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INERTIAL NAVIGATION

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*Inertial Navigation	Navigation Aids
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Instrumentation	Tactical Aircraft
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This bibliography contains unclassified-unlimited citations on *Inertial Navigation*. These citations pertain to instrumentation, application, alignment, reliability, feasibility, cost effectiveness, test & evaluation of inertial navigation, and information on the doppler inertial navigation system. The four computer-generated indexes provided are Corporate Author-Monitoring Agency, Subject, Title and Personal Author.

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F O R E W O R D

This bibliography contains 167 unclassified-unlimited citations on *Inertial Navigation*.

These citations are studies and analyses pertaining to instrumentation, application, alignment, reliability, feasibility, cost effectiveness, test and evaluation of inertial navigation, and some pertinent information on the doppler inertial navigation system.

Entries have been selected from references processed into the Defense Documentation Center data bank from January 1953 to September 1977.

Individual entries are arranged in AD number sequence under the heading bibliographic references. Computer-generated indexes of Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided.

BY ORDER OF THE DIRECTOR, DEFENSE LOGISTICS AGENCY

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TITLE	T-1
PERSONAL AUTHOR	P-1

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 600 140 17/7
MICHIGAN UNIV ANN ARBOR INST OF SCIENCE AND TECHNOLOGY

A SETTLING TIME CONSTRAINED OPTIMIZATION OF A VELOCITY INERTIAL NAVIGATION SYSTEM, (U)

MAY 64 22P PORTER,W. A. ;KUO,M. ;
CONTRACT: DA36 039SC78801

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON PROJECT MICHIGAN.

DESCRIPTORS: (*DOPPLER NAVIGATION, OPTIMIZATION), (*INERTIAL NAVIGATION, OPTIMIZATION), NAVIGATION, DOPPLER SYSTEMS, INSTRUMENTATION, PERFORMANCE, TRANSIENTS, DIFFERENTIAL EQUATIONS (U)
IDENTIFIERS: MICHIGAN PROJECT, STANDARD DEVIATION (U)

A TECHNIQUE IS DESCRIBED FOR IMPROVING TRANSIENT PERFORMANCE IN THE VELOCITY INERTIAL SYSTEM WHILE MINIMIZING THE STANDARD DEVIATION OF THE SYSTEM ERROP (FOR EXAMPLE, THE STANDARD DEVIATION OF THE SYSTEM VELOCITY MEASUREMENT ERROR). TO ACCOMPLISH THIS, A PRESCRIBED SETTLING TIME CONSTRAINT IS FORMULATED FOR THE SYSTEM RESPONSE, AND THE CONSTRAINT EQUATION IS THEN IMPOSED ON THE MINIMIZATION PROCESS. THE RESULT SHOWS THAT CONSIDERABLE SETTLING TIME IMPROVEMENT CAN BE DERIVED WITHOUT SACRIFICING SYSTEM ACCURACY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 602 682
SPERRY RAND CORP LONG ISLAND CITY N Y FORD INSTRUMENT DIV

NO-GIMBAL FEASIBILITY FLIGHT TEST PROGRAM. (U)

NOV 62 108P XENAKIS, JAMES ;
CONTRACT: AF33 616 8463
PROJ: 5201
TASK: 520104
MONITOR: ASD , TDR62 913

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*INERTIAL NAVIGATION, FEASIBILITY STUDIES), NAVIGATION COMPUTERS, ACCELEROMETERS, GYROSCOPES, SYSTEMS ENGINEERING, MODELS (SIMULATION), FLIGHT TESTING, DATA PROCESSING, TEST EQUIPMENT (U)

THE PROGRAM SUCCESSFULLY DEMONSTRATED THE FEASIBILITY OF A STRAP-DOWN INERTIAL NAVIGATION SYSTEM AND VERIFIED THE PREDICTED PERFORMANCE OF THE BREADBOARD MODEL OF THE SYSTEM. THE REPORT DESCRIBES THE RESULTS OF EIGHT FLIGHT AND TWO GROUND TESTS DURING WHICH APPROXIMATELY 40 HOURS OF SYSTEM OPERATION, INCLUDING 20 HOURS IN THE AIR AND 20 HOURS ON THE GROUND, WERE ACCUMULATED. A COMPLETE DESCRIPTION OF THE FLIGHT TEST AND DATA PROCESSING PROCEDURE IS PRESENTED HEREIN AS WELL AS A DESCRIPTION OF SPECIAL EQUIPMENT DESIGNED FOR THE EVALUATION PROGRAM. A BRIEF SUMMARY OF SYSTEM OPERATION IS ALSO INCLUDED. FINALLY, RECOMMENDATIONS FOR FOLLOW-UP PROGRAMS, WHICH WOULD INVESTIGATE IMPROVEMENTS IN, AND CERTAIN APPLICATIONS FOR A NO-GIMBAL SYSTEM, ARE PRESENTED.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 603 959
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO

THE FEASIBILITY OF A VELOCITY-DAMPED INERTIAL NAVIGATION SYSTEM. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
AUG 64 122P TURLEY,ALBERT RAY ;WILSON, ROBERT JOHN ,III.;
MONITOR: AFIT , GGC/EE/64 18

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*INERTIAL NAVIGATION, FEASIBILITY STUDIES), (*DAMPING, VELOCITY), ACCELERATION, ERRORS, FLIGHT PATHS, MATHEMATICAL ANALYSIS, DIGITAL COMPUTERS, AERIAL PHOTOGRAPHY, OSCILLATION (U)

A PASSIVE INERTIAL NAVIGATION SYSTEM GENERATES POSITION INFORMATION CONTAINING AN OSCILLATING ERROR. PREVIOUS FLIGHT-TEST RESULTS OF A GIMBALLESS NAVIGATOR CLEARLY INDICATE THIS UNWANTED OSCILLATION. EXTERNAL VELOCITY INFORMATION, REDUCED FROM AERIAL PHOTOGRAPHS, WAS SUCCESSFULLY EMPLOYED IN THE STUDY TO DAMP THE OSCILLATION IN FLIGHTS UNDER THE SAME DYNAMIC ENVIRONMENT. COMPARISON OF UNDAMPED AND DAMPED POSITION ERROR CURVES PROVES VELOCITY DAMPING HAD LITTLE EFFECT ON AVERAGE SYSTEM ERROR, BUT IMPROVES POSITION UNCERTAINTY BY APPROXIMATELY 43%. TO OPTIMIZE THE INERTIAL SYSTEM FOR ALL FLIGHT CONDITIONS, THE STUDY RESULTS SUGGEST A VARIABLE DAMPING RATIO. VALUES OF 0.7 PRIOR TO TAKE OFF AND BETWEEN 0.07 AND 0.L AFTER TAKE OFF ARE RECOMMENDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 607 853 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

INERTIAL NAVIGATIONAL SYSTEMS, (U)

SEP 64 128P FROLOV,V. S. ;
MONITOR: FTD ,TT MT64-57,64-71637

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED MACHINE TRANS. OF MONO.
INERTIAL'NYE SISTEMY NAVIGATSII, MOSCOW, 1963, 126P.

DESCRIPTORS: (*INERTIAL NAVIGATION, REVIEWS),
ACCELEROMETERS, GYRO STABILIZERS, TRACKING,
SERVOMECHANISMS, NAVIGATION COMPUTERS, AIRCRAFT,
SUBMARINES, UNDERWATER NAVIGATION, ERRORS, DOPPLER
NAVIGATION, RADIO NAVIGATION, RADAR NAVIGATION,
CELESTIAL NAVIGATION, SCANNING, SPACECRAFT, SPACE
NAVIGATION, WEIGHTLESSNESS, USSR (U)

A SEMI-TECHNICAL DISCUSSION IS GIVEN OF OPERATING CONDITIONS, INTERACTION OF SEPARATE UNITS AND CAUSES OF ERRORS OF INERTIAL GUIDANCE AND NAVIGATIONAL SYSTEMS. CONSIDERABLE ATTENTION IS GIVEN TO ANALYSIS OF THE OPERATION OF INERTIAL SYSTEMS UNDER CONDITIONS OF SPACE FLIGHT AND THEIR USE IN THE SINGLE NAVIGATIONAL COMPLEX OF AN AIRCRAFT.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZDM07

AD- 612 362 17/7
AIRBORNE INSTRUMENTS LAB DEER PARK N Y

USE OF SELF-CONTAINED NAVIGATION AIDS IN DOMESTIC AIRSPACE. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
SEP 64 123P HOOTON,E. N. ;WISEPART,I. S. ;ABRAMSON,P. ;
REPT. NO. AIL-3523-1
CONTRACT: FA WA4680
PROJ: 115 17R
MONITOR: SRDS , RD-64-131

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*NAVIGATIONAL AIDS, CIVIL AVIATION), (*AIR TRAFFIC CONTROL SYSTEMS, NAVIGATIONAL AIDS), (*DOPPLER NAVIGATION, CIVIL AVIATION), (*INERTIAL NAVIGATION, CIVIL AVIATION), FLIGHT PATHS, ALL WEATHER AVIATION, GROUND SUPPORT EQUIPMENT (U)

THIS REPORT CONTAINS AN INTRODUCTION TO GENERAL NAVIGATIONAL PRINCIPLES AS APPLIED TO THE USE OF DOPPLER AND INERTIAL SYSTEMS. THIS IS FOLLOWED BY A DESCRIPTION OF BOTH SYSTEMS CONCERNING METHODS OF OPERATION (SUCH AS STEERING), ACCURACY, ETC. IN-FLIGHT ERRORS MUST BE CHECKED BY SOME EXTERNAL GROUND-BASED NAVIGATION AIDS AND THIS IS DISCUSSED IN SOME DETAIL. A SIMPLIFIED PROCEDURE IS GIVEN USING VORTAC. AFTER A DESCRIPTION OF AIRLINE FLIGHT PLANNING, THE IMPACT OF SELF-CONTAINED NAVIGATION TECHNIQUES ON THE AIR-TRAFFIC-CONTROL SYSTEM IS DISCUSSED RELATIVE TO EN-ROUTE FLYING AND THE TERMINAL AREA. IT IS CONCLUDED THAT DOPPLER AND INERTIAL CAN BE USED SUCCESSFULLY IN DOMESTIC OPERATIONS AND THAT, SUBJECT TO CERTAIN PROCEDURES, EVERY ENCOURAGEMENT SHOULD BE GIVEN TO ALL OPERATORS (INCLUDING GENERAL AVIATION) TO USE DOPPLER, AND LATER INERTIAL, IN THE DOMESTIC AIRSPACE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 615 418
MASSACHUSETTS INST OF TECH CAMBRIDGE INSTRUMENTATION LAB

APPLICATION OF INERTIAL LOCATOR CONCEPTS TO FAA BASIC FLIGHT INSPECTION. VOLUME I. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JAN 65 119P HALL,ROBERT L. ;HATFIELD, JOHN ;
REPT. NO. R-483
CONTRACT: FA64WA5139
PROJ: 341 001 01N
MONITOR: SRDS , RD-65-9

