weight Engineers, Seattle, May 5-7, 1975)

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B.6.1.2.96 N74-32432/8SL 1 Aug 74
National Aeronautics and Space Administration, Langley Research Center, Langley Station, VA
Snow, D.B.
Title: A Study of Subsonic Transport Aircraft Configurations Using Hydrogen ($H_2$) and Methane ($CH_4$) as Fuel

ABSTRACT

The acceptability of alternate fuels for future commercial transport aircraft are discussed. Using both liquid hydrogen and methane, several aircraft configurations are developed and energy consumption, aircraft weights, range and payload are determined and compared to a conventional Boeing 747-100 aircraft. The results show that liquid hydrogen can be used to reduce aircraft energy consumption and that methane offers no advantage over JP or hydrogen fuel. (Report)

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B.6.1.2.97 77N28322 1977
NASA, Langley Research Center, Langley Station, VA
Witcofski, R.D.
Title: Alternate Aircraft Fuels: Prospects and Operational Implications

ABSTRACT

The potential use of coal-derived aviation fuels was assessed. The studies addressed the prices and thermal efficiencies associated with the production of coal-derived aviation kerosene, liquid methane and liquid hydrogen and the air terminal requirements and subsonic transport performance when utilizing liquid hydrogen. The fuel production studies indicated that liquid methane can be produced at a lower price and with a higher thermal efficiency than aviation kerosene or liquid hydrogen. Ground facilities of liquefaction, storage, distribution and refueling of liquid hydrogen fueled aircraft at airports appear technically feasible. The aircraft studies indicate modest onboard energy savings for hydrogen compared to conventional fuels. Liquid hydrogen was found to be superior to both aviation kerosene and liquid methane from the standpoint of aircraft engine emissions. (Report)

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B.6.1.2.98 79N10026*# Jan 1977
General Dynamics Convair, San Diego, Calif.
Oman, B. H.
Title: Vehicle Design Evaluation Program (VDEP).

ABSTRACT

The NASA Langley Research Center vehicle design evaluation program (VDEP-2) was expanded by incorporating into the program a capability to conduct preliminary design studies on subsonic commercial transport type aircraft using both JP and such alternate fuels as hydrogen and methane. (Report)

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B.6.1.2.99 79A21908 Dec 1978
Royal Aeronautical Society and American Institute of Aeronautics and Astronautics
UNK
Title: Energy and Aerospace: Proceedings of the Anglo/American Conference, London, England, December 5 - 7, 1978

ABSTRACT

The energy research and development program of the U.S. is considered along with aspects of energy research and development on the basis of a UK view, prospects for reducing the fuel consumption of civil aircraft, the NASA aircraft energy efficiency program, aviation fuel from coal, commercial transports in the 1980s. (Conference Proceedings)

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B.6.1.2.100 N76-23249/5ST 6 Oct 75
ECON, Inc., Princeton, NJ
Unknown
Title: An Assessment of the Benefits of the Use of NASA Developed Fuel Conservative Technology in the US Commercial Aircraft Fleet

ABSTRACT

Cost and benefits of a fuel conservative aircraft technology program proposed by NASA are estimated. NASA defined six separate technology elements for the proposed program: (a) engine component improvement (b) composite structures (c) turboprops (d) laminar flow control (e) fuel conservative engine and (f) fuel conservative transport. (Report)

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B.6.1.2.101 78N28051# Sept 1977
Rand Corp., Santa Monica, Calif
Mikolowsky, W. T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

The specific objectives of this work were: Evaluate very large airplanes (VLAs) in the context of existing and possible future Air Force missions, and determine the most attractive alternative fuel for airplanes of this type. (Report)

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B.6.1.2.102 77N33154# Dec 1976
Rand Corp., Santa Monica, Calif
Mikolowsky, W. T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels: Executive Summary

ABSTRACT

This report summarizes the military utility of very large airplanes (over 1 million pounds gross weight) and examined several alternative fuels that could be used by such airplanes. (Executive Summary Report)

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B.6.1.2.103 77A4721# Sept 1977
Rand Corp., Washington, D.C.
Mikolowsky, W. T.
Title: The Military Utility of Very Large Airplanes and Alternative Fuels

ABSTRACT

Study evaluating very large airplanes (VLA°s) in the context of Air Force missions and the most attractive alternative fuel for these airplanes. The chemical fuel alternatives considered are liquid hydrogen, liquid methane, and synthetic JP, each of which can be readily synthesized from coal. The nuclear-fueled VLA was a fourth candidate aircraft. Concluded that overall conventional hydrocarbon jet fuel remains the most attractive fuel for military aircraft. Nuclear propulsion is attractive only for station-keeping missions requiring large station radii. (Paper: Astronautics and Aeronautics, vol. 15, Sept. 1977)

B.6.1.2.104 76A45397# Sept 1976
Rand Corp., Washington, D.C.
Mikolowsky, W. T.
Title: An Evaluation of Very Large Airplanes and Alternative Fuels

ABSTRACT

The paper examines the potential of very large airplanes (VLA) in the context of Air Force missions. Synthetic jet fuel, liquid methane, liquid hydrogen, and nuclear propulsion are the fuel alternatives selected for detailed analysis. It is shown that for most military applications, VLA with gross weight exceeding one million pounds promise to be superior to contemporary vehicles in terms of cost and energy effectiveness. The conventional jet fuel (made from coal, oil shale or crude oil) appears to be the most effective at least up to year 2000. Nuclear propulsion is attractive only for station keeping missions requiring larger station radii (greater than about 4000 nautical miles). (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Dallas, Tex., Sept 27-29 1976.)

B.6.1.2.105 77A36434 Apr 1977
ERDA, Washington, D.C.
Seamans, R. C., Jr.
Title: Energy and Aerospace (Sixty Fifth Wilbur and Orville Wright Memorial Lecture) Aerospace Contributions to Energy Conservation

ABSTRACT

Some ways that aerospace science can contribute to conserving or obtaining energy are discussed. Developments leading to increased fuel efficiency and the possibility of using alternative fuels for aviation are considered, as is the use of fuel-efficient lighter-than-air vehicles for transporting heavy cargo. (Paper: Aeronautical Journal, Vol 81, Apr 1977)

B.6.1.2.106 N75-30145/7ST Nov 74
Boeing Vertol Co., Philadelphia, Pa
Widdison, C. A.
Title: Conceptual Design Study of a 1985 Commercial STOL Tilt Rotor Transport

ABSTRACT

Results of conceptual engineering design studies of a STOL tilt rotor commercial aircraft for the 1985 time frame are presented. The details of aircraft size, performance, flying qualities, noise, and cost are included. The savings in terms of fuel economy resulting from STOL operations compared with VTOL vehicles are determined. (Report)

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B.6.1.2.107 75A26000 Sept 1974
Aerospace Developments, London, England
Wood, J. E. R.
Title: The Aerospace Developments Concept - Airship Design for Natural Gas Transport

ABSTRACT

A project assessing the viability of using airships for the transport of natural gas, completing the design of the airship and its associated ground structures, and carrying out a continuing economic analysis on itself is described. Unnecessary expense incurred in cryogenic tanker natural gas transport, the choice of type of LTA aircraft (supported monocoque), the basic system of construction featuring the 'unitary panel', powering requirements, the building facility for the craft, gassing and degassing the ship, and the prototype program are discussed. (Paper: Interagency Workshop on Lighter than Air Vehicles, Monterey, Calif., September 9-13, 1974, Proceedings)

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B.6.1.2.108 N76-29218/4ST May 1976
NASA, Langley Research Center, Langley Station, Va
Schrader, O. E.
Title: Application of Advanced Technology to Future Long-Range Aircraft

ABSTRACT

An assessment is presented of three separate programs that have incorporated advanced technology into the design of long-range passenger and cargo aircraft. The first technology centers around the use of a

span-loaded cargo aircraft with the payload distributed along the wing. The second technology is the application of laminar flow control to the aircraft to reduce the aerodynamic drag. The last program evaluates the production of alternate aircraft fuels from coal and the use of liquid hydrogen as an aircraft fuel. (Paper: 35th Ann. Conf. of the Soc. of Allied Weight Engr., Inc., Philadelphia, 24-26 May 1976)

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B.6.1.2.109 78A31207# 1978
Lockheed-California Co, Burbank, Calif
Hopps, R. H.
Title: Fuel Efficiency -- Where We Are Heading in the Design of Future Jet Transports

ABSTRACT

Three potential technologies for the 1980s are discussed: laminar flow control, advanced turboprops, and liquid hydrogen. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3-4 1977)

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B.6.1.2.110 AD-C016 288L 15 Sep 77 - 28 Mar 78
Boeing Aerospace Co., Seattle, WA, Boeing Military Airplane Development
Smith, Robert H.
Title: Innovative Strategic Aircraft Design Study

ABSTRACT

Six conceptual designs of strategic bomber aircraft for initial operational availability around the year 2000 were developed from innovative applications of advanced technologies. Airframe technology levels were projected to a 1995 maturity. (Final Report - Secret)

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B.6.1.2.111 SSIE No: XH 870082 1 10/77
NASA, Office of Aeronautics and Space Technology, Ames Research Center, Moffett Field, California, 94035,
Unknown
Title: Hybrid Rotor/Airship Flight Controls and Aerodynamic Performance