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*POSITION FINDING, FEASIBILITY STUDIES), DETECTORS, AIRCRAFT, FLIGHT SIMULATORS, INSTRUMENT LANDINGS (U)
IDENTIFIERS: TACAN, VOR, VORTAC (U)

FEASIBILITY STUDIES WERE MADE OF UTILIZING AN AIRBORNE INERTIAL NAVIGATION SYSTEM (INERTIAL LOCATOR EQUIPMENT) TO PROVIDE AIRCRAFT POSITION INFORMATION TO THE FAA BASIC FLIGHT INSPECTION SYSTEM. DESIGN OBJECTIVES WERE ESTABLISHED FOR THE FLIGHT INSPECTION OF VOR, VORTAC, AND TACAN STATIONS AND INSTRUMENT LANDING SYSTEMS (ILS). ANALYSES WERE MADE, INCLUDING SIMULATED COMPUTER FLIGHTS, OF THE CAPABILITIES OF INERTIAL EQUIPMENT TO PERFORM IN THE FLIGHT INSPECTION MISSIONS. CONCLUSIONS, BASED ON ASSUMED INERTIAL SYSTEM PERFORMANCE, INDICATE THAT THE USE OF INERTIAL LOCATOR EQUIPMENT IS FEASIBLE, USING UPDATING TECHNIQUES FOR SOME MISSIONS. RECOMMENDATIONS ARE MADE FOR A FLIGHT DEMONSTRATION PROGRAM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 617 528
RAYTHEON CO SUDBURY MASS SPACE AND INFORMATION SYSTEMS DIV

VEHICLE-FIXED COMPONENT INERTIAL GUIDANCE SYSTEM STUDY, (U)

DEC 64 114P BROXMEYER,CHARLES ;WISHNER, HOWARD ;
CONTRACT: N60530-10010
TASK: 4068 1
MONITOR: NAVWEPS,NOTS 8668,TP-3715

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: ALSO AVAILABLE AS REPT. NO. IDEP-347.00.00.00-X7-50

DESCRIPTORS: (*INERTIAL GUIDANCE, NUMERICAL METHODS + PROCEDURES), (*INERTIAL NAVIGATION, NUMERICAL METHODS + PROCEDURES), (*DATA PROCESSING, INERTIAL NAVIGATION), GUIDED MISSILE COMPUTERS, MATHEMATICAL PROGRAMMING, VECTOR ANALYSIS (U)

THE GENERAL STRUCTURE OF A VEHICLE-FIXED COMPONENT INERTIAL NAVIGATION SYSTEM IS OUTLINED. THE PORTION OF THE COMPUTATION PROBLEM PERTAINING TO THE COMPUTATION OF DIRECTION COSINES RELATING TWO ROTATING COORDINATE FRAMES IS DISCUSSED, AND THE DIFFERENTIAL EQUATIONS SATISFIED BY THE DIRECTION COSINES IS DERIVED. A BRIEF DESCRIPTION IS GIVEN OF THE PRINCIPAL PROBLEMS ENCOUNTERED IN THE VEHICLE-FIXED OPERATION OF COMPONENTS. THREE ALGORITHMS FOR THE COMPUTATION OF DIRECTION COSINES IN THE SINGLE-AXIS CASE ARE DERIVED. THE DIRECTION COSINE DIFFERENTIAL EQUATION IS SOLVED BY EXPANSION IN SERIES AND THREE-AXIS ALGORITHMS DEFINED SPECIALIZATION OF THE CORRECT SOLUTION. THE NONCOMMUTATIVITY PROBLEM IS DISCUSSED AND A METHOD SUGGESTED FOR REDUCING ERRORS RESULTING FROM NONCOMMUTATIVITY. THE ALGORITHMS APPLICABLE TO SINGLE-AXIS MOTION ARE SPECIFIED AND COMBINED WITH SIMPLE ASSUMPTIONS ON VEHICLE MOTION, TO YIELD SETS OF DIFFERENCE EQUATIONS. THE DIFFERENCE EQUATIONS ARE SOLVED AND THE ERRORS IN THE DIRECTION COSINES PLOTTED AGAINST FUNCTIONS PROPORTIONAL TO TIME. THE REQUIREMENTS OF SPECIAL-PURPOSE COMPUTERS DESIGNED TO IMPLEMENT THE THREE-AXIS ALGORITHMS ARE OUTLINED AND THE GENERAL ORGANIZATION, AND THE PARAMETERS, OF SEVERAL COMPUTERS, IS GIVEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 618 684
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

AN INVESTIGATION OF OPTIMIZATION TECHNIQUES APPLICABLE TO A NON-LINEAR, VELOCITY-DAMPED INERTIAL NAVIGATOR. (U)

DESCRIPTIVE NOTE: MASTERS' THESIS,
JUN 65 130P KALISH,JOHN LOUIS ;SWIFT, CHARLES FRANKLIN ,JR.;
REPT. NO. GGC/EE/65-8

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*OPTIMIZATION, INERTIAL NAVIGATION), (*INERTIAL NAVIGATION, INSTRUMENTATION), DAMPING, NONLINEAR SYSTEMS, ADAPTIVE CONTROL SYSTEMS, COMPUTER(U)
IDENTIFIERS: IBM 7094 COMPUTERS (U)

TWO ADAPTIVE CONTROL TECHNIQUES ARE USED TO DAMP A SECOND-ORDER VELOCITY-DAMPED INERTIAL NAVIGATOR. THE FIRST TECHNIQUE USES THE SQUARE OF THE VELOCITY ERROR TO VARY THE DAMPING AND THE SECOND TECHNIQUE USES THE CROSSCOUPLING EFFECTS OF THE EARTH-LEVEL PLATFORM. AN ANALOG SIMULATION IS MADE TO TEST THE FEASIBILITY OF THE APPROACHES TAKEN AND TO FIND REPRESENTATIVE NON-LINEARITIES AND DAMPING PARAMETERS IN THE ADAPTIVE LOOPS. THE SYSTEM IS THEN 'FLOWN' ON THE IBM 7094 COMPUTER. AN ACTUAL UNDAMPED INERTIAL NAVIGATION SYSTEM SENSOR PACKAGE, USING STRAPPED DOWN SENSORS, HAD BEEN PREVIOUSLY FLIGHT-TESTED AND THE SENSOR OUTPUTS WERE STORED ON MAGNETIC TAPE. THE IBM 7094 COMPUTER IS PROGRAMMED TO ACCEPT THIS SENSOR INFORMATION ALONG WITH THE ADAPTIVE LOOP DAMPING INFORMATION WHICH ALLOWS THE SYSTEM TO BE TESTED UNDER REALISTIC FLIGHT CONDITIONS. DIRECT COMPARISONS BETWEEN THE SYSTEMS CAN THEN BE MADE. A COMPARISON OF THE UNDAMPED, ADAPTIVE DAMPED, AND CONSTANT DAMPED POSITION ERROR CURVES SHOWS THAT THE ADAPTIVE DAMPING IMPROVES THE POSITION UNCERTAINTY BY APPROXIMATELY 70 PERCENT OVER THE UNDAMPED SYSTEM AND BY APPROXIMATELY 35 PERCENT OVER THE BEST CONSTANT DAMPED SYSTEM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 618 893
MASSACHUSETTS INST OF TECH CAMBRIDGE INSTRUMENTATION LAB

INERTIAL NAVIGATION STUDY FOR CIVIL AIR TRANSPORT. (U)

DESCRIPTIVE NOTE: PHASE 1.
MAR 65 136P
REPT. NO. R-484
CONTRACT: FA64WA 5127
PROJ: 116 11N
MONITOR: SRDS , RD-65-36

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*INERTIAL NAVIGATION, CIVIL AVIATION), (*CIVIL AVIATION, AIR TRANSPORTATION), SYSTEMS ENGINEERING, PERFORMANCE(ENGINEERING), FLIGHT INSTRUMENTS, AVIATION SAFETY, AIR TRAFFIC CONTROL SYSTEMS, TRANSPORT AIRCRAFT, INERTIAL GUIDANCE (U)

THE APPLICATION OF INERTIAL NAVIGATION AND GUIDANCE SYSTEMS TO CIVIL AIR TRANSPORT OPERATIONS FROM THE SYSTEMS ENGINEERING VIEWPOINT IS DEVELOPED. THE CONCEPT OF AN OPERATIONAL SYSTEM FOR NAVIGATION AND GUIDANCE IS INTRODUCED TO FACILITATE CONSIDERATION OF THE RELATIONSHIPS WHICH WILL EXIST BETWEEN THE INERTIAL SYSTEM AND THE OPERATING FUNCTIONS NECESSARY FOR THE CONDUCT OF A FLIGHT. INERTIAL SYSTEM CONFIGURATIONS SATISFYING THE REQUIREMENTS IMPLIED BY THESE RELATIONSHIPS ARE PRESENTED. THE GENERAL REQUIREMENTS FOR INPUT DATA PANELS AND SYSTEM OUTPUT DISPLAYS FOR ALL FLIGHT PHASES ARE DISCUSSED. SEVERAL BASIC NAVIGATION SYSTEM MECHANIZATIONS ARE ANALYZED AND THE GENERAL CHARACTERISTICS OF A RECOMMENDED CONFIGURATION FOR AN INTEGRATED NAVIGATION AND GUIDANCE SYSTEM DESCRIBED. THE REPORT ALSO INCLUDES AN ESTIMATE OF THE SYSTEM PERFORMANCE REQUIRED FOR THE VARIOUS FLIGHT PHASES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY ' SEARCH CONTROL NO. Z0M07

AD- 619 972
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

AN INVESTIGATION OF NOISE AND BIAS EFFECTS ON DOPPLER-INERTIAL NAVIGATION SYSTEM ACCURACY. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
JUN 65 136P SNEAD,JACK CARSON ;
REPT. NO. GGC/EE/65-13

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*DOPPLER NAVIGATION, ERRORS), (*INERTIAL NAVIGATION, ERRORS), SIGNAL-TO-NOISE RATIO, FEEDBACK, INTERFERENCE, SIMULATION, DIGITAL COMPUTERS (U)

AN ANALYTICAL INVESTIGATION IS PERFORMED TO DETERMINE AND COMPARE THE PERFORMANCES OF FOUR SECOND-ORDER AND THIRD-ORDER DOPPLER-INERTIAL NAVIGATION SYSTEM CONFIGURATIONS WHEN SUBJECTED TO SENSOR ERRORS. THIS IS DONE BY DETERMINING THE STEADY-STATE RMS VELOCITY OUTPUT ERROR DUE TO NOISE AND BIAS INPUTS FOR THE GYRO AND DOPPLER RADAR AND BY DETERMINING THE CHARACTERISTICS OF THE TRANSIENT ERROR IN VELOCITY DUE TO STEP INPUTS OF ACCELEROMETER, GYRO, AND DOPPLER BIAS. SIMULATION OF THE SYSTEM ERROR MODELS IN BLOCK DIAGRAM FORM IS ACCOMPLISHED BY MIDAS PROGRAMMING OF A DIGITAL COMPUTER. THE NOISE ANALYSIS SIMULATION IS BASED ON THE ASSUMPTION THAT THE RANDOM PROCESS IS ERGODIC AND REPRESENTABLE BY AN EXPONENTIAL AUTOCORRELATION FUNCTION. THE RESULTS INDICATE THAT SYSTEM PERFORMANCE IS HIGHLY DEPENDENT UPON THE MANNER OF UTILIZING THE MIXED DOPPLER-INERTIAL VELOCITY INFORMATION IN FEEDBACK LOOPS AND UPON THE DYNAMIC RESPONSE CHARACTERISTICS REQUIRED OF THE SYSTEM. MIDAS DIGITAL SIMULATION WAS FOUND TO BE A USEFUL ANALYTICAL TOOL FOR STUDIES OF THIS NATURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 639 554 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

APPLICATION OF THE INVARIANCE THEORY TO THE SYNTHESIS OF INERTIAL NAVIGATIONAL SYSTEMS. (U)

JUN 66 17P SMENKOVSKII,E. G. ;
REPT. NO. FTD-TT-65-1860,
MONITOR: TT 66-62360

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. OF MONO. OF TEORIYA INVARIANTNOSTI V SISTEMAKH AVTOMATICHESKOGO UPRAVLENIYA, MOSCOW, 1964 P449-56 (PUBLISHED AS VSESOYUZNAYD SOVESHCHANIYA SOSTOYAVSHEGOSYA (NO. 2) KIEV, 29 MAY-1 JUN 62. TRUDY, MOSCOW, 1964, P449-56).

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), SYNTHESIS, INVARIANCE, THEORY, USSR (U)

TRANSLATION OF RUSSIAN RESEARCH: APPLICATION OF THE INVARIANCE THEORY TO THE SYNTHESIS OF INERTIAL NAVIGATIONAL SYSTEMS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 640 601 17/7 1/2
PAN AMERICAN WORLD AIRWAYS INC NEW YORK

EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME III. OPERATIONAL EVALUATION. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 66 119P REYNOLDS,P. R. J. ;ELDRED,M. W. ;MOSS,W. W. ;
CONTRACT: FA 64WA-5192,
PROJ: 350-101-01N,
MONITOR: SRDS RD-66-30-VOL-3

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*INERTIAL NAVIGATION, *JET TRANSPORT PLANES), (*CIVIL AVIATION, OPERATIONS RESEARCH), TESTS, NAVIGATION COMPUTERS, INSTRUMENTATION (U)

AIRCRAFT INSTALLATION OF AN LN-12 INERTIAL NAVIGATION SYSTEM IS DESCRIBED. INFLIGHT DATA-COLLECTION METHODS ARE DESCRIBED. GROUND SUPPORT EXPERIENCE IS ITEMIZED. OBSERVED ERROR DATA ARE PLOTTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 641 282 17/7
BENDIX CORP TETERBORO N J ECLIPSE-PIONEER DIV

EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME II. BANC-461 STEERING COMPUTER PERFORMANCE. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 66 142P WALCOTT,H. R. ;KILMARTIN,JOHN
;
REPT. NO. PUB-7311-66-17R,
CONTRACT: FA64WA-5208,
PROJ: FA-350-101-02N,
MONITOR: SRDS RD-66-30-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-640 601.

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*COMMERCIAL PLANES, INERTIAL NAVIGATION), (*NAVIGATION COMPUTERS, STEERING), AUTOMATIC PILOTS, TRANSPORT AIRCRAFT, PERFORMANCE(ENGINEERING) (U)

THE REPORT SUMMARIZES THE WORK PERFORMED TO EVALUATE THE FIRST AUTOPILOT COUPLED INERTIAL NAVIGATION SYSTEM INSTALLED IN A COMMERCIAL JET AIRCRAFT ENGAGED IN REGULAR SCHEDULED PASSENGER OPERATIONS. CONTRACTUAL PROVISIONS ARE LISTED AND REVIEWED. MODIFICATIONS TO THE BENDIX AN/ASN-46 NAVIGATIONAL COMPUTER USED IN THIS PROGRAM ARE RECORDED. PREFLIGHT TEST PROGRAMS ARE DESCRIBED. DATA TAKEN DURING 185 FLIGHT LEGS OF 43 FLIGHTS IS ANALYZED FOR BANC-461 STEERING COMPUTER PERFORMANCE. CALCULATIONS ARE MADE OF CROSS-TRACK AND ALONG-TRACK ERRORS WITH RESPECT TO BOTH THE ORIGINAL FLIGHT PLAN AND THE ACTUAL COORDINATES USED IN SETTING UP THE FLIGHT LEGS. PREDICTED ERRORS FROM AN EARLIER REPORT (RD-65-126 DATED AUGUST 31, 1965) ARE COMPARED WITH FLIGHT RESULTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 641 719 17/7
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE LONG PERIOD ERRORS OF DOPPLER AND INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 66 27P SMITH,S. G. ;THOMAS,I. L. ;
REPT. NO. TR-66084

UNCLASSIFIED REPORT

DESCRIPTORS: (*DOPPLER NAVIGATION, ERRORS), (*INERTIAL NAVIGATION, ERRORS), GREAT BRITAIN, EQUATIONS (U)

DEAD RECKONING NAVIGATION SYSTEMS MAKING USE OF GYROS HAVE TO TAKE ACCOUNT OF THE EARTHS ROTATION AND THE VEHICLES MOTION ROUND THE EARTH SINCE THESE ROTATIONS WILL BE SENSED BY THE GYROS. IN GENERAL THE GYRO CORRECTION TERMS ARE FUNCTIONS OF LATITUDE AND THEREFORE THE SYSTEM GENERATES A FEEDBACK LOOP WITHIN ITSELF SINCE THE FINAL OUTPUT (LATITUDE) IS USED TO CORRECT THE MECHANISM WHICH IS PRODUCING THIS OUTPUT. BY GOOD FORTUNE THE SENSE OF THIS FEEDBACK IN MOST CASES IS SUCH THAT THE ERRORS ARE OSCILLATORY RATHER THAN DIVERGENT. THE PERIOD OF OSCILLATION IS 24 HOURS FOR A STATIONARY I.N. SYSTEM BUT IN GENERAL THIS IS MODIFIED BY THE E-W COMPONENT OF VEHICLE VELOCITY. THE EFFECTS ARE SHOWN TO HAVE LITTLE SIGNIFICANCE IN DOPPLER SYSTEMS BUT ARE HELPFUL IN SOME CASES OF LONG FLIGHTS (> 4 HOURS) WITH INERTIAL SYSTEMS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 646 297 17/7 22/2 22/3
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

ASSESSMENT OF THE PERFORMANCE OF THE ELDO FIRST PROGRAM ATTITUDE REFERENCE UNIT IN AN INERTIAL ROLE. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
OCT 66 53P ALBERY,D. W. ;
REPT. NO. TR-66314

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*INERTIAL GUIDANCE, INERTIAL NAVIGATION), ACCELEROMETERS, GYROSCOPES, LAUNCH VEHICLES, ERRORS, ORBITS, MATHEMATICAL MODELS (U)
IDENTIFIERS: ELDO (U)

THE REPORT PRESENTS NUMERICAL RESULTS FOR VELOCITY AND POSITION ERRORS ACCRUED BY AN IMPERFECT INERTIAL NAVIGATOR, WHEN THE GYROSCOPES AND ACCELEROMETERS COMPRISING THE INSTRUMENT ARE SUBJECTED TO THE ACCELERATION HISTORY EXPECTED FROM A LAUNCH TRAJECTORY OF THE ELDO-A SATELLITE LAUCH VEHICLE. THE INERTIAL NAVIGATOR UNDER CONSIDERATION CONSISTS OF THE ELDO FIRST PROGRAM ATTITUDE REFERENCE UNIT MODIFIED FOR AN INERTIAL ROLE BY THE ADDITION OF THREE ACCELEROMETERS AND ASSOCIATED ELECTRONIC CIRCUITS. THE SOURCES OF ERROR CONSIDERED ARE DISCUSSED BRIEFLY. RESULTS ARE PRESENTED FOR THREE TRAJECTORIES OF IMPORTANCE, A MEDIUM ALTITUDE (550 KM) CIRCLE, A MEDIUM ALTITUDE (700 KM) CIRCLE WITH TWO LEVELS OF THRUST IN THE THIRD STAGE, AND A LOW ALTITUDE (200 KM) CIRCLE WITH PARKING PERIODS. METHODS OF REDUCING THE ERRORS ARE DISCUSSED. NO ACCOUNT IS TAKEN OF THE EFFECT OF INSTRUMENT ERRORS ON THE CLOSED GUIDANCE LOOP, OR OF THE VIBRATION ENVIRONMENT TO BE MET WITH DURING FLIGHT. THE DYNAMIC RESPONSE OF THE HARDWARE (CAPTURE AMPLIFIERS, GIMBAL SERVOS ETC) IS ALSO NEGLECTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 646 934 17/7
REDSTONE SCIENTIFIC INFORMATION CENTER REDSTONE ARSENAL
ALA TRANSLATION BRANCH

ON THE CALCULATION OF AN INERTIAL NAVIGATION SYSTEM, (U)

DEC 66 17P VOVCHENKO,N. YA. ;
REPT. NO. RSIC-621
MONITOR: TT 67-60987

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF UNIDENTIFIED MONO., MOSCOW, 1965 P76-85.