ABSTRACT

The objective of this RTOP is to provide aerodynamics, flight dynamics, and control systems technology development for promising modern airship concepts. Emphasis will be on the flight dynamics simulation of an airship concept employing substantial amounts of rotor lift and designed for transporting heavy payloads over short ranges. (Plan)

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B.6.1.2.112 79A53261 Sept 1979
Franklin Institute, Franklin Research Center, Philadelphia, Pa
Okress, E. C.
Title: Solar Thermal Aerostat Research Station (STARS)

ABSTRACT

The paper introduces the concept of a large, constant volume, solar powered, warm air, spherical, rigid, navigable aerostat able to remain aloft in the stratosphere for many years. Capable of performing on a 24 hour basis, a wide variety of missions, including surveillance, solar energy generation and radiation of particle beam transmission to the surface, environmental monitoring, local weather modifications, long-range communications and microwave power relay, night time target illumination, weapons platform of high energy requirements, platform for aircraft, launch and recovery, platform for space hardware and reusable spacecraft catapult launching, etc. With solar energized compressed air and electric thrusters it will be capable of 24 hours navigation and hovering in the stratosphere in most regions about the earth, and throughout the year, for many (e.g., about 10) years. (Paper: International Astronautical Federation, International Astronautical Congress, 30th Munich, West Germany, Sept. 17-22, 1979)

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B.6.1.2.113 N76-31090/2ST May 76
Aerospace Corp., El Segundo, Calif., Energy and Transportation Div.
Unknown
Title: Effect of Aircraft Technology Improvements on Intercity Energy Use

ABSTRACT

Examination of energy consumption in short haul, high density intercity transportation is made in relation to changes in aeronautical technology. Improvements or changes in the technology of competitive modes are also included. Certain improvements in air traffic control precedures were included to determine their effectiveness in saving energy along with a fuel efficient turboprop short haul aircraft concept. (Final Report)

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B.6.1.2.114 73X71028# 1 Jul. 1971 - 28 Feb. 1972
United Aircraft Corp., East Hartford, Conn
Robson, F. L.
Title: Analysis of Nuclear Propulsion and Power-Conversion Systems for Large Subsonic Aircraft (U)

ABSTRACT

Studies made of alternate conceptual propulsion and power conversion systems identify two systems that are the most suitable for converting nuclear energy to aircraft propulsion. Performance of these systems has been defined and a logical program leading to the demonstration of the concepts has been identified. Approach was based upon technology currently available as well as attainable in the 1975-1980 time period. Take-off, climb, and cruise thrust requirements for a one-million-pound aircraft designed for cruising at M = 0.7, 30,000 ft were estimated. Take-off, climb to cruise altitude, descent and landing use normal chemical fuel, whereas only the 30-day cruise requirement would be performed using the nuclear reacter heat source. (Final Report - (Conf.)

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B.6.1.2.115 79A23825# Apr 1979
American Institute of Aeronautics and Astronautics, Inc., 1979
Layton, J. P.
Title: Advanced Nuclear Systems for Large Aircraft

ABSTRACT

An approach to the interdependent definition of future military missions and credible nuclear aircraft based on a carefully conceived program of analysis, research, and technology is outlined. Particular consideration is given to advanced nuclear aircraft concepts, including heavier-than-air and lighter-than-air. Aspects of operational safety and emphasized. (Paper: AIAA Very Large Vehicle Conference, Arlington, Va, April 26-27, 1979)

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B.6.1.2.116 79A47919# Aug 1979
Airships International Inc., Tustin, Calif.
Pavlecka, V. H.
Title: Air Buoyant Vehicles - Energy Efficient Aircraft

ABSTRACT

Energy and overall economic considerations of airplane and two airships in terms of a cost intensity parameter indicate that metalclad airships can now be constructed and operated with an economic superiority to wide-body jet transports. Comparisons are based on computer printouts of actual flights to 747F and on design studies of MC-80 and MC-100. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, New York, N.Y., Aug. 20-22, 1979)

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B.6.1.2.117 EI761171865 May 1976
Bendix Corp.,
Long, Moses J.
Title: Powered Wheels for Aircraft

ABSTRACT

There are several reasons for using powered wheels on auxiliary power unit for aircraft ground movements in lieu of the main engines. The main benefit is energy conservation. This paper presents the engineering details of a drive system being developed by the Bendix Corporation under contract from NASA Langley Research Center. (Paper: SAE MTG May 18-20 1976)

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B.6.1.2.118 N76-20063/7ST Mar 76
Hudson Inst., Inc., Croton-on-Hudson, N.Y.
Unknown
Title: The Outlook for Aeronautics, 1980 - 2000 -- Study Report

ABSTRACT

Trends in civil and military aviation in the period 1980-2000 are examined in terms of the role that NASA should play in aeronautical research and development during this period. Factors considered include the character of the aircraft to be developed, and the technology advances that will be required. (Report)

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B.6.1.2.119 EI72X010154 May 1971
Univ of Surrey, Guildford, England
Mowforth, E.
Title: Design Study for a Freight Carrying Airship

ABSTRACT

Analysis investigates briefly the applicability of the large airship in selected categories of freight transport. Most immediately profitable field of operation would be in the movement of large indivisible loads over moderate distances. Proposed airship would have a gas capacity of 30 million cu ft and be capable of carrying up to 280 t over 1600 mi at 5000 ft or up to 400 t over shorter distances at 2000 ft. Modes of propulsion, operation, and construction are described. (Paper: Aeron J v 75 n 723 Mar 1971)

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B.6.1.2.120 N75-10943/9ST Jan 74
Lockheed California Co, Burbank
Brewer, G. D.
Title: Advanced Supersonic Technology Concept Study: Hydrogen Fueled Configuration

ABSTRACT

Conceptual designs of hydrogen fueled supersonic transport configurations developed and compared with equivalent Jet A-1 fueled vehicles to determine the economic and performance potential of liquid hydrogen as an alternate fuel. Evaluation of costs and environmental

considerations. Technology development requirements presented. (Final Report)

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B.6.1.2.121 N79-13207/8 Jan 75
Lockheed-California Co., Burbank
Brewer, G. D.
Title: Study of the Application of Hydrogen Fuel to Long-Range Subsonic Transport Aircraft Volume 1: Summary

ABSTRACT

Feasibility of using liquid hydrogen in long range, subsonic transport aircraft assessed. Comparisons of physical, performance, and economic parameters of the LH2 fueled designs with conventionally fueled aircraft. Design studies to determine characteristics for hydrogen related systems required on board the aircraft. Include material, structural, and thermodynamic requirements of cryogenic fuel tanks and fuel systems with the structural support and thermal protection systems. (Final Report)

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B.6.1.2.122 N76-19144/4ST Jan 76
Lockheed-California Co, Burbank
Brewer, G. D.
Title: Study of LH2 Fueled Subsonic Passenger Transport Aircraft

ABSTRACT

Liquid hydrogen as fuel in subsonic transport aircraft investigated to explore aircraft sizes. Both liquid hydrogen and conventionally fueled aircraft in each mission category compared on the basis of weight, size, cost, energy utilization, and noise. (Final Report)

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B.6.1.2.123 N75-30162/0ST Jan 75
Lockheed-California Co., Burbank
Brewer, G. D.
Title: Study of the Application of Hydrogen Fuel to Long-Range Subsonic Transport Aircraft, Volume 2

ABSTRACT

Feasibility and potential advantages/disadvantages of liquid hydrogen in long range, subsonic transport aircraft studied. Liquid hydrogen and Jet A fueled aircraft compared on basis of weight, size, energy utilization, cost, noise, emissions, safety, and operational characteristics. Program of technology development formulated. (Final Report)

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B.6.1.2.124 N78-21086/9ST Jul 78
Lockheed-California Co., Burbank
Brewer, G. D.
Title: Study of Fuel Systems for LH2-Fueled Subsonic Transport Aircraft, Volume 2

ABSTRACT

Engine concepts examined for use with hydrogen fuel in aircraft. Candidate tank structure and cryogenic insulation systems evaluated. Designs of aircraft fuel system (pumps, lines, valves, regulators, and heat exchangers) received attention. Designs of boost pumps mounted in the LH2 tanks, high pressure pump mounted on the engine were defined. Aircraft compared with conventionally fueled counterpart. (Final Report)

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B.6.1.2.125 76A39843*# Aug 1976
NASA, Ames Research Center, Moffett Field, Calif.
Ardema, M. D.
Title: Conceptual Design of Reduced Energy Transports

ABSTRACT

Paper reports the results of a conceptual design study of new near-term fuel conservative aircraft. Supercritical wing technology and advanced engine cycles were assumed. Based on the results of the parametric study, a reduced energy configuration has a higher aspect ratio wing with lower sweep, and cruises at a slightly lower Mach number. It yields about 30% more seat-miles/gal than current wide-body aircraft. (Paper: Journal of Aircraft, Vol 13, Aug 1976)

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B.6.1.2.126 AD-A041 234/6ST Jun 77
Boeing Aerospace Co., Seattle, Wash.
Barber, E. A.
Title,: Innovative Aircraft Design Study (IADS), Task II, Volume 1