DESCRIPTORS: (*INERTIAL NAVIGATION, STABILIZED PLATFORMS), ACCELERATION, INSTRUMENTATION, EQUATIONS, GYRO STABILIZERS, USSR (U)

THE ARTICLE PRESENTS A REFINEMENT OF PREVIOUSLY DERIVED DYNAMICS EQUATIONS FOR THE CALCULATION OF A GEOMETRICAL INERTIAL NAVIGATION SYSTEM. THE OPERATION OF THE SYSTEM DURING THE MOTION OF AN OBJECT IN A GREAT CIRCLE RELATIVE TO THE EARTH IS CONSIDERED. AN ESTIMATE IS MADE OF THE METHODOLOGICAL ERRORS DUE TO TRANSLATIONAL AND CORIOLIS ACCELERATIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 648 070 17/7
IBM FEDERAL SYSTEMS DIV OWEGO N Y ELECTRONICS SYSTEMS CENTER

SYNERGISTIC NAVIGATION SYSTEM STUDY. (U)

DESCRIPTIVE NOTE: FINAL REPT. ON PHASE 1,
OCT 66 113P KLEMENTIS,KENNETH A. ;
STANDISH,CHARLES J. ;
REPT. NO. IBM-67-928-7
CONTRACT: N00014-66-C-0192

UNCLASSIFIED REPORT

DESCRIPTORS: (*DOPPLER NAVIGATION, NAVIGATION COMPUTERS), (*INERTIAL NAVIGATION, NAVIGATION COMPUTERS), (*NAVIGATION COMPUTERS, OPTIMIZATION), DATA PROCESSING, COSTS, EFFECTIVENESS, COMPUTER PROGRAMS, DATA STORAGE SYSTEMS, DETECTORS, ERRORS, POSITION FINDING, NOISE, ELECTROMAGNETIC WAVE FILTERS, CIRCUIT(U)
IDENTIFIERS: KALMAN FILTERS (U)

PHASE I OF THE SYNERGISTIC NAVIGATION SYSTEMS STUDY IS A COMPARISON ANALYSIS OF THE COST/EFFECTIVENESS OF VARIOUS OPTIMAL FILTERING TECHNIQUES FOR A DOPPLER-INERTIAL NAVIGATION SYSTEM WITH POSITION-FIXING. THE COSTS ARE ASSESSED IN TERMS OF PROGRAM EXECUTION TIME AND STORAGE REQUIREMENTS IMPOSED ON THE NAVIGATION COMPUTER. THE EFFECTIVENESS IS ASSESSED IN TERMS OF IMPROVEMENTS IN NAVIGATION ACCURACY, ERECTION AND ALIGNMENT TIMES, ETC. THE STUDY DEMONSTRATED THAT AN OPTIMAL KALMAN FILTER, EMPLOYING VELOCITY AND POSITION-FIX INFORMATION, IMPROVES NAVIGATION ACCURACY OVER THE ACCURACY OF A CONVENTIONAL DOPPLER-INERTIAL POSITION-FIX RESET TECHNIQUE. THESE MEMORY AND PROCESSING-RATE REQUIREMENTS CAN BE BROUGHT WITHIN THE ACCEPTABLE IMPLEMENTATION . LIMITS ON AN AIRBORNE DIGITAL COMPUTER. PRESTORED APPROXIMATIONS TO THE OPTIMAL FILTER GAINS SHOULD YIELD NAVIGATION ACCURACY ONLY SLIGHTLY DEGRADED FROM THE OPTIMAL FILTER ACCURACY, BUT WITH FAR FEWER PROGRAM STORAGE REQUIREMENTS. HOWEVER, THE PRESTORED GAIN SUBOPTIMAL FILTER IS LESS FLEXIBLE THAN THE OPTIMAL FILTER. THE ACCURACY OF THE PRESTORED GAIN SUBOPTIMAL FILTER COULD BE DEGRADED IF THE ACTUAL MISSION DIFFERS SUBSTANTIALLY FROM THE MISSION FOR WHICH THE GAINS WERE PRECOMPUTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 649 127 17/7
LITTON SYSTEMS INC WOODLAND HILLS CALIF GUIDANCE AND CONTROL SYSTEMS DIV

EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME I. LN-12. INERTIAL NAVIGATION SYSTEM. BOOK I. DISCUSSION AND ANALYSIS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 66 173P HOLM,ROBERT J. ;
REPT. NO. A022016E66
CONTRACT: FA-65-WA-1112
MONITOR: FAA RD-66-30-1

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *CIVIL AVIATION), (*TRANSPORT AIRCRAFT, INERTIAL NAVIGATION), INSTRUMENTATION, PERFORMANCE(ENGINEERING), RELIABILITY, MAINTENANCE, STEERING (U)
IDENTIFIERS: EVALUATION (U)

A LITTON LN-12 INERTIAL NAVIGATION SYSTEM, WITH A BENDIX CORPORATION INERTIAL NAVIGATION STEERING COMPUTER, WAS FLOWN IN A PAN AMERICAN WORLD AIRWAYS DC-8 AIRCRAFT FOR 55 SCHEDULED TRANSATLANTIC CROSSINGS AND 32 OTHER SHORT FLIGHTS, DOMESTIC AND FOREIGN. PERFORMANCE DATA WERE COLLECTED ON INERTIAL ACCURACY, STEERING BEHAVIOR, TRACK HOLDING, MAINTENANCE, RELIABILITY, IN-FLIGHT OPERATION, POSITION CHECKS AND AZIMUTH DRIFT. EIGHTY PERCENT OF THE FLIGHTS EXHIBITED TERMINAL ERRORS OF 10 MILES OR LESS IN EITHER LATITUDE OR LONGITUDE COORDINATES. THE LN-12 INERTIAL SYSTEM OPERATED 424 HOURS IN THE NAVIGATION MODE, DURING 233 HOURS OF WHICH THE AIRCRAFT WAS GUIDED BY AUTOPILOT CONTROLLED BY INERTIAL STEERING COMMANDS. TWO TRANSATLANTIC FLIGHTS ARE EXAMINED IN DETAIL FOR DOPPLER COMPARISON IN CROSS TRACK MILES TO GO, GROUND SPEED, AND DRIFT ANGLE. THESE FLIGHTS ARE ALSO ANALYZED FOR COMPARISON WITH AIRCRAFT COMPASS HEADING, MEASURED TRACK, DRIFT ANGLE, MILES TO GO, TRACK HEADING, AND WAYPOINT MISSES. RELIABILITY AND MAINTENANCE FACTORS WERE NOT SIGNIFICANT DURING CONDUCT OF THE PROGRAM. PRIOR TO COMMENCEMENT OF THE DATA FLIGHTS, TWO DEMONSTRATION FLIGHTS OF DUAL LN-12 INERTIAL SYSTEMS WERE PERFORMED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 649 634 17/7
LITTON SYSTEMS INC WOODLAND HILLS CALIF GUIDANCE AND CONTROL SYSTEMS DIV

EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME I. LN-12: INERTIAL NAVIGATION SYSTEM. BOOK II. DATA SHEETS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 66 328P HOLM,ROBERT J. ;
REPT. NO. AQ22016E66
CONTRACT: FA-65-WA-1112
MONITOR: FAA-RD 66-30-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-649 127, AD-641 282.

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*COMMERCIAL PLANES, INERTIAL NAVIGATION), (*NAVIGATION COMPUTERS, TRANSPORT AIRCRAFT), JET AIRCRAFT, DATA, POSITION FINDING, ERRORS (U)

BOOK II PRESENTS THE FLIGHT DATA SHEETS AND IN-FLIGHT POSITION ERROR PLOTS COLLECTED BY PAN AMERICAN WORLD AIRWAYS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 650 859 17/7
BENDIX CORP TETERBORO N J FLIGHT CONTROL LAB

COMMERCIAL INERTIAL NAVIGATION SYSTEM PREDICTED ACCURACY OF THE BANC-461/LN-12 INERTIAL NAVIGATION SYSTEM WHEN INSTALLED IN A DC-8 AIRCRAFT. (U)

DESCRIPTIVE NOTE: INTERIM REPT.
AUG 65 73P
REPT. NO. 7311-66-2R
CONTRACT: FA-64-WA-5208
PROJ: FAA-350-101-02N
MONITOR: FAA-RD 65-126

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *COMMERCIAL PLANES), ERRORS, AIRBORNE, ACCURACY, INSTRUMENTATION, NAVIGATION COMPUTERS, POSITION FINDING, MATHEMATICAL PREDICTION, AUTOMATIC PILOTS, AUTOMATIC PILOTS, MATHEMATICAL MODELS, NUMERICAL ANALYSIS, PERFORMANCE(ENGINEERING), JET TRANSPORT PLANES (U)
IDENTIFIERS: DC-8 AIRCRAFT (U)

THE REPORT PRESENTS THE RESULTS OF AN ERROR ANALYSIS STUDY (USING A MATHEMATICAL MODEL) OF THE BANC 461/LN-12 INERTIAL NAVIGATION SYSTEM INSTALLED IN A DC-8 AIRCRAFT. THIS STUDY WAS UNDERTAKEN TO DESCRIBE THE THEORETICAL PERFORMANCE OF THE FIRST AUTOMATIC AUTOPILOT COUPLED INERTIAL NAVIGATION SYSTEM INSTALLED IN A COMMERCIAL JET AIRCRAFT ENGAGED IN REGULAR PASSENGER SERVICE. SPECIFICATIONS FOR SUBSYSTEM ERROR WERE FURNISHED BY THE MANUFACTURERS; BENDIX CORPORATION AND LITTON SYSTEMS, INC. THE DC-8 AIRFRAME/ AUTOPILOT RESPONSE WAS APPROXIMATED BY THE TURN COORDINATION DYNAMICS. TRACKING PERFORMANCE WAS PREDICTED USING THE MATHEMATICAL MODEL AND NUMERICAL ANALYSIS TECHNIQUES. CURVES OF CROSS-TRACK AND ALONG TRACK PREDICTED ERRORS ARE GIVEN FOR A TYPICAL ATLANTIC CROSSING LEG. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 654 373 17/7
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

INERTIAL NAVIGATION SYSTEM DYNAMICS, (U)

OCT 58 23P MUNRO, G. C. ;
REPT. NO. CF-2759
CONTRACT: NORD-7386

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), DYNAMICS, OSCILLATION, MATHEMATICAL ANALYSIS, PERTURBATION THEORY, EARTH(PLANET) (U)

THE PERTURBATION EQUATIONS, WHICH DESCRIBE THE BEHAVIOR OF AN IDEAL INERTIAL NAVIGATION SYSTEM RESULTING FROM SMALL DEPARTURES FROM THE EQUILIBRIUM POSITION, ARE DERIVED FOR ALL COMBINATIONS OF THE SIMPLEST POSSIBLE ASSUMPTIONS CONCERNING BOTH THE INERTIAL NAVIGATION SYSTEM AND THE FIGURE OF THE EARTH, INCLUDING AT LEAST ONE CASE OF PRACTICAL IMPORTANCE. A FEATURE COMMON TO ALL CASES IS FOUND TO BE THE EXISTENCE OF AN OSCILLATION WITH A PERIOD OF TWENTY-FOUR HOURS. IT IS ALSO SHOWN THAT, UNDER CERTAIN SETS OF ASSUMPTIONS, THE OSCILLATION WITH TWENTY-FOUR HOUR PERIOD MAY EXIST WHEN THE ERRORS ARE NOT NECESSARILY SMALL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 654 751 17/7
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

ERROR OSCILLATIONS IN INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 67 36P COUPERTHWAITE,W. J. ;
REPT. NO. RAE-TR-67053

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), GREAT BRITAIN, ERRORS, OSCILLATION, EQUATIONS (U)

INERTIAL NAVIGATION SYSTEM ERRORS ARE ANALYSED IN MORE DETAIL THAN IS FOUND IN THE READILY AVAILABLE LITERATURE, PARTICULARLY IN RESPECT OF THE LONG PERIOD ERRORS. THE EXISTENCE IS SHOWN OF OSCILLATORY ERRORS OF THREE DIFFERENT PERIODS: 84 MINUTES, A NOMINAL 24 HOURS AND A LESS IMPORTANT FOUCAULT PERIOD. THE BASIC EQUATIONS ARE ESSENTIALLY NON-LINEAR AND THIS LIMITS THE SCOPE OF THE ANALYTICAL APPROACH. IT IS HOPED TO ATTEMPT A MORE COMPLETE COMPUTER SIMULATION OF THE PROBLEM LATER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 656 562 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

BASIS OF INERTIAL NAVIGATION, (U)

MAY 67 159P YAKUSHENKOV,A. A. ;
REPT. NO. FTD-MT-65-189
MONITOR: TT 67-62509

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED MACHINE TRANS. OF MONO. OSNOVY INERTSIALNOI NAVIGATSII, MOSCOW, 1963 146P.