ABSTRACT

The study was concerned with the conceptual design and evaluation of military heavy logistics transport aircraft entering service in the 1990-2000 time period. An advanced technology review, including evaluations and sensitivity analyses, was accomplished. These studies indicated that substantial gains were possible in reducing operating costs by incorporating both the low risk technology and innovative designs available in 1985, and advanced technology such as composite structures available at a later time. (Final Report)

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B.6.1.2.127 SSIE: CQF246430 2 1/76 to Cont
Raven Industries Inc., 205 E. 6th St., Sioux Falls, South Dakota, 57101
Beemer, J. D.
Title: High-Altitude Tethered Balloon Design and Fabrication

ABSTRACT

Advanced high-altitude tethered balloon system for surveillance and monitoring. Design and fabricate a balloon capable of being raised to and tethered at an altitude of 20 km. Research development and flight at 20 km will prove the feasibility of operating tethered ballons under these conditions on an operational basis. (Plan)

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B.6.1.2.128 AD-A061 712 Sep 78
Oklahoma Univ., Norman School of Aerospace Mechanical and Nuclear Engineering
Bergey, Karl H.
Title: Assessment of New Technologies for General Aviation Aircraft

ABSTRACT

This report assesses the use of new technologies in general aviation aircraft. It also investigates the potential for a technology demonstration program aimed specifically at the needs of general aviation. It concludes that at least 46 new or under-used technologies could be incorporated in general aviation aircraft with benefit to safety, performance and cost. (Final Report)

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B.6.1.2.129 SSIE: ZQF136750 2 2/75
Air Force, Flight Dynamics Lab., Wright Patterson AFB, Dayton, Ohio, 45433
Brown, S. L.
Title: New Strategic Airlift Concepts

ABSTRACT

Advanced technologies with application to very large military aircraft will be identified by the technology divisions (flight mechanics, flight control, structures, vehicle equipment and vehicle dynamics). Design data and relative state of advancement for each technology will be provided for incorporation in in-house design studies. These studies will identify the high leverage technologies and critical mission areas for further investigations. (Plan)

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B.6.1.2.130 N76-31079/6ST Jun 76
United Air Lines, Inc., San Francisco, Calif
Coykendall, R. E.
Title: Study of Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System

ABSTRACT

Economics studies were conducted for three general fuel conserving options: (1) improving fuel consumption characteristics of existing aircraft via retrofit modifications; (2) introducing fuel efficient

derivations of existing production aircraft and/or introducing fuel efficient, current state-of-the-art new aircraft; and (3) introducing an advanced state-of-the-art turboprop airplane. (Report)

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B.6.1.2.131 78A31206*# Oct 1977
Boeing Commercial Airplane Co., Seattle, Wash.
Davenport, F. J.
Title,: Fuel Saving Potential of Mach 0.8 Twin Engine Prop-Fan Transports

ABSTRACT

The fuel saving and economic potentials of the prop-fan high speed propeller concept have been evaluated for twin engine commercial transport airplanes designed for 3333.6 km range, 180 passengers, and Mach 0.8 cruise. A fuel saving of 9.7% at the design range was estimated for a prop fan aircraft having wing mounted engines, while a 5.8% saving was estimated for a design having the engines mounted on the aft body. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4, 1977, Proceedings)

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B.6.1.2.132 N76-23250/3ST Nov 75
Boeing Vertol Co., Philadelphia, Pa
Davis, S. J.
Title: Identifying and Analyzing Methods for Reducing the Energy Consumption of Helicopters

ABSTRACT

The results are presented of a study to identify those helicopter technology areas which would result in the largest energy (or fuel) savings when applied to large tandem (100 passenger) civil helicopters in the 1985 time frame. (Report)

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B.6.1.2.133 N77-27104/7ST Dec 76
Boeing Vertol Co., Philadelphia, Pa
Davis, S. J.
Title: Identifying and Analyzing Methods for Reducing the Energy Consumption of Helicopters

ABSTRACT

Reductions in helicopter energy consumption can be accomplished through the use of advanced technology in the areas of power plant design, improved rotor efficiency, reduced parasite drag, and reduced structural empty weight. (Report)

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B.6.1.2.134 80A14700*# Nov 1979
NASA, Langley Research Center, Langley Station, Va
Driver, C.
Title: The Role of Technology as Air Transportation Faces the Fuel Situation

ABSTRACT

Brief description of the existing fuel situation, the progress made in fuel reduction, near-term prospects for further reductions, and long-term prospects for even further reductions all primarily from the technology point of view. (Paper: Upper Midwest Council, Meeting, Minneapolis, Minn., Nov 1, 1979)

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B.6.1.2.135 SSIE: ZQF582770 10/78 to 12/79
Air Force, Geophysics Lab., L.G. Hanscom Field, Bedford, Massachusetts, 01731
Dwyer, J. F.
Title: Shape Stress Analysis of Natural Shape Balloons

ABSTRACT

Objective - A general computer code for the generation of natural shape balloon designs and the analysis of such balloons under representative flight conditions will be written and demonstrated for selected practical problems. Will enable rapid evaluation of balloon requirements for proposed efforts. (Plan)

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B.6.1.2.136 SSIE: CQF-461870-2 5/78 to 8/80
McDonnell Douglas Corp., 3855 Lakewood Blvd. Long Beach, California 90808
Peacock, T.
Title: Fuel/Engine/Airframe Cost Tradeoff Studies

ABSTRACT

Determine the optimum aviation turbine fuel properties based upon tradeoff/relationship between fuel, engine and airframe so that an otpimized solution to the alternate fuels problem may be formulated. Refinery operation cost factors. estimates of combustion and fuel system modifications and airframe alterations will be made. (Plan)

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B.6.1.2.137 AD-806 811/6ST Sep 66
Air Force AERO Propulsion Lab., Wright Patterson AFB, Ohio
Elrod, Charles W.
Title: Hydrogen-JP-4 Dual Fuel Concept for the C-5A Aircraft

ABSTRACT

This report presents an overall evaluation of the safety, ground handling, tankage, and use aspects of the dual use of hydrogen and JP-4 fuel. The report shows that the possibility of the dual-fuel concept for this aircraft definitely exists; the potential payoff may be doubtful, but the feasibility exists. (Report)

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B.6.1.2.138 79A16960*# Dec 1978
NASA, Langley Research Center, Hampton, Va.
Bower, R. E.
Title: Future Directions in Aeronautical Research and Technology

ABSTRACT

The aeronautical R and D effort in NASA is discussed in conference proceedings. Consideration given to hypersonic propulsion and alternate fuels. (Paper: Proc. of Conf. on Diamond Jubilee of Powered flight: The Evolution of Aircraft Design, Dayton, Ohio, Dec 14-15, 1978)

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B.6.1.2.139 AD-693 529 1960
Unknown
Cheng Kuang-hua
Title: Composite Power Plant for High-Speed Aircraft

ABSTRACT

Explains the three common types of engines of high-speed aircraft: turbojet, ramjet, and liquid rocket engines, pointing out the shortcomings of each type. The paper then outlines the advantages of combining two types of engines for one aircraft, making the two types of engines complement each other's shortcomings. (Article: Edited trans. of Hang K'ung Chih Shih (Mainland China), nl 1960)

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B.6.1.2.140 78N29064*# 1978
NASA, Langley Research Center, Langley Station, Va.
Nagel, A. L.
Title: Studies of Advanced Transport Aircraft

ABSTRACT

Several concepts for possible future airplanes, including all-wing distributed-load airplanes, multibody airplanes, a long-range laminar flow control airplane, a nuclear-powered airplane designed for towing conventionally powered airplanes during long-range cruise, and an aerial transportation system comprised of continuously flying liner airplanes operated in conjunction with short-range feeder airplanes are described. Performance and economic advantages of each concept are indicated. Further research is recommended in the following areas: all-wing airplane aerodynamics, aerial rendezvous, nuclear aircraft engines, air-cushion landing systems and laminar flow control, as well as the basic research discipline areas of aerodynamics, structures, propulsion, avionics, and computer applications. (Article: CTOL Transport Technol., 1978)

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B.6.1.2.141 79A20485# 1979
Aeronautical Systems Div., Wright Patterson AFB, Ohio
Noggle, L. W.
Title: Large-Vehicle Concepts Aircraft Design

ABSTRACT

The paper briefly surveys most of the very large vehicle concepts examined by Air Force, Navy, NASA, and industry in recent study efforts. Some of these include a conventional aircraft capable of carrying a 400,000-lb load over a range of 6200 n. mi., a laminar flow control aircraft, nuclear-powered aircraft with active-controls technology, swept-wing space-distributed-load aircraft capable of carrying a million pounds of payload, wing-in-ground-effect vehicles, a power-augmented-ram/wing-in-ground-effect vehicle, and the heavy lift airship. (Article: Astronautics and Aeronautics, Vol. 17, Apr 1979)

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B.6.1.2.142 N79-28134/1ST Jun 79
Kentron International, Inc., Hampton, VA Technical Center
Turriziani, R. V.
Title: Sensitivity Study for a Remotely Piloted Microwave Powered Sailplane Used as a High Altitude Observation

ABSTRACT

The sensitivity of several performance characteristics of a proposed design for a microwave-powered, remotely piloted, high-altitude sailplane to changes in independently varied design parameters was investigated. Results were expressed as variations from baseline values of range, final climb altitude and onboard storage of radiated energy. (Report)