DESCRIPTORS: (*INERTIAL NAVIGATION, TEXTBOOKS), THEORY, GYROSCOPES, KINEMATICS, INSTRUMENTATION, STABILIZATION SYSTEMS, ACCELEROMETERS, INTEGRATORS, AUTOMATIC PILOTS, SHIPS, USSR (U)

THE WORK EXPOUNDS THE BASES OF THE THEORY OF INERTIAL SYSTEMS DESIGNED FOR NAVAL NAVIGATION, THE PRINCIPLE OF ACTION OF THEIR COMPONENT ELEMENTS AND QUESTIONS OF LONG-TERM DEVELOPMENT OF INERTIAL NAVIGATION FOR THE NAVAL FLEET. AS THE BASIS OF THE BOOK THERE ARE THE SOMEWHAT EXPANDED AND CONSIDERATION IS GIVEN TO THE KINEMATICS OF SYSTEMS OF INERTIAL NAVIGATION, ORIENTED IN CERTAIN COORDINATE SYSTEMS, WHICH ARE OF INTEREST FOR THE NAVAL FLEET, COMPOSED OF BLOCK DIAGRAMS OF INERTIAL REFERENCE-POINTS IN THESE COORDINATE SYSTEMS; ALSO CONSIDERED ARE CERTAIN SPECIFIC ERRORS OF NAVAL INERTIAL SYSTEMS, AND PRINCIPLES ARE PRESENTED OF AUTOMATIC PILOTAGE USING INERTIAL SYSTEMS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 20M07

AD- 657 161 17/7
GOODYEAR AEROSPACE CORP LITCHFIELD PARK ARIZ

A THEORETICAL TREATMENT OF SCHULER TUNING AS APPLIED TO INERTIAL NAVIGATION SYSTEMS, (U)

NOV 56 43P CURTIS,DAVID W. ;
REPT. NO. GERA-406
CONTRACT: NORD-16164

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH JOHNS HOPKINS UNIV., SILVER SPRING, MD. APPLIED PHYSICS LAB., REPT. CF-2521.

DESCRIPTORS: (*INERTIAL NAVIGATION, EQUATIONS OF MOTION), ACCELEROMETERS, STABILIZED PLATFORMS, DIFFERENTIAL EQUATIONS, ERRORS, ANALYSIS, THEORY (U)

TWO METHODS OF SCHULER-TUNING AN INERTIAL NAVIGATION SYSTEM FOR MOTION ON A SPHERICAL EARTH WERE PARTIALLY INVESTIGATED UNDER THE ASSUMPTION OF PERFECT COMPONENTS. IN EACH METHOD, DIFFERENTIAL EQUATIONS WERE DERIVED THAT DESCRIBE THE ORIENTATION OF THE SYSTEM AS A FUNCTION OF TIME RELATIVE TO A PARTICULAR COORDINATE SYSTEM. IN EACH CASE, THE PARTICULAR COORDINATE SYSTEM REPRESENTED THE DESIRED ORIENTATION OF THE SYSTEM. FOR EACH METHOD, THE DIFFERENTIAL EQUATIONS WERE STUDIED FOR THE SPECIAL CASE OF MOTION THAT CANCELS THE EARTH'S ROTATION (I.E., THE SYSTEM REMAINS STATIONARY WITH RESPECT TO INERTIAL SPACE); AND SOLUTIONS WERE FOUND INSOFAR AS WAS POSSIBLE WITHOUT RECOURSE TO NUMERICAL METHODS. AS WAS EXPECTED, BOTH METHODS LEAD TO SYSTEMS THAT ARE INHERENTLY UNSTABLE. SYSTEM B SEEMS TO BE SUPERIOR TO SYSTEM A IN THAT IT IS SUBJECT TO FEWER UNSTABLE MODES OF MOTION UNDER THE CONDITIONS STUDIED. VARIATIONS IN ALTITUDE ABOVE THE EARTH AND THE ELLIPTICITY OF THE EARTH WERE NEGLECTED TO PERMIT SOME SOLUTIONS TO THE DIFFERENTIAL EQUATIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 659 316 17/7 12/1
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

IDEAS OF THE INVARIANCE THEORY AND INERTIAL NAVIGATION, (U)

AUG 67 23P ISHLINSKII,A. YU ;
REPT. NO. FTD-MT-67-69
MONITOR: TT 67-62999

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: IDEI TEORII INVARIANTNOSTI I INERTSIALNAYA NAVIGATSIYA, EDITED MACHINE TRANS. OF MONO., TEORIYA INVARIANTNOSTI I SISTEMAKH AVTOMATICHESKOGO UPRAVLENIYA, MOSCOW, 1964 P56-64; ALSO PUB. AS VSESOYUZNOE SOVESHCHANIE (NO. 2), KIEV, 29 MAY-1 JUN 1962. TRUDY, MOSCOW, 1964 P56-64.

DESCRIPTORS: (*INVARIANCE, THEORY), (*INERTIAL NAVIGATION, INVARIANCE), CONTROL SYSTEMS, AUTOMATIC, SATELLITES(ARTIFICIAL), ORBITS, GYRO STABILIZERS, USSR (U)

THE ARTICLE REVIEWS THE BASIC CONCEPTS OF THE THEORY OF INVARIANCE AS PERTAINS TO AUTOMATIC CONTROL SYSTEMS, THAT IS, SYSTEMS IN WHICH PERTURBATIONS IMPINGING ON THE SYSTEM ARE AUTOMATICALLY COMPENSATED FOR. THE BASIC IDEAS ARE ILLUSTRATED USING THE CASE OF A PENDULUM, BOTH NEGLECTING AND CONSIDERING THE CURVATURE OF THE EARTH. THIS EXAMPLE IS THEN APPLIED TO THE PROBLEM OF INERTIAL NAVIGATION OF A SATELLITE. THE OBJECT IN THE FIGURE IS ASSUMED TO BE TRAVELING ALONG A GREAT CIRCLE OF THE EARTH. FROM THE POINT OF VIEW OF THE THEORY OF INVARIANCE, THE COMPENSATING FORCE IS SHOWN TO BE M(T). VARIOUS APPLICATIONS OF THE SOLUTION OF THE GYROSCOPIC CONTROL PROBLEM TO ORBITING OBJECTS ARE THEN PRESENTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 70M07

AD- 665 269 17/7
NEW YORK UNIV N Y DEPT OF ELECTRICAL ENGINEERING

DAMPING GIMBALLESS INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
SEP 65 16P GRAMMATIKOS,ANTHONY ;SCHULER,
ALFRED R. ;FEGLEY,KENNETH A. ;
CONTRACT: AF-AFOSR-499-67, NGR-39-010-02
PROJ: AF-9749
TASK: 974901
MONITOR: AFOSR 68-0298

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN IEEE TRANSACTIONS ON AEROSPACE AND ELECTRICAL SYSTEMS, VAES-3, N3 P481-94 MAY 1967.
SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH MELPAR, INC., FALLS CHURCH, VA. AND UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PA.

DESCRIPTORS: (*SPACE NAVIGATION, *INERTIAL NAVIGATION), ACCELEROMETERS, ERRORS, DAMPING, DOPPLER SYSTEMS, COMPUTERS, TRANSCENDENTAL FUNCTIONS, MATRICES(MATHEMATICS), GRAVITY, TRAJECTORIES, STABILIZATION SYSTEMS, STAR TRACKERS, DESIGN (U)
IDENTIFIERS: HYBRID NAVIGATION (U)

THE MECHANIZATION OF A GIMBALLESS INERTIAL SYSTEM FOR SPACE NAVIGATION IS CONSIDERED. AN ERROR ANALYSIS REVEALS THAT THE ERRORS CONTAIN BOTH SINUSOIDAL AND DIVERGING COMPONENTS. ERROR DAMPING METHODS ARE PROPOSED AND IT IS SHOWN THAT DAMPING CAN BE ACHIEVED BY USING APPROPRIATE DAMPING CIRCUITS AND AUXILIARY INFORMATION OBTAINED FROM DEVICES SUCH AS STELLAR TRACKERS, VELOCITY-MEASURING OPTICAL DOPPLER, OR RADAR DOPPLER. COMPUTER-STORED REFERENCE-TRAJECTORY INFORMATION CAN ALSO BE USED FOR ERROR DAMPING. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 666 561 17/7 8/5
HARVARD UNIV CAMBRIDGE MASS LAB FOR COMPUTER GRAPHICS

GEOGRAPHY AND THE PROPERTIES OF SURFACES. A NOMOGRAPHIC REPRESENTATION OF TRAJECTORIES, (U)

MAR 68 13P MESSCHER,WALTER ;
REPT. NO. PAPER-14
CONTRACT: N00014-67-A-0298-0004
PROJ: NR-389-147

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON HARVARD PAPERS IN THEORETICAL GEORGRAPHY.

DESCRIPTORS: (*GEODESICS, *GRAPHICS), (*TRAJECTORIES, NOMOGRAPHS), (*INERTIAL NAVIGATION, TRAJECTORIES), SURFACES, SPACE NAVIGATION, CATHODE RAY TUBE SCREENS, OPTIMIZATION (U)

IT IS SHOWN THAT CERTAIN CLASSES OF 3 DIMENSIONAL TRAJECTORIES ARE EASILY REPRESENTED IN NOMOGRAPHIC FORM. A SERIES OF INCREASINGLY COMPLEX EXAMPLES ARE PRESENTED AS ILLUSTRATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 670 004 17/7
HARVARD UNIV CAMBRIDGE MASS DIV OF ENGINEERING AND APPLIED PHYSICS

APPLICATION OF STATISTICAL SMOOTHING TECHNIQUES TO INERTIAL NAVIGATION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
APR 68 31P MEHRA,R. K. ;
REPT. NO. TR-560
CONTRACT: N00014-67-A-0298, NGR-22-007-068
PROJ: NR-372-012

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, CORRECTIONS), ERRORS, STATISTICAL ANALYSIS, NUMERICAL ANALYSIS, APPROXIMATION(MATHEMATICS), GYROSCOPES, ACCELEROMETERS, DRIFT, SHIPBOARD, VELOCITY, TIME, NOISE, MATRICES(MATHEMATICS) (U)
IDENTIFIERS: KALMAN FILTERS, SHIP'S INERTIAL NAVIGATION SYSTEMS, SINS(SHIP'S INERTIAL NAVIGATION SYSTEM) (U)