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B.6.1.2.143 SSIE: ZH 870140 1 10/77
NASA, Office of Aeronautics and Space Technology, Langley Research Center, Hampton, VA, 23665
Unknown
Title: Advanced Transport Aircraft Technology

ABSTRACT

The objective will be to provide technology for advanced transport aircraft through: (1) studies of all-new total aircraft configuration concepts; (2) studies of incorporating promising new subsystem concepts in advanced aircraft configurations; and (3) precursor studies to generate

the technology identified as critical to advanced subsystems where such technology needs are not otherwise being addressd. These studies covering future needs for both passenger and cargo transports, are aimed at improving aircraft economics, fuel use, noise, emissions and airport congestion. Subsystem areas involve advanced structures, advanced aerodynamics, and advanced propulsion systems including use of alternate fuels. (Plan)

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B.6.1.2.144 76A31424 Jan 1976
Aereon Corp., Princeton, N.J.
Miller, W. M., Jr.
Title: The Lifting Body Airship -- A Future Delivery System for Remote Area Logistics

ABSTRACT

The problem of gaining access to natural resources located in remote or almost inaccessible regions is considered on the basis of three criteria for an optimal solution. It is argued that the Lifting Body Airship (LBA) uniquely meets these criteria and can provide remote area logistics for the developing world. Fuel efficiency and productivity are compared for conventional airships and CTOL, VTOL, C/STOL, and V/STOL LBAs. It is shown that the STOL LBA is unsurpassed in productivity while the V/STOL LBA is the most energy efficient vehicle. (Article: Canadian Aeronautics and Space Journal, vol. 2, Jan-Feb. 1976)

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B.6.1.2.145 75N17339 Feb 1975
NASA, Langley Research Center, Langley Station, VA
Nagel, A. L.
Title: Future Long-Range Transports: Prospects for Improved Fuel Efficiency

ABSTRACT

A status report is provided on current thinking concerning potential improvements in fuel efficiency and possible alternate fuels. Topics reviewed are: (1) historical trends in airplane efficiency; (2) technological opportunities including supercritical aerodynamics, (3) vortex diffusers, (4) composite materials, (5) propulsion systems, (6) active controls and terminal-area operations; (7) unconventional design concepts, and (8) hydrogen-fueled airplane. (Progress Report)

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B.6.1.2.146 76A45781 Nov 1975
Stanford University Stanford, Calif.
Shevell, R. S.
Title: Advanced Subsonic Aircraft - The Technological Response to Future Air Transportation Needs

ABSTRACT

The history of transport aircraft is reviewed as are technological advances in drag reduction, weight reduction, improvement in lift coefficient, etc. Some developments in air transportation which raised great expectations but have failed to have a significant impact are reviewed: laminar flow control, nuclear powered aircraft. STOL and the supersonic transport. The feasibility of hydrogen-fueled aircraft is discussed. (Paper: The Future of Aeronautical Transportation; Proceedings of the Princeton University Conference Princeton, N.J. November 10, 11, 1975)

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B.6.1.2.147 73A23682 1972
Unknown
Tolztych, I.
Title: Civil Transport Aircraft Future Design Trends, Discussing Subsonic, Supersonic, Hypersonic and V/STOL Aircraft, Engine Design, Fuels and Noise Reduction

ABSTRACT

Evaluation of the technical and economic efficiency of types of aircraft likely to be developed in the coming decades. The problem of evaluating the degree of structural maturity and perfection of passenger aircraft and their economic efficiency is discussed. Problems connected with the development of increasingly high-speed subsonic aircraft, supersonic, and ultimately, hypersonic aircraft are discussed, including engine designs, fuels, and noise reduction. In addition, the use of VSTOLs to provide more efficient transportation between airports and city centers is considered. (German translation of Russian article, Technisch-oekonomische Information, der zivilen Luftfahrt, Vol. 8 no. 9, 1972.)

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B.6.1.2.148 N76-28203/7ST Jun 76
United Technologies Research Center, East Hartford, Conn.
Gobetz, F. W.
Title: Cost/Benefit Trade-Offs for Reducing the Energy Consumption of Commercial Air Transportation (Recat)

ABSTRACT

A study performed to evaluate the opportunities for reducing the energy requirements of the U.S. air passenger transport system through improved operational techniques, modified in-service aircraft, derivatives of current production models, or new aircraft using either current or advanced technology. Alternatives investigated individually to test its potential for fuel conservation out to the year 2000. (Final Report) (Note: Summary Report - N7628204/5ST)

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B.6.1.2.149 AD-A016 393/1ST Aug 75
Air Force Inst. of Tech., Wright Patterson AFB, Ohio, School of Systems and Logistics
O'Gorman, Kenneth P.
Title: An Evaluation of the Operational Capabilities and Fuel Conservation Implications of Using Remotely Piloted Vehicles, Advanced Aircraft Flight Simulators, and Lighter-Than-Air Aircraft

ABSTRACT

This thesis researched literature in three areas -- remotely piloted vehicles, advanced aircraft simulators, and lighter-than-air aircraft -- to explore their operational capabilities and to evaluate any fuel energy benefits that may be derived from their use. The thesis concludes that remotely piloted vehicles and advanced aircraft flight simulators can be utilized to meet various operational requirements while reducing fuel consumption. However, lighter-than-air aircraft designs do not currently possess the technology needed to accomplish operational requirements while reducing fuel consumption. (Master's Thesis)

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B.6.1.2.150 AD-C005376 Feb 1976
Rand Corp, Santa Monica, Calif.
Harris, E. D.
Title: Potential for Advanced Technology to Reduce Military Aircraft Energy Consumption for 1975-2000

ABSTRACT

Technological options for reducing peacetime USAF jet fuel consumption in this century are evaluated. Half the projected reduction comes from changing to the B-1 with hypothetical efficient tanker, and another 30% from new energy-efficient fighter/attack/reconnaissance planes. Lightweight airframe structural materials hold promise mainly for new designs. Variable cycle and tuboprop engines do not offer substantial fuel savings. Reengining the C-141S with TF-39 turbofan engines could start now. Also recommended: limiting military airlift to higher value cargo; shifting more to the C-5; shorter mission legs; increased load factor; cutting training flights as far as practicable. RPVS would produce sizable savings only when replacing manned missions. (Report (Secret))

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B.6.1.2.151 AD-A079 320/8 Aug 78 - Sep 79
Nero and Associates, Inc. Portland, OR
Linstone, Harold A.
Title: Technology Assessment of Low Energy Vehicles

ABSTRACT

Key suggested steps for U.S. Coast Guard energy savings include the LTAV, an energy monitoring system, computer-aided mission planning, and production facility to serve eastern and southeastern disticts. Improved power plant and engine component design and remote sensing and communications systems offer other technological opportunities for energy savings. (Final Report)

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B.6.1.2.152 [illegible] July 1979
NASA, Langley Research Center, Langley Station, Va
Conner, D. W.
Title: CTOL Concepts and Technology Development

ABSTRACT

Various developments in the Aircraft Energy Efficiency (ACEE) program are discussed. Terminal-area operations are considered with emphasis on the Terminal Configured Vehicle program. Consideration is also given to aircraft systems studies and economics (including noise reduction programs), coal-derived fuels for aviation systems (including LH2-fueled aircraft), and transport-aircraft concepts (including laminar flow control). (Paper: Astronautics and Aeronautics, Vol. 16, July-Aug. 1978)

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B.6.1.2.153 AD-A063 793 Nov 78
Advisory Group for Aerospace Research and Development
Neuilly-sur-Seine (France)
Kurzhals, P. R.
Title: Active Controls In Aircraft Design

ABSTRACT

Active controls offer the promise of significantly increased aircraft performance and operational capability. However, realization of these gains will require major changes in both the aircraft design approach and in the implementation of the flight control system. This AGARDograph addresses related control configured vehicle design and system considerations and summarizes representative applications of active control for fighter and transport aircraft. (Report)

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B.6 SYSTEMS AND OPERATIONAL CONCEPTS

B.6.2 ADVANCED OPERATIONAL CONCEPTS

B.6.2.1 NAVY FUNDED

B.6.2.1.1 RM790506 May 78
(Naval Material Command Program)
Unknown
Title: Energy Technology Assessment

ABSTRACT

Objective: This project provides a core program of analytic support on alternate energy resources, the management of energy resources and the development of new sources. Plans: identification of procedural areas for energy conservation in Navy aircraft will be initiated. Energy conservation analytical studies for design retrofit in Navy aircraft will be completed. Progress: Initiated analysis effort in aircraft energy conservation to identify promising procedural and design areas for various classes of existing aircraft. (Plan)

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B.6 SYSTEMS AND OPERATIONAL CONCEPTS

B.6.2 ADVANCED OPERATIONAL CONCEPTS

B.6.2.2 NON NAVY FUNDED

B.6.2.2.1 74A28898 Mar 1974
American Institute of Aeronautics and Astronautics, Inc., New York
Grey, J.
Title: Aircraft Fuel Conservation: An AIAA View: Proceedings of a Workshop Conference, Reston, VA, March 13 - 15, 1974

ABSTRACT

Aspects of aircraft fuel conservation are reviewed and discussed, and measures are recommended. Fuel conservation is discussed from the viewpoint of aircraft operations, design, propulsion systems, and fuels. Principal measures included: increasing load factors, achieved by revised rerouting and scheduling and routing patterns, matching aircraft size to demand, and better matching of total service to the market; research on advanced onboard avionics which will give the pilot sufficient information for him to make real-time selection of fuel-optimum flight profiles and airspeeds; drag reduction by the use of a properly designed small vertical "winglet" located just inboard of each wingtip; the implementation of supercritical aerodynamic wing designs; increase in frequency and tightening the standards of regular engine maintenance procedures; and modification of hydrocarbon fuel currently used by relaxation of freeze point and flash point specifications and by use of wider fractions and more aromatics.