ALL INERTIAL NAVIGATION SYSTEMS ARE EXCITED BY RANDOM ERROR INPUTS SUCH AS GYRO DRIFT RATES, ACCELEROMETER ERRORS ETC. THESE ERRORS MAKE THE POSITION AND VELOCITY ERRORS OF THE INERTIAL NAVIGATOR GROW UNBOUNDED WITH TIME IF NO EXTERNAL MEASUREMENTS ARE MADE. STATISTICAL SMOOTHING TECHNIQUES PROVIDE METHODS OF ESTIMATING THESE RANDOM INPUTS FROM TEST RUNS OF THE SYSTEM. (SMOOTHING INVOLVES ESTIMATING THE STATE OF A SYSTEM AT TIME T USING MEASUREMENTS MADE BOTH BEFORE AND AFTER TIME T.) IN THE PRESENT REPORT, A SHIP'S INERTIAL NAVIGATION SYSTEM IS CONSIDERED. IT IS SHOWN THAT BY USING SMOOTHING TECHNIQUES, UNCERTAINTIES IN THE KNOWLEDGE OF RANDOM ERROR SOURCES, PARTICULARLY, GYRO DRIFT RATES, CAN BE SIGNIFICANTLY REDUCED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 20M07

AD- 673 250 17/7 1/2
NAVAL AVIONICS FACILITY INDIANAPOLIS IND

THE USE OF RELATIVE VELOCITY CORRECTIONS IN CARRIER ALIGNMENTS. (U)

DESCRIPTIVE NOTE: WORKING PAPER,
JUL 62 21P BELL,HOWARD E. ;
REPT. NO. NAFI-W-62-820-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIRCRAFT CARRIERS, INERTIAL NAVIGATION), (*CARRIER LANDINGS, ALIGNMENT), INSTRUMENTATION, VELOCITY, CORRECTIONS, NAVAL AIRCRAFT, SKIDDING, FLIGHT DECKS (U)

THE ACCURACY OF AN ALIGNMENT OF AN INERTIAL NAVIGATION SYSTEM ON A MOVING SHIP DEPENDS ON THE ACCURACY OF THE REFERENCE VELOCITY AVAILABLE. THE SENSOR OBTAINING THIS REFERENCE VELOCITY IS ALMOST ALWAYS LOCATED AWAY FROM THE NAVIGATION SYSTEM BEING ALIGNED SUGGESTING THAT A RELATIVE VELOCITY CORRECTION WOULD BE HELPFUL. THIS IS TRUE WHEN THE SENSOR SEES INERTIAL VELOCITY. WHEN THE SOURCE IS AN EM LOG WHICH DOES NOT SEE INERTIAL VELOCITY, A RELATIVE VELOCITY CORRECTION CAN EITHER IMPROVE OR DEGRADE THE REFERENCE VELOCITY DEPENDING ON THE LOCATION OF THE SOURCE AND THE NATURE OF THE TURN. WITH THE APPROPRIATE DATA ON HOW A SHIP TURNS IT MIGHT BE POSSIBLE TO FIND AN EMPIRICAL EQUATION THAT COULD BE USED TO CORRECT EM LOG VELOCITIES TO INERTIAL VELOCITIES REGARDLESS OF THE NATURE OF TURN. THE REPORT GIVES THE EQUATIONS FOR MAKING A RELATIVE VELOCITY CORRECTION WHEN THE SENSOR IS AN INERTIAL SOURCE, AND ALSO DISCUSSES THE ENVELOPE OF CONDITIONS UNDER WHICH THESE SAME CORRECTIONS ARE HELPFUL WHEN THE SENSOR IS AN EM LOG. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 673 861 17/7 1/3
SPERRY RAND CORP GREAT NECK N Y SPERRY GYROSCOPE DIV

JET-FLIGHT EVALUATION OF INERTIAL NAVIGATION OPERATIONS: VOLUME I. (U)

DESCRIPTIVE NOTE: FINAL REPT.
JUL 68 190P
CONTRACT: FA-67-WA-1723
PROJ: FAA-350-101-03N
MONITOR: FAA-RD 68-36-VOL-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH ARINC RESEARCH CORP., ANNAPOLIS, MD. REPT. NO. 558-01-1-879, AND UNITED AIR LINES, INC., ELK GROVE TOWNSHIP, ILL.

DESCRIPTORS: (*COMMERCIAL PLANES, INERTIAL NAVIGATION), (*INERTIAL NAVIGATION, RELIABILITY), JET TRANSPORT PLANES, CIVIL AVIATION, POSITION FINDING, PLOTTERS, HUMAN FACTORS ENGINEERING, AUTOMATIC PILOTS, GROUND SUPPORT EQUIPMENT, DOPPLER SYSTEMS, CORRELATION TECHNIQUES, FAILURE, LIFE EXPECTANCY, FAILURE(ELECTRONICS), FLIGHT PATHS, GROUND POSITION INDICATORS, AIR TRAFFIC CONTROL SYSTEMS, ANALYSIS OF VARIANCE (U)
IDENTIFIERS: *COMPARATIVE STUDIES, EVALUATION, HISTOGRAMS, INERTIAL NAVIGATION, INS(INERTIAL NAVIGATION SYSTEM) (U)

THIS REPORT DESCRIBES THE RESULTS OF A JET-FLIGHT EVALUATION OF INERTIAL NAVIGATION SYSTEM (INS) PERFORMANCE IN THE COMMERCIAL-AIRLINE OPERATIONAL ENVIRONMENT, BOTH DOMESTIC AND OVERWATER. EVALUATION OBJECTIVES INCLUDED (1) ASSESSMENT OF THE COMPATIBILITY OF INERTIAL TECHNIQUES WITH THE PRESENT AIR TRAFFIC CONTROL (ATC) SYSTEM, (2) DETERMINATION OF THE RELATIVE ACCURACY OF INERTIAL NAVIGATION AS COMPARED WITH VOR/DME NAVIGATION, (3) ASSESSMENT OF INERTIAL-SYSTEM UPDATING REQUIREMENTS, (4) EVALUATION OF PILOT-WORKLOAD EFFECTS, AND (5) INVESTIGATION OF SEVERAL OTHER ASPECTS OF THE USE OF AN INERTIAL SYSTEM IN THE COMMERCIAL-AIRLINE ENVIRONMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 674 526 17/7
MASSACHUSETTS UNIV AMHERST SCHOOL OF ENGINEERING

AN ERROR ANALYSIS TECHNIQUE FOR INERTIAL NAVIGATION SYSTEMS AND KALMAN FILTERS, (U)

SEP 68 91P HUTCHINSON,C. E. ;WONDERGEM, H. M. ;
REPT. NO. THEMIS-UM-68-2
CONTRACT: N00014-68-A-0146

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, ERRORS), CONTROL, OPTIMIZATION, CONTROL SYSTEMS, MATHEMATICAL ANALYSIS, NOISE(RADIO), MATRICES(MATHEMATICS), COMPUTER PROGRAM(U)
IDENTIFIERS: KALMAN FILTERS, THEMIS PROJECT (U)

THIS REPORT DEVELOPS A METHOD FOR ANALYZING THE ERRORS INCURRED IN OPTIMUM ESTIMATION SCHEMES. THE OPTIMUM CONTROL LAW FOR MODERN CONTROL SYSTEMS IS USUALLY A FUNCTION OF ALL THE STATES OF THE SYSTEM. IN MANY PRACTICAL CASES IT IS NECESSARY TO EXTRACT INFORMATION CONCERNING THE STATES FROM THE MEASUREMENT OF THE OUTPUT. THIS EXTRACTION PROCESS IS CALLED ESTIMATION. DUE TO RANDOM MEASUREMENT NOISE AND THE RANDOM NOISE COMPONENTS OF THE STATES OF THE SYSTEM, THE ESTIMATE OF THE STATES IS NOT PERFECT. A SET OF COMPUTER PROGRAMS HAS BEEN DEVELOPED THAT PROVIDES A WAY OF EVALUATING OPTIMUM AND SUB-OPTIMUM KALMAN ESTIMATION TECHNIQUES. THE RANDOM NOISE PROCESSES HAVE BEEN DESCRIBED IN A STATISTICAL MANNER, IN ORDER TO SPECIFY THE RANDOM NOISE QUANTITATIVELY AS A FUNCTION OF TIME. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 679 906 17/7
MASSACHUSETTS UNIV AMHERST SCHOOL OF ENGINEERING

OPTIMUM ALIGNMENT OF INERTIAL NAVIGATION SYSTEMS, (U)

NOV 68 88P HUTCHINSON,C. E. ;DE SOUSA,E. A. ;
REPT. NO. THEMIS-UM-68-3
CONTRACT: N00014-68-A-0146

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, ALIGNMENT), INSTRUMENTATION, OPTIMIZATION, ACCURACY, ERRORS, CONTROL SYSTEMS, VELOCITY, FEEDBACK, CORRELATION TECHNIQUES, TIME, COMPUTER PROGRAMS, GYROSCOPES (U)
IDENTIFIERS: CONTROL THEORY, KALMAN FILTERS, THEMIS PROJECT (U)

AT PRESENT, THE ACCURACY OF AN INERTIAL NAVIGATION SYSTEM IS LIMITED BY THE ACCURACY OF THE INITIAL PLATFORM ALIGNMENT PROCESS. THE ACCURACY OF THE PLATFORM IS FURTHER DEGRADED BY INSTRUMENT ERRORS; NAMELY, GYRO DRIFTS, ACCELEROMETER ERRORS, AND INDEPENDENT VELOCITY ERROR SOURCES. THE SPECIFIC ALIGNMENT PROBLEM UNDER CONSIDERATION CONSISTS OF PLACING THE PLATFORM IN A PRESCRIBED ORIENTATION AS RAPIDLY AS POSSIBLE UNDER THE CONSTRAINTS OF MAXIMUM ALLOWABLE ERROR. THE DESIRE TO ALIGN RAPIDLY MAY BE ESSENTIAL TO SUCCESSFUL MISSION ACCOMPLISHMENTS, SO THAT LIMITED RESTRICTIONS ARE PLACED ON THE VEHICLE BEING NAVIGATED BY INERTIAL SYSTEM. CONSEQUENTLY, IT BECOMES NECESSARY TO DESIGN A CONTROL SYSTEM TO MINIMIZE THE EFFECT OF THESE ERRORS AS RAPIDLY AS POSSIBLE. THIS REPORT COMPARES TWO CONTROL SCHEMES; NAMELY, THE KALMAN ESTIMATOR AND THE CLASSICAL VELOCITY FEEDBACK SYSTEM, SO THAT THE BEST POSSIBLE ALIGNMENT BE ACHIEVED. PRESENTLY THE APPLICATION OF SIMPLE VELOCITY FEEDBACK IS THE METHOD EMPLOYED IN PRACTICE. HOWEVER, WITH RECENT ADVANCES IN MODERN CONTROL THEORY, THE ABILITY OF THE ESTIMATION SCHEME OF KALMAN TO PROVIDE SUPERIOR PERFORMANCE CAN BE ILLUSTRATED. THE COMPARISON IS MADE WITH RESPECT TO TWO CRITERIA: THE ABILITY OF THE CONTROL SYSTEM TO PROVIDE ACCURATE ALIGNMENT, AND SPEED OF RESPONSE. A COMPUTER PROGRAM HAS BEEN DEVELOPED TO ANALYZE AND EVALUATE THE RELATIVE MERITS OF THE OPTIMUM KALMAN ESTIMATOR AND THE CLASSICAL FEEDBACK SYSTEM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 682 461 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

ABOUT EQUATIONS OF ERRORS OF INERTIAL NAVIGATION SYSTEMS, DETERMINING ARBITRARY CURVILINEAR COORDINATES OF A MOVING OBJECT, (U)

JUL 68 19P ANDREEV, V. D. ;
REPT. NO. FTD-HT-23-98-68

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. OF AKADEMIYA NAUK SSSR. IZVESTIYA. MEKHANIKA, N4 P108-116 1965, BY L. MAROKUS.