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B.6.2.2.2 75A10259 Oct 1974
Unknown
Epstein, M.
Title: Powerplant Energy Management

ABSTRACT

Methods and developments aimed at improving the pilot's ability to schedule and control engine thrust in accordance with aircraft power requirements during various flight regimes. Methods vary from normal manual control by the pilot's throttle to a fully automated push-button system implemented by a combination of electronic and hydromechanical devices. Estimates of potential savings in fuel to result from optimum thrust management are presented. Also, modifications in current normal operational/airport practices are suggested, and their impact on fuel consumption is examined. (Paper: AIAA/SAE Propulsion Conference, 10th, San Diego, CA, Oct 21 - 23, 1974)

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B.6.2.2.3 76A27360 1976
Gesellschaft Fuer Internationalen Flugverkehr mbH, Berlin, East Germany
Gloeckner, B.
Title: Fuel Economy Measures - Possibilities and Problems. II

ABSTRACT

An investigation is conducted concerning the possibilities for saving fuel with the aid of approaches which involve a coopoeration of the ATC organization, the meteorological service, and the flying personnel. The effect of the meteorological-technical equipment on the efficiency of the air traffic is considered along with the effect of the approaches used in the weather forecasts. Possibilities for saving fuel in connection with the operational procedures used on the ground, during takeoff, and during the approach are also discussed. (Paper: Technisch-oekonomische Information der zivilen Luftfahrt, vol. 12, no. 1, 1976)

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B.6.2.2.4 76A32200 1976
NASA, Ames Research Center, Moffett Field, CA
Bull, J.S.
Title: Energy Management - The Delayed Flap Approach

ABSTRACT

Flight test evaluation of a Delayed Flap approach procedure intended to provide reductions in noise and fuel consumption is underway using the NASA CV-990 test aircraft. Approach is initiated at a high airspeed (240 kt) and in a drag configuration that allows for low thrust. The aircraft is flown along the conventional ILS glide slope. A Fast/Slow message display signals the pilot when to extend approach flaps, landing gear, and land flaps. Implementation of the procedure in commercial service may require the addition of a DME navigation aid co-located with the ILS glide slope transmitter. The Delayed Flap approach saves 250 lb of fuel over the Reduced Flap aproach. (Paper: Shell Aviation News, no. 434, 1976)

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B.6.2.2.5 74A17821 Aug 1974
NASA, Ames Research Center, Moffett Field, CA
Bull, J.S.
Title: Jet Transport Energy Management for Minimum Fuel Consumption and Noise Impact in the Terminal Area

ABSTRACT

Significant reductions in both noise and fuel consumption can be gained through careful tailoring of approach flightpath and airspeed profile, and the point at which the landing gear and flaps are lowered. A significant reduction in fuel consumption can be achieved with the 'Decelerating approach' concept. In this case, the approach is initiated at high airspeed and in a drag configuration that allows for low thrust. The landing flaps are then lowered at the appropriate time so that the airspeed slowly decelerates to V sub r at touchdown. The decelerating approach concept can be applied to constant glideslope flightpaths or segmented flightpaths such as the two-segment approach. (Paper: AIAA, Mechanics and Control of Flight Conference, Anaheim, CA, Aug 5 - 9, 1974)

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B.6.2.2.6 74A38315 Jun 1974
Unknown
Cuesta Alvarez, M.
Title: The Energy Crisis of Fuel and the Procedures of Cruising Flight

ABSTRACT

The energy crisis has focused attention on questions concerning the aircraft type with the lowest operational fuel consumption. Other important questions are related to the flight procedures which have optimum characteristics with regard to fuel consumption and total operational costs. It has been found that aircraft equipped with turbojet engines require the least amount of fuel for their operation. Details of turbojet design and operation are discussed along with questions of cruising range, thrust, and velocity, taking into account conditions at various altitudes. The characteristics of cruising flight undertaken under conditions of constant Mach number and constant altitude and of constant thrust and constant altitude are considered. (Paper: Revista de Aeronautica y Astronautica, vol. 34, June 1974, in Spanish)

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B.6.2.2.7 76A39525 1975
Unknown
Skripnichenko, S.
Title: Optimization of Aircraft Flight Regimes: Economical Flight Regimes

ABSTRACT

The book deals with cost analysis of transport aircraft flight and studies methods of calculating optimal flight regimes according to economic criteria and an energy approach. Operational constraints on flight paths and their influence on the flight regimes of subsonic and supersonic aircraft are examined. Fundamental economic indices are defined and discussed, and their dependence on time of flight and fuel consumption is traced. systems of equations are introduced for determining optimal regimes of cruising flight, altitude climb, and descent according to criteria of minimal trnasport costs with allowance for the mutual influence of the different flight stages. A method is studied for determining the optimal flight plan with consideration for the meteorological conditions on the path. (Book: Moscow, Izdatel°stvo Mashinostroenie, 1975. In Russian)

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B.6.2.2.8 74A37822 Aug 1974
Arizona State University, Tempe, AZ
Hedrick, J.K.
Title: Sensitivity of Suboptimal Fixed-Range Flight Paths

ABSTRACT

The sensitivity of fuel consumption to variations in aircraft and atmospheric parameters is investigated using aerodynamic data for a F-4 type aircraft and atmospheric data as specified by MIL-STD-210A. The flight paths considered contain a full throttle °Rutowski° energy climb arc, a classical minimum fuel cruise arc, and a maximum range glide arc. Aircraft parameters considered were maximum available thrust, induced and zero-lift drag coefficients, aircraft weight, and specific fuel consumption; atmospheric parameters considered were temperature and density variations. The results show that fuel consumption is sensitive to variations in the drag coefficients, aircrft weight, and specific fuel consumption. However, compensating by flying trajectories adjusted to be fuel optimal for each variation does not appreciably improve the fuel penalty. (Paper: AIAA, Mechanics and Control of Flight Conference, Anaheim, CA, Aug 5 - 9, 1974)

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B.6.2.2.9 AIAA: 79-1651 Aug 1979
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Overview of Technology Advancements for Energy Efficient Transports

ABSTRACT

Several research activities, conducted under NASA contract and directed toward improved fuel efficiency of commercial transports, are described. Emphasis is placed on advancements in aerodynamics and avionics/controls. Aerodynamic advancements include wing geometry variations and the winglet concept for improved lift/drag ratio, improved high-lift design, evaluation of natural laminar flow for drag reduction, and improved surfact coatings for reduced drag and surface erosion. Application of active controls; closed-loop flight path control using direct computer control of autopilot and autothrottle during ascent, cruise and descent; and the use of delayed flap operation and precise flight path control in the terminal area are included as potential improvements that rely on advanced avionics/controls. Evaluation of potential application is provided. (Paper: AIAA Atomospheric Flight Mechanics Conference and Special Session: Energy Efficient Aircraft Design, August 7 - 8 1979, Boulder, Colorado)

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B.6.2.2.10 AIAA: 80-0906 May 1980
Boeing Commercial Airplane Company, Seattle, Washington
Hanks, G. W.
Title: Technology Advancements for Energy Efficient Transports

ABSTRACT

Ongoing government and industry supported research activities pertaining to improved fuel efficiency of commercial transports are described with particular attention to advancements in aerodynamics, avionics, and controls technologies. Emphasis is placed on the interaction of these technologies with the structure, propulsion, and other technologies involved in transport configuration design, as well as the impact on airline operation they could imply. The potential benefits offered by these technologies and the research activities required to support their commitment to future models are discussed. (Paper: AIAA International Meeting and Technical Display "Global Technology 2000," May 6 - 8, 1980, Baltimore, MD)

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B.6.2.2.11 76A26606 May 1976
Unknown
Stern, J.
Title: Aircraft Propulsion - A Key to Fuel Conservation: An Aircraft Manufacturer's View

ABSTRACT

A range of possible approaches to fuel conservation is examined. The fuel contributions to direct operating costs, aircraft operations and maneuvers designed to conserve fuel, aircraft design variants, modifications, and refittings capable of aiding fuel conservation are discussed. Advantages of turbofan and turboprop derivatives of basic aircraft designs are examined. The RECAT (Reducing Energy Consumption of Commercial Air Transportation) program is outlined. The possible impact of recent technological advances in aircraft design (supercritical airfoils, optimized wing geometry, longitudinal stability augmentation, composites, new metallic structures) on fuel conservation is examined. (Paper: Society of Automotive Engineers, Air Transportation Meeting, New York, NY, May 18 - 20, 1976)

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B.6.2.2.12 78A38798 July 1977
Unknown
Killian, D.C.
Title: The Impact of Flight Simulators on U.S. Airlines

ABSTRACT

The use of flight simulators by U.S. airlines to conduct flight training and proficiency checks is discussed. It is estimated that use of the simulators for training and proficiency checks saved 204 million gallons of jet fuel during 1976. (Paper: Summer Comuter Simulation Conference, Chicago, Ill, July 18 - 20, 1977)

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B.6.2.2.13 N77 22072/0ST Jun 76
Douglas Aircraft Co., Inc. Long Beach, CA
Kraus, E.F.
Title: Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System. Volume 1: Technical Analysis

ABSTRACT

The effectiveness of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state-of-the-art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. (Final Report)

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B.6.2.2.14 N77-22072/0ST Jun 76
Douglas Aircraft Co., Inc., Long Beach, CA
Kraus, E.F.
Title: Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System. Volume 1: Technical Analysis

ABSTRACT

The effectiveness of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state-of-the-art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. (Final Report)

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B.6.2.2.15 77A12102*# May 1976
NASA, Ames Research Center, Moffett Field, CA
Williams, L.J.
Title: Air Transportation Energy Efficiency - Alternatives and Implications

ABSTRACT

Results from recent studies of air transportation energy efficiency alternatives are discussed. Included are aircraft operation, aircraft modification, derivative aircraft, and [illegible] aircraft. In order to obtain significant improvements in energy efficiency, new aircraft must truly exploit advanced technology in such areas as aerodynamics, composite structures, active controls, and advanced propulsion. (Paper: Society of Allied Weight Engineers, Annual Conference, 35th, Philadelphia, PA, May 24 - 26, 1976)

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B.6.2.2.16 AD-A081 182 Sep 79
Federal Aviation Administration, Office of Environment and Energy, Washington, DC,
Unknown
Title: Energy Conservation Potential of General Aviation Activity

ABSTRACT

Three approaches for reducing energy consumption were investigated: hardware modification, pilot education, and air traffic control. It is recommended that research into new aircraft engine designs, automatic mixture controls, conventional engine fuel saving improvements, composite materials development, and aerodynamic drag reduction continue. (Report)

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B.6.2.2.17 N74-20654/1 20 Dec 73
NASA, Langley Research Center, Langley Station, VA
Braslow, A. L.
Title: Aeronautical Fuel Conservation Possibilities for Advanced Subsonic Transports

ABSTRACT

Fuel conserving possibilities attainable through the application of advances in aeronautical technology to aircraft design are identified with the intent of stimulating NASA R and D and systems study activities in the various disciplinary areas. The material includes: drag reduction; weight

reduction; increased efficiency of main and auxiliary power systems; unconventional air transport of cargo; and operational changes. (Report)

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B.6.2.2.18 79N13192# Oct 1978
Advisory Group for Aerospace Research and Development, Paris (France)
Unknown
Title: Aircraft Engine Future Fuels and Energy Conservation

ABSTRACT

Current and forecasted world energy demands, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs. The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal, oil shale, and tar sands) and techniques for reducing energy consumption in refining processes are examined. Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems. An assessment of made as to what technology advancements are currently under way and what other advancements are needed with reference to engine components, engine systems, aircraft designs and operational procedures to help conserve fuel resources. (AGARD Lectures in Munich and London, Oct 1978)

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B.6.2.2.19 79A12376 Oct 1977
Western Michigan University, Kalamazoo, Mich.
Behm, H. D.
Title: National Conference on Energy Conservation in General Aviation, 1st, Kalamazoo, Mich., October 10, 11 1977, Proceedings

ABSTRACT

Topics discussed include alternative aviation turbine fuels, economy in flight operations, and efficiency through angle-of-attack monitoring. (Proceedings)

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B.6.2.2.20 79A11572# Oct 1978
ONERA, Chatillon-sous-Bagneux Hauts-de-Seine, France
Poisson-Quinton, P.
Title: Energy Conservation Aircraft Design and Operational Procedures

ABSTRACT

Paper reviews studies associated with improved fuel efficiency. Design concepts are described including: (1) increase in aerodynamic efficiency through decreased friction drag, parasitic drag, and drag due to lift, (2) structural efficiency and the implementation of composite materials, (3) active control technology, (4) the optimization of airframe-engine integration, and (5) VTOL and STOL concepts. Consideration is also given to operational procedures. (Paper: NATO, AGARD,, Lecture Series on Energy Conservation in Aircraft Propulsion, Munich, West Germany, Oct 26, 27, 1978)

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B.6.2.2.21 78A15020 Jun 1977
Societe Nationale Industrielle Aerospatiale, Division Helicopters, Paris, France
Petit, G.
Title: Helicopters and Energy Savings

ABSTRACT

The article discusses various means to economize helicopter fuel consumption, noting possible modifications in engine specific fuel consumption, rotor aerodynamic quality, parasitic drag of the fuselage, helicopter empty weight, and flight path optimization. Improvements in specific fuel consumption (30 percent reduction predicted) and in structural characteristics (15 percent reduction predicted). (Paper: Congres International Aeronautique, 13th Paris, France, June 2,3 1977) L°Aeronautique et l°astronautique, No. 66, 1977)

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B.6.2.2.22 79A31911 Dec 1978
Royal Aircraft Establishment, Farnborough, Hants., England
Pope, G. G.
Title: Prospects for Reducing the Fuel Consumption of Civil Aircraft

ABSTRACT

Outline of technological advances that contribute to the reduction of fuel consumption. Attention is concentrated on advances being made in the UK. Advances in powerplants are examined along with developments in aerodynamics, taking into account advances in design techniques, experimental facilities, wing tip design, drag reduction, and laminar flow control. Attention is also given to materials and structures, active control technology, and operational considerations. (Paper: Energy and Aerospace; Proceedings of the Anglo/American Conference, London, England, December 5-7, 1978)

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B.6.2.2.23 78A43358*# July 1978
NASA, Langley Research Center, Langley Station, VA
Conner, D. W.
Title: CTOL Concepts and Technology Development

ABSTRACT

Various developments in the Aircraft Energy Efficiency (ACEE) program are discussed. Terminal-area operations are considered with emphasis on the Terminal Configured Vehicle program. Consideration is also given to aircraft systems studies and economics (including noise reduction programs) coal-derived fuels for aviation systems (including LH2-fueled aircraft), and transport-aircraft concepts (including laminar flow controls. (Paper: Astronautics and Aeronautics, vol. 16 July-Aug, 1978)

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B.6.2.2.24 73A23682 1972
Unknown
Tolztych, I.
Title: Civil Transport Aircraft Future Design Trends, Discussing Subsonic, Supersonic, Hypersonic and V/STOL Aircraft, Engine Design, Fuels and Noise Reduction

ABSTRACT

Evaluation of the technical and economic efficiency of types of

aircraft likely to be developed in the coming decades. The problem of evaluating the degree of structural maturity and perfection of passenger aircraft and their economic efficiency is discussed. Problems connected with the development of increasingly high-speed subsonic aircraft, supersonic, and ultimately, hypersonic aircraft are discussed, including engine designs, fuels, and noise reduction, In addition, the use of VSTOLs to provide more efficient transportation between airports and city centers is considered. (German translation of Russian article, Technisch-oekonomische Information, der zivilen Luftfahrt, Vol. 8 no. 9, 1972.)

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B.6.2.2.25 N76-28203/7ST Jun 76
United Technologies Research Center, East Hartford, Conn.
Gobetz, F. W.
Title: Cost/Benefit Trade-Offs for Reducing the Energy Consumption of Commercial Air Transportation (Recat)

ABSTRACT

A study performed to evaluate the opportunities for reducing the energy requirements of the U.S. air passenger transport system through improved operational techniques, modified in-service aircraft, derivatives of current production models, or new aircraft using either current or advanced technology. Alternatives investigated individually to test its potential for fuel conservation out to the year 2000. (Final Report) (Note: Summary Report - N7628204/5ST)

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B.6.2.2.26 AD-A016 393/1ST Aug 75
Air Force Inst. of Tech., Wright Patterson AFB, Ohio, School of Systems and Logistics
O'Gorman, Kenneth P.
Title: An Evaluation of the Operational Capabilities and Fuel Conservation Implications of Using Remotely Piloted Vehicles, Advanced Aircraft Flight Simulators, and Lighter-Than-Air Aircraft

ABSTRACT

This thesis researched literature in three areas -- remotely piloted vehicles, advanced aircraft simulators, and lighter-than-air aircraft -- to explore their operational capabilities and to evaluate any fuel energy benefits that may be derived from their use. The thesis concludes that remotely piloted vehicles and advanced aircraft flight simulators can be utilized to meet various operational requirements while reducing fuel

consumption. However, lighter-than-air aircraft designs do not currently possess the technology needed to accomplish operational requirements while reducing fuel consumption. (Master's Thesis)

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B.6.2.2.27 AD-C005376 Feb 1976
Rand Corp, Santa Monica, Calif.
Harris, E. D.
Title: Potential for Advanced Technology to Reduce Military Aircraft Energy Consumption for 1975-2000