DESCRIPTORS: (*INERTIAL NAVIGATION, ERRORS), INSTRUMENTATION, GYROSCOPES, EQUATIONS OF MOTION, PERTURBATION THEORY, TENSOR ANALYSIS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE REPORT DISCUSSES THE PERTURBED MOTION OF AN INERTIAL NAVIGATION SYSTEM, WHEN ITS ELEMENTS HAVE INSTRUMENTAL ERROR, AND THE INITIAL CONDITIONS ARE INACCURATE. DERIVED ARE EQUATIONS OF ERRORS IN THE DETERMINATION OF INERTIAL COORDINATE SYSTEMS OF AN OBJECT AND PARAMETERS, CHARACTERIZING ITS ORIENTATION IN SPACE. IT IS SHOWN, HOW THESE EQUATIONS CAN BE REDUCED TO EQUATIONS OF ERRORS OF INERTIAL SYSTEMS, DETERMINING DESCARTES' COORDINATES OF THE OBJECT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 687 232 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

OPTIMUM SIGNAL CONVERSION IN AN ASTROINERTIAL SYSTEM, (U)

FEB 69 15P KHENIN,YU. N. ;CHELPANOV, I. B. ;
REPT. NO. FTD-MT-24-429-68

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED MACHINE TRANS. OF POLITEKHNICHESKII INSTITUT, LENINGRAD. TRUDY (USSR) N266 P119-125 1966.

DESCRIPTORS: (*INERTIAL NAVIGATION, POSITION FINDING), ACCELERATION, CELESTIAL NAVIGATION, SIGNALS, INTERFERENCE, TIME SERIES ANALYSIS, ELECTRIC FILTERS, ERRORS, SIGNAL-TO-NOISE RATIO, USSR, INFORMATION THEORY, ACCELEROMETERS, TRANSFER FUNCTIONS (U)
IDENTIFIERS: TRANSLATIONS (U)

THE PROBLEM OF CONTINUOUS DETERMINATION OF THE COORDINATE S(T), WHICH IS MEASURED ON THE EARTH'S SURFACE ALONG THE ARC OF THE GREAT CIRCLE FROM POINT A TO POINT B (WHERE THE OBJECT IS LOCATED) IS EXAMINED. A SINGLE-CHANNEL ASTRO-INERTIAL SYSTEM IS USED. THE PRINCIPLE OF MINIMUM ERROR DISPERSIONS IS USED AS THE TEST OF OPTIMALNESS IN SOLVING THE PROBLEM OF SYNTHESIS OF THE DYNAMIC CHARACTERISTICS OF OPTIMAL CONVERSION ENSURING A MINIMAL TOTAL ERROR. THREE LIMITING CASES ARE EXAMINED: (1) THE INITIAL COORDINATE IS KNOWN PRECISELY AND THE MEAN VELOCITY IS KNOWN WITH LOW ACCURACY; (2) THE INITIAL COORDINATE IS PRACTICALLY UNKNOWN AND THE MEAN VELOCITY IS KNOWN VERY ACCURATELY; (3) NEITHER VALUE IS KNOWN. ALL OF THE RESULTS PERTAIN TO OPERATING TIMES OF UP TO 1000 SEC AND ON THE ORDER OF TENS AND HUNDREDS OF HOURS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 690 789 17/7
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

A DOPPLER INERTIAL INVESTIGATION. (U)

DESCRIPTIVE NOTE: RESEARCH AND DEVELOPMENT TECHNICAL REPT.,
JUN 69 59P LEVINE,IRVING ;GALANTI,CARL J. ;
REPT. NO. ECOM-3137
PROJ: DA-1-H-162202-A-219
TASK: 1-H-162202-A-21901

UNCLASSIFIED REPORT

DESCRIPTORS: (*DOPPLER NAVIGATION, *INERTIAL NAVIGATION), INSTRUMENTATION, ERRORS, ANALYSIS (U)

AN ERROR ANALYSIS OF A HYBRID DOPPLER-INERTIAL SYSTEM (SECOND ORDER) WAS PERFORMED WITH AND WITHOUT NOISE ERROR SOURCES. FROM THIS ANALYSIS IT WAS DETERMINED THAT THE DOPPLER IS THE KEY CONTRIBUTOR TO THE VELOCITY ERROR OF THE SYSTEM. ALSO, A PROCEDURE FOR SELECTING THE PARAMETERS OF A DOPPLER-INERTIAL SYSTEM FOR MINIMUM COST AND MAXIMUM PERFORMANCE WAS DERIVED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 692 540 17/7
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT
PARIS (FRANCE)

INERTIAL NAVIGATION - SYSTEMS AND
COMPONENTS. (U)

DESCRIPTIVE NOTE: CONFERENCE PROCEEDINGS.
MAY 68 568P
REPT. NO. AGARD-CP-43

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: NATO FURNISHED. PRESENTED AT TWO MEETINGS OF THE GUIDANCE AND CONTROL PANEL OF AGARD, IN OXFORD, ENGLAND DURING 1967 AND AT BRAUNSCHWEIG, GERMANY, IN MAY 1968.

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), SYMPOSIA, INERTIAL GUIDANCE, STABILIZED PLATFORMS, GYRO STABILIZERS, NAVIGATION COMPUTERS, DOPPLER NAVIGATION, DETECTORS, REDUNDANT COMPONENTS, ACCELEROMETERS, QUARTZ RESONATORS, GIMBALS, GAS BEARINGS, GYROSCOPES (U)
IDENTIFIERS: STRAPPED-DOWN GUIDANCE SYSTEMS (U)

THIS VOLUME OF SYMPOSIA PROCEEDINGS OF THE OXFORD AND BRAUNSCHWEIG MEETINGS REPRESENTS THE FIRST PUBLICATION OF THE GUIDANCE AND CONTROL PANEL. THE READER WILL FIND CONTAINED HEREIN COVERAGE OF THE BROAD AREAS OF INERTIAL NAVIGATION: COMPONENTS, SYSTEMS AND APPLICATIONS. FOURTEEN PAPERS WERE PRESENTED AT THE OXFORD SYMPOSIUM AND ALL BUT TWO OF THESE ARE INCLUDED HERE AS INDICATED IN THE TABLE OF CONTENTS. TWENTY-ONE PAPERS WERE PRESENTED AT THE BRAUNSCHWEIG SYMPOSIUM AND ALL BUT THREE OF THESE ARE INCLUDED HERE, ALSO AS INDICATED IN THE TABLE OF CONTENTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 698 293 17/7
IOWA STATE UNIV AMES ENGINEERING RESEARCH INST

ANALYSIS OF AN INTEGRATED INERTIAL/DOPPLER-SATELLITE NAVIGATION SYSTEM: PART I. THEORY AND MATHEMATICAL MODEL. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
DEC 69 71P BROWN,R. GROVER ;
REPT. NO. ERI-62600
CONTRACT: N00014-68-A-0162

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON PROJECT THEMIS, AUTOMATIC NAVIGATION AND CONTROL.

DESCRIPTORS: (*INERTIAL NAVIGATION, *NAVIGATION SATELLITES), DOPPLER NAVIGATION, CORRECTIONS, DRIFT, ERRORS (U)
IDENTIFIERS: KALMAN FILTERS, THEMIS PROJECT (U)

INERTIAL NAVIGATION SYSTEMS HAVE REACHED A HIGH LEVEL OF SOPHISTICATION IN RECENT YEARS, BUT THE EFFECT OF LONG-TERM-DRIFT IS STILL A PROBLEM IN MANY APPLICATIONS. IT HAS BEEN DEMONSTRATED THAT POSITION FIXES OBTAINED FROM THE NAVY NAVIGATION SATELLITE SYSTEM MAY BE USED TO UPDATE AN INERTIAL SYSTEM, BUT SIMPLE POSITION UPDATING CAN NOT CORRECT THE UNDERLYING CAUSES OF THE DRIFT NOR CAN IT CORRECT THE SCHULER OSCILLATION IN THE UNDAMPED CASE. THIS REPORT DESCRIBES A METHOD OF SYSTEM INTEGRATION WHEREBY THE DOPPLER DATA IS TREATED DIRECTLY AS THE OBSERVABLE IN A KALMAN-FILTER RESET SCHEME. THE ADVANTAGE OF THIS APPROACH IS THAT ESTIMATES OF THE INERTIAL VELOCITY AND GYRO BIAS ERRORS ARE OBTAINED AS WELL AS THE POSITION ERRORS. THUS, THE ADDITIONAL INFORMATION OBTAINED FROM THE KALMAN FILTER CAN BE USED TO REDUCE THE RATE OF ERROR PROPAGATION IN THE INTERIM BETWEEN PASSES. DETAILS OF THE KALMAN FILTER MODEL ARE PRESENTED IN THE REPORT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 700 039 17/7 22/2
AEROSPACE CORP EL SEGUNDO CALIF SYSTEMS ENGINEERING OPERATIONS

CHARACTERISTICS OF A SATELLITE NAVIGATION SYSTEM OPERATED IN CONJUNCTION WITH A USER INERTIAL SYSTEM. (U)

DESCRIPTIVE NOTE: REPT. FOR 1965-JUL 69, JAN 70 14P LEONARD,B. P. ;WOODFORD,J. B. ;
REPT. NO. TR-0066(5521-01)-2
CONTRACT: F04701-69-C-0066
MONITOR: SAMSO TR-69-401

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *NAVIGATION SATELLITES), SYNCHRONOUS SATELLITES, INCLINED ORBIT TRAJECTORIES, RANGE(DISTANCE), TIME, CORRECTIONS, CALIBRATION (U)