ABSTRACT

Technological options for reducing peacetime USAF jet fuel consumption in this century are evaluated. Half the projected reduction comes from changing to the B-1 with hypothetical energy-efficient tanker, and another 30% from new energy-efficient fighter/attack/reconnaissance planes. Lightweight airframe structural materials hold promise mainly for new designs. Variable cycle and tuboprop engines do not offer substantial fuel savings. Reengining the C-141S with TF-39 turbofan engines could start now. Also recommended: limiting military airlift to higher value cargo; shifting more to the C-5; shorter mission legs; increased load factor; cutting training flights as far as practicable. RPVS would produce sizable savings only when replacing manned missions. (Report (Secret))

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B.6.2.2.28 AD-A079 320/8 Aug 78 - Sep 79
Nero and Associates, Inc., Portland, OR
Linstone, Harold A.
Title: Technology Assessment of Low Energy Vehicles

ABSTRACT

Key suggested steps for U.S. Coast Guard energy savings include the LTAV, an energy monitoring system, computer-aided mission planning, and production facility to serve eastern and southeastern districts. Improved power plant and engine component design and remote sensing and communications systems offer other technological opportunities for energy savings. (Final Report)

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B.6.2.2.29 N75-16557/1ST Feb 75
Lockheed Aircraft Corp., Burbank, Calif.
Sweet, H. S.
Title: Evaluation of Advanced Lift Concepts and Potential Fuel Conservation for Short-Haul Aircraft

ABSTRACT

The effect of different field lengths, cruise requirements, noise level, and engine cycle characteristics on minimizing fuel consumption and minimizing operating cost at high fuel prices were evaluated for some aircraft, using the upper surface-internally blown jet flap, the augmentor wing, and the mechanical flap lift systems. Advanced conceptual STOL engines were evaluated as well as a near-term turbofan and turboprop engine. (Report)

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B.6.2.2.30 EI790314064 Sep 1978
Boeing Commercial Airplane Co., Seattle, Wash.
Miller, M. P.
Title: Transportation and The U.S. Petroleum Resource: An Aviation Perspective

ABSTRACT

This paper provides an overview of several facets of commercial aviation fuel consumption: the merits of its public services, the conservation measures taken to date, the consequence of future shortages, energy conservation strategies, modal efficiency comparisons, and alternate fuels considerations. (Paper: J Energy V 2 N 5 Sep-Oct 1978)

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B.6.2.2.31 79A45328# Aug 1979
Dynamics Research Corp., Wilmington, Mass
Aggarwal, R.
Title: An Analysis of Operational Procedures and Design Modifications for Aircraft Fuel Conservation

ABSTRACT

Two year study conducted to determine the effectiveness of fuel conservation measures as applied to Air Force bomber/transport type aircraft. The impact of various potential design and operational procedure improvements are quantified. A major contribution of this study is the approach taken to generate the effect of design changes on fuel consumption and direct operating cost (DOC). (Paper: Atmospheric Flight

Mechanics Conference for Future Space Systems, Boulder, Colo., August 6-8, 1979)

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B.6.2.2.32 75A41698* Aug 1975
Boeing Commercial Airplane Co., Seattle, Wash.
Hanks, G. W.
Title: Fuel Conservation Possibilities for Terminal Area Compatible Transport Aircraft

ABSTRACT

Design characteristics that would reduce mission fuel consumption and improve terminal-area operations for advanced transports are discussed. Sensitivity studies of the effects of cruise speed, wing geometry, propulsion cycle, operational procedures, and payload on fuel usage are presented. (Paper: American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Los Angeles, Calif. Aug 4-7, 1975)

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B.6.2.2.33 N77-15008/4ST Nov 1974 - Mar 1976
Lockheed-California Co., Burbank
Hopkins, J. P.
Title: Study of the Cost/Benefit Tradeoffs for Reducing the Energy Consumption of the Commercial Air Transportation System

ABSTRACT

Practical means assessed for achieving reduced fuel consumption in commercial air transportation. Five areas were investigated: current aircraft types, revised operational procedures, modifications to current aircraft, derivatives of current aircraft and new near-term fuel conservative aircraft. (Summary of Final Report Vol I. See also Vol. II, N77-15007/6ST)

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B.6.2.2.34 79A42800*# July 1979
NASA, Ames Research Center, Moffett Field, Calif., National Aviation Facilities Experimental Center, Atlantic City, N.J.
Tobias, L.
Title: Simulation Study of the Operational Effects of Fuel Conservative Approaches

ABSTRACT

Fuel conservative procedures have been investigated using real time air traffic control simulations linked to two piloted simulators. The fuel conservative procedures studied were profile descents and two types of landing approaches, delayed flap and IATA. (Paper: Journal of Aircraft, Vol 16, July 1979)

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B.6.2.2.35 N77-24082/8ST Aug 1975 - Sep 1976
Champlain Technology, Inc., West Palm Beach, Fla.
Scott, R.W.
Title: An Avionics Sensitivity Study. Volume I: Operational Considerations

ABSTRACT

Equipment and operational concepts affecting aircraft in the terminal area are reported. Curved approach applications and modified climb and descent procedures for minimum fuel consumption are considered. Alternative flight path control regimes are considered to achieve minimum fuel consumption. (Report)

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B.6.2.2.36 PB-274 586/7ST Feb 75
MITRE Corp., McLean, Va., METREK Div.; Federal Aviation Administration, Washington, D.C. Office of System Engineering Management
Sinha, A. N.
Title: An Analysis of Fuel Conservation Through Aircraft Towing

ABSTRACT

An analysis of aircraft towing at the top twenty air carrier airports in the United States. The study of towing aircraft analyzes the economic feasibility of two towing scenarios: towing arrivals and departures, towing departures only. A number of operational factors which would

reduce the fuel savings and further increase the cost of towing have been identified but not explicitly accounted for in the analysis. (Report)

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B.6.2.2.37 N75-15157/1ST May 74
United Air Lines, Inc., San Francisco, Calif.
Unknown
Title: Fuel Conservation Capability and Effort by Commercial Air Carriers

ABSTRACT

Computer capability, weather input data, performance data, and ATC interface are discussed in terms of their role in preflight and inflight planning for commercial flights. The effect of preflight and inflight planning on fuel efficient operation was evaluated along with the impact of avionics. There is a potential for saving fuel through use of avionics, especially in the area of vertical guidance in all phases of flight. Results indicate: (1) preflight planning as it now stands is adequate with the exception that more accurate and up-to-date weather information is desirable; (2) better inflight information about existing weather conditions is needed; and (3) ATC can aid in fuel conservation. (Report)

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B.6.2.2.38 SSIE: ZH770080 2 10/77
NASA, Office of Aeronautics and Space Technology, Ames Research Center, Moffett Field, California, 94035
Unknown
Title: Digital Operations Rotocraft and V/STOL

ABSTRACT

The objective of this research is to extend modern guidance and navigation theory to optimize rotorcraft, VTOL, and STOL aircraft operations. Research involves tasks to develop methodology and onboard computer algorithms for efficiently synthesizing time-constrained or 4D trajectories that minimize fuel use. (Plan)

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B.6.2.2.39 79A23581* Oct 1978
National Aviation Facilities Experimental Center, Atlantic City, N.J.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
O'Brien, P. J.
Title: Dynamic Simulation Studies of Fuel Conservation Procedures Used in Terminal Areas

ABSTRACT

A simulation program was devised to study the effects of fuel conservation procedures on ATC and terminal area operations. The FAA National Aviation Facilities Experimental Center and the Ames Research Center have interconnected ATC and piloted simulation facilities at both centers. (Paper: Air Traffic Control Association, Annual Fall Conference, 23rd, Fort Worth Tex., October 2-5, 1978, Proceedings.)

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B.6.2.2.40 AD-A028 888/6ST May 75
Defense Systems Management School, Fort Belvoir, VA
Ortner, Anthony Joseph
Title: A Proposed Flight Simulator Technology Program

ABSTRACT

This study develops a flight simulator training technology program. Specific goals include identification of: (1) environmental considerations and concerns of DOD, OMB, GAO and Congress; (2) training issues; (3) organizational interfaces and interrelationships; and (4) the process and structure considerations for achieving DOD flight simulator goals in the future. The project derives importance due to the energy crisis and the resultant search for means to conserve fuel and funds. (Report)

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B.6.2.2.41 EI741274937 Oct 1974
Oak Ridge Natl Lab, Tenn
Pilati, David A.
Title: Energy Use and Conservation Alternatives For Airplanes

ABSTRACT

Commercial airplane fuel use is examined and energy conservation strategies are assessed. A fuel use model using eight of the most popular airplanes is described. Fuel savings for increasing load factors, reducing cruise speeds, increasing cruise altitudes, and changing ground

operations are assessed. (Paper: Transp Res V 8 n 4-5 Oct 1974)

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B.6.2.2.42 78A31314# Oct 1977
Transport Canada, Ottawa, Canada
Merritt, H. R.
Title: Air Traffic Control and Energy Conservation in Air Transportation

ABSTRACT

The Canadian ATC system is discussed in the framework of energy conservation in air transportation. Such ATC activities as the Joint Enroute Terminal System, the Integrated Communications Control System, MLS, The Vortex Avoidance System, area navigation and airspace planning are examined. (Paper: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3,4 1977, Proceedings)

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B.6.2.2.43 79A12383# Oct 1977
United Air Lines, Inc.
McKinzie, C. A.
Title: Economy In Flight Operations