A HYBRID SATELLITE/INERTIAL NAVIGATION SYSTEM POSSESSING MANY UNIQUE AND DESIRABLE FEATURES IS DEFINED. A SET OF FOUR SATELLITES PLACED IN 24-HOUR INCLINED, ELLIPTICAL ORBITS CAN BE MADE SO THAT THREE SATELLITES FORM A STATIONARY, CIRCULAR GROUND TRACE WITH THE FOURTH SATELLITE MOVING IN A SMALLER, CLOSED PATH AT THE CENTER. THREE OR FOUR SUCH CONSTELLATIONS CAN PROVIDE NEARLY GLOBAL COVERAGE. THE SYSTEM WORKS ON THE FOLLOWING PRINCIPLE: EACH SATELLITE CONTAINS A CLOCK, A TRANSMITTER, AND A RECEIVER. A MASTER GROUND STATION (WITH ASSOCIATED CALIBRATION STATIONS) PERIODICALLY CHECKS AND UPDATES THE SATELLITE CLOCKS AND EPHEMERIDES. THE SATELLITES ARE CONSTANTLY TRANSMITTING A SIGNAL MODULATED WITH A TIME CODE. THE USER SIMULTANEOUSLY RECEIVES ALL FOUR SIGNALS, WHICH CONTAIN RANGE, TIME, AND SATELLITE POSITION DATA. WITH FOUR SUCH MEASUREMENTS THE USER CAN BOTH ADJUST HIS CLOCK TO THAT OF THE SATELLITES AND COMPUTE A THREE-DIMENSIONAL FIX. CORRESPONDINGLY, WITH RANGE RATE DATA, HE CAN ESTABLISH A THREE-DIMENSIONAL VELOCITY. IT IS IMPORTANT TO NOTE THAT THE SATELLITE SYSTEM DESCRIBED IS NOT SELF-CONTAINED. HOWEVER, IF THE USER COMBINES THIS SYSTEM WITH AN INERTIAL NAVIGATION SYSTEM, MANY OF THE ADVANTAGES OF A TOTALLY SELF-CONTAINED SYSTEM CAN BE ACHIEVED. THE SATELLITE SYSTEM WOULD BE USED TO POSITION-UPDATE, ALIGN, AND FAILURE-MONITOR THE INERTIAL SYSTEM AND CALIBRATE THE ACCELEROMETER. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 70M07

AD- 700 462 11/3 11/8 17/2.1 14/2
13/8

FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

DESCRIPTIONS OF INVENTIONS (A COLLECTION OF SOVIET PATENTS), (U)

OCT 69 33P VAINSHTEIN,V. E. ;MODEL,A. M. ;ZAKHARIN,M. I. ;KAMKHIN,YA. B. ;KULIK, P. P. ;

REPT. NO. FTD-7230178

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF VARIOUS SOVIET PATENTS, BY D. KOOLBECK.

DESCRIPTORS: (*LUBRICANTS, COATINGS), (*RADIO RELAY SYSTEMS, *WAVEGUIDES), (*INERTIAL NAVIGATION, TRACKING), (*ROLLER BEARINGS, MONITORS), (*VISCOSIMETERS, VAPORS), (*ELECTRODEPOSITION, SILVER ALLOYS), (*VAPOR PLATING, METAL COATINGS), PATENTS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

CONTENTS: METHOD OF APPLYING A SOLID LUBRICANT COATING; DEVICE FOR CONNECTING TWO RADIO-RELAY SYSTEMS TO A COMMON ANTENNA-WAVEGUIDE CHANNEL; METHOD FOR DETERMINING INSTANTANEOUS VALUES OF COORDINATES OF MOVING OBJECTS; INSTRUMENT FOR MONITORING PLAY IN ROLLER BEARINGS; DEVICE FOR MEASURING VISCOSITY OF ALKALI METAL VAPORS; ANTIFRICTION GREASE; LUBRICANT FOR RETAINING PARTICLES ON A SOLID SURFACE; METHOD FOR ELECTRODEPOSITION OF A SILVER-LEAD ANTIFRICTION ALLOY; METHOD OF METAL COATING OF FOAMED PLASTICS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 701 641 1/3 1/4
AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT BOSCOMBE DOWN (ENGLAND)

USE OF A FLYING LABORATORY COMET AIRCRAFT FOR NAVIGATION AND RADIO EQUIPMENT TRIALS, (U)

DEC 68 28P DYER,G. C. ;
REPT. NO. AAEE/TECH/395/NAV

UNCLASSIFIED REPORT

DESCRIPTORS: (*JET TRANSPORT PLANES, INSTRUMENTATION), (*AIRCRAFT EQUIPMENT, TEST FACILITIES), (*INERTIAL NAVIGATION, TEST FACILITIES), ALTIMETERS, DIGITAL COMPUTERS, PHOTOGRAPHIC EQUIPMENT, DIGITAL RECORDING SYSTEMS, LASERS, GREAT BRITAIN (U)
IDENTIFIERS: AVIONICS, COMET 4C AIRCRAFT (U)

A PERMANENTLY INSTRUMENTED COMET 4C AIRCRAFT IS OPERATED EXCLUSIVELY FOR FLIGHT TESTING OF NEW AVIONIC EQUIPMENT. THIS REPORT DESCRIBES THE FACILITIES OFFERED BY THIS FLYING LABORATORY; EMPHASIS IS PLACED ON THE DIGITAL TRIALS METHODS APPROPRIATE TO THE TESTING OF INERTIAL NAVIGATION SYSTEMS. THE FUNCTIONS PROVIDED BY A MICRO-MINIATURE GEC G719 DIGITAL COMPUTER IN REAL-TIME PROCESSING OF INFORMATION FROM VARIOUS 'DATUM' SENSORS, AND PRODUCING, IN-FLIGHT, RECORDS OF TEST EQUIPMENT ERRORS IS DESCRIBED. THE USE OF A 'DATUM' LASER ALTIMETER FOR RADIO ALTIMETER TESTING IS ALSO DESCRIBED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 701 853 17/7
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT E V OBERPFAFFENHOFEN (WEST GERMANY)

ZUR ENTWICKLUNG DER TRAEGHEITSNAVIGATION: EINE HISTORISCHE RICHTIGSTELLUNG (THE DEVELOPMENT OF INERTIAL NAVIGATION: A HISTORICAL CORRECTION), (U)

APR 69 5P ZETZMANN,H. J. ;
REPT. NO. DFVLR-SONDERDRUCK-1

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN LUFTFAHRTZUBEHOER, V48 N4 P141-144 APR 69. NO COPIES FURNISHED.
SUPPLEMENTARY NOTE: TEXT IN GERMAN.

DESCRIPTORS: (*INERTIAL NAVIGATION, REVIEWS), GYROSCOPES, NUMERICAL INTEGRATION, WEST GERMANY (U)

REPRINT: THE DEVELOPMENT OF INERTIAL NAVIGATION: A HISTORICAL CORRECTION.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 702 090 17/7
NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATLANTIC CITY N J

INERTIAL NAVIGATION SUPPORT, PHASE III. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
MAR 70 74P MAYER,ROBERT H. ;
REPT. NO. NA-70-24
PROJ: FAA-350-101-03X
MONITOR: FAA-RD 70-3

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-852 583L.

DESCRIPTORS: (*JET TRANSPORT PLANES, *INERTIAL NAVIGATION), FEASIBILITY STUDIES, COSTS, COST EFFECTIVENESS, AIR TRAFFIC CONTROL SYSTEMS, FLIGHT TESTING (U)

THE REPORT CONSIDERS SEVERAL ASPECTS OF THE USE OF INERTIAL NAVIGATION AND GUIDANCE IN THE U. S. DOMESTIC AIR TRAFFIC ENVIRONMENT. IT PRESENTS FLIGHT TEST DATA TAKEN ON REGULAR SCHEDULED COMMERCIAL CARGO JET AIRCRAFT FLIGHTS OF THE SPERRY SGN-10 INERTIAL NAVIGATION SYSTEM (INS.) IT FURTHER PRESENTS AN OPERATIONAL STUDY OF INERTIAL GUIDANCE AS COMPARED WITH THE PRESENT VORTAC SYSTEM OF NAVIGATION. THE RESULTS OF THE DATA ANALYSIS AND THE STUDY INDICATE THAT IT IS FEASIBLE TO USE INERTIAL NAVIGATION DURING THE ENROUTE PORTION OF THE FLIGHT AND THAT BENEFITS CAN THEREBY BE OBTAINED. IT ALSO SHOWS THAT VERY LITTLE USE OF THE SYSTEM COULD BE REALIZED IN THE TERMINAL AREAS UNDER THE PRESENT STANDARD INSTRUMENT DEPARTURES (SIDS) AND APPROACH PROCEDURES. A COST-BENEFIT STUDY SHOWED THAT THE COST OF OPERATION AND OWNERSHIP EXCEEDED THE BENEFITS DERIVED UNLESS THE COST OF OPERATION WAS PRORATED WITH SOME OTHER SERVICE, SUCH AS INTERNATIONAL GUIDANCE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 705 256 17/7
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

A DOPPLER INERTIAL INVESTIGATION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 70 58P GALANTI,CARL J. ;LEVINE,
IRVING ;
REPT. NO. ECOM-3247
PROJ: DA-1-H-162202-A-219
TASK: 1-H-162202-A-21901

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SUPERSEDES AD-690 789.

DESCRIPTORS: (*DOPPLER NAVIGATION, *INERTIAL NAVIGATION), HELICOPTERS, INSTRUMENTATION, ERRORS, ANALYSIS, NOISE(RADIO) (U)

AN ERROR ANALYSIS OF A HYBRID DOPPLER-INERTIAL SYSTEM (SECOND ORDER) WAS PERFORMED WITH AND WITHOUT NOISE ERROR SOURCES. FROM THIS ANALYSIS IT WAS DETERMINED THAT THE DOPPLER IS THE KEY CONTRIBUTOR TO THE VELOCITY ERROR OF THE SYSTEM. ALSO, A PROCEDURE FOR SELECTING THE PARAMETERS OF A DOPPLER-INERTIAL SYSTEM FOR MINIMUM COST AND MAXIMUM PERFORMANCE WAS DERIVED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 706 219 17/7
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

RAPID INITIALIZATION OF INERTIAL NAVIGATION SYSTEMS THROUGH PARAMETER ESTIMATION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 70 104P DASARO,JOSEPH A. ;
REPT. NO. ECOM-3243
PROJ: DA-1-H-163207-D-235
TASK: 1-H-163207-D-23508

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIRCRAFT, INERTIAL NAVIGATION), (*STABILIZED PLATFORMS, ALIGNMENT), INSTRUMENTATION, GYRO COMPASSES, AZIMUTH, DRIFT, INFORMATION THEORY, AIRCRAFT EQUIPMENT, COMPUTER PROGRAMS, THESES (U)

THE ACCURACY OF AN AIRCRAFT INERTIAL NAVIGATION SYSTEM DEPENDS UPON THE ACCURACY WITH WHICH THE SYSTEM IS INITIALLY ALIGNED. ONE PROCEDURE FOR INITIAL ALIGNMENT INVOLVES THE USE OF AN EXTERNAL REFERENCE. THIS METHOD UTILIZES EQUIPMENT WHICH IS MUCH TOO ELABORATE FOR NORMAL OPERATIONAL USE. AN ALTERNATE PROCEDURE USES THE SYSTEM