ABSTRACT

A strategy for fuel conservation in general aviation is outlined. The author suggests fuel burnout monitoring, loading for minimum drag, elimination of unnecessary "tankering", and careful monitoring of the fueling operations. (Paper: National Conference on Energy Conservation in General Aviation, 1st, Kalamazoo, Mich., October 10, 11, 1977, Proceedings)

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B.6.2.2.44 79A13085# Nov 1977
United Airlines, Inc., Chicago, Ill.
Lahr, H. R.
Title: Pilot's View of the Evolving Air Transport

ABSTRACT

The pilot's role in conserving energy is described and attention is given to the impact of energy conservation efforts on evolving air transport. Some proposals for conserving fuel during various phases of the flight operation are discussed. (Paper: Radio Technical Commission

for Aeronautics, Annual Assembly, Washington, D. C. November 17-19, 1977, Proceedings)

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B.6.2.2.45 78A11103 Oct 1976
ARO, Inc., Arnold Air Force Station, Tenn.
Hensel, R. W.
Title: Energy Conservation in Aeronautical Ground Testing

ABSTRACT

Some USAF ground test facilities are described, and procedures for conserving energy at these facilities are considered. (Paper: Energy Crisis: An Evaluation of our Resource Potential; Proceedings of the Third Annual UMR-MEC Conference on Energy, Rolla, MO., October 12-14, 1976)

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B.6.2.2.46 SSIE: CI 729 2 1/77 to 6/79
Aeronautical Research Inst., Syst. Study and Flight Safety Sec, Box 11021, Bromma, Sweden, S16111 Bromma
Gustafson, A.
Title: Fuel Conservation With Air Transportation

ABSTRACT

To study different possibilities for flight operational improvements with great fuel saving potentials. Development of simple aids which can be used by pilots and ATC personnel. (Plan)

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B.6.2.2.47 76A17412# 1975
Gesellschaft fuer Internationalen Flugverkehr mbH, Berlin, East Germany
Gloeckner, B.
Title: Possibilities and Problems Concerning Fuel Economy Measures I -- For Aircraft

ABSTRACT

Possibilities forsaving fuel by the selection of suitable altitudes and flight Mach numbers are examined, taking into account fuel consumption per hour, fuel consumption characteristics, the effect of wind conditions on the appropriate Mach number value, and certain practical problems concerning the adherence to the selected Mach number during the flight. Fuel economy measures related to refuelling procedures and the amount of

fuel taken by the aircraft during refuelling are discussed. Attention is given to the effects of differing aircraft weights on fuel consumption. (Paper: Technisch-oekonomische Information der zivilen Luftfahrt, Vol. 11, No. 5, 1975, In German)

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B.6.2.2.48 AD-A059 050/5ST May 78
Mitre Corp., METREK Div., McLean, VA
Mohleji, Satish C.
Title: ATC Accomodation of Fuel Conservative Turbojet Operations

ABSTRACT

Study estimates and compares the fuel savings potential of each of five fuel conservation ideas: (1) absorb landing delays before leaving en route airspace, (2) permit cleaner, higher speed approach and landing procedures, (3) lower the altitude restriction on the 250 knot speed limit in TCAs, (4) increase the number of flight levels above 29,000 feet, and (5) eliminate fixed cruise or crossing altitude restrictions. Comparative estimates of the fuel-saving potential of each of these ideas are developed. (Final Report)

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B.6.2.2.49 77A44434# Apr 1977
Mitre Corp., METREK Div., McLean, VA
Mohleji, S. C.
Title: Fuel Conservation for High Performance Aircraft In The Terminal Area

ABSTRACT

Paper describes an approach for the Air Traffic Control (ATC) system in the terminal area to accommodate fuel conserving landing approaches. Analytical results presented that illustrate the impact of fuel economic design on terminal controllability and airport capacity. An analytical fuel consumption model is used to estimate the fuel benefits of lifting the 250 knots speed restriction below 10,000 ft mean sea level (MSL) for both arrivals and departures. (Paper: National Aerospace Meeting, Denver, Colo., April 13, 14, 1977, Proceedings)

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B.6.2.2.50 N79-26009/7ST June 79
NASA Ames Research Center, Moffett Field, Ca.
Erzberger, H.
Title: Fuel-Conservative Guidance System for Powered-Lift Aircraft

ABSTRACT

Concept for automatic terminal area guidance, comprising two modes of operation, was developed and evaluated in flight tests. In the predictive mode, fuel efficient approach trajectories are synthesized in fast time. In the tracking mode, the synthesized trajectories are reconstructed and tracked automatically. An energy rate performance model derived from the lift, drag, and propulsion system characteristics of the aircraft is used. (Paper: AIAA Guidance and Control Conf., Boulder, Colo., 6-7 Aug. 1979)

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B.6.2.2.51 AD-A062 609/3ST July 78
Dynamics Research Corp., Wilmington, MA, Systems Div.
Aggarwal, Romesh K.
Title: An Analysis of Fuel Conserving Operational Procedures and Design Modifications for Bomber/Transport Aircraft, Volume II

ABSTRACT

Various proposed improvements in the design and operational procedures for bomber/transport aircraft are evaluated. The evaluation is performed in terms of the estimated savings in fuel consumption and in Direct Operating Cost (DOC). (Final Report)

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B.6.2.2.52 N77-19060/1ST Feb 77
Boeing Commercial Airplane Co., Seattle, Wash.
Allison, R. L.
Title: AEMS Implementation Cost Study for Boeing 727

ABBSTRACT

Costs for airline operational implementation of a NASA-developed approach energy management system (AEMS) concept as applied to the 727 airplane, were determined. Estimated costs are provided for airplane retrofit and for installation of the required DME ground stations. Operational costs and fuel cost savings are presented in a cost-of-ownership study. (Final Report)

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B.6.2.2.53 SSIE: EB 59 7/77 to 3/78
Aerospace Corp., P.O. Box 95085, Los Angeles, California, 90045
unk
Title: Examination of Commercial Aviation Operational Energy Conservation Strategies

ABSTRACT

The objectives of this study are: (1) to examine and quantify fuel savings realizable through implementation of various non-hardware energy conservation strategies; (2) to rate and rank each strategy in a manner which will clearly indicate viable strategies and their relative fuel conservation potentials; (3) to select the most promising strategies for further, more comprehensive study; (4) to transfer the study results to appropriate industry and government groups; and (5) to document all significant study results. (Plan)

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B.6.2.2.54 N76-31090/3ST May 76
Aerospace Corp., Energy and Transportation Div., El Segundo, CA
unk
Title: Effect of Aircraft Technology Improvements on Intercity Energy Use

ABSTRACT

Examination of energy consumption in short haul, high density intercity transportation is made in relation to changes in aeronautical technology. Improvements or changes in the technology of competitive modes are also included. Certain improvements in air traffic control procedures were included to determine their effectiveness in saving energy along with a fuel efficient turboprop short haul aircraft concept. (Final Report)

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B.6.2.2.55 78A30698# Sept 1976
Unknown
Craig, V. F. J.
Title: Aviation Fuel Usage - Economy and Conservation

ABSTRACT

Methods of conserving aircraft fuel are discussed; the emphasis is on short-term operational and procedural measures. Reduction of required fuel reserves for flights operating under excellent weather conditions, minimization of jet-powered taxiing maneuvers, better sequencing of takeoffs at peak hours, and the selection off appropriate airspeed, altitude, climb, cruise and descent options. (Article: Canadian Aeronautics and Space Journal, Vol. 24, Jan.-Feb. 1978)

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B.6.2.2.56 79A13080# Nov 1977
FAA Air Traffic Service, Atlantic City, N.J.
Cunningham, F. L.
Title: Resource Conservation Through Air Traffic Control

ABSTRACT

Ongoing FAA programs concerned with fuel conservation through the modification of AIC operations are reviewed. Consideration is given to programs directed primarily toward: (1) more efficient airspace utilization, (2) reduction of engine run time, (3) procedural modification to accommodate more efficient flight paths and profiles, and (4) relocation of unavoidable airborne delays to higher, more economical altitudes. (Paper: Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D.C., November 17-19, 1977 Proceedings.)

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B.6.2.2.57 AD-B029009L Apr 1978
Air Command and Staff College, Maxwell AFB, AL
Demmon, John L.
Title: Energy, Flight Simulation, Flying Hours, Aircraft Maintenance, and Supply. An Examination of the Relationships

ABSTRACT

As a result of the energy shortage of the seventies, the United States Air Force reduced fuel consumption by reducing programmed flying hours and increasing flight simulator usage. Study reviews the current energy situation, examines future flight simulator programs, and evaluates

the potential impacts of flying hour reductions on aircraft maintenance and supply support. (Report)

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B.6.2.2.58 AD-A064 623/2ST Nov 78
Federal Aviation Administration, Office of Aviation Policy, Washington, DC
Unknown
Title: A Proposed Aviation Energy Conservation Program for the National Aviation System

ABSTRACT

Overview of potential options for improving aviation energy efficiency. Included in the proposed program are alternatives that could be pursued by the Federal Government as well as options that could be adopted by the various segments of the aviation industry. The report is in four volumes: Volume I - The Short Run, 1977-1978, Volume II - The Intermediate and Long Run, 1979-1990, Volume III - The Proposed Aviation Energy Conservation Program, Summary - Overview of preceding technical volumes. (Final Report)

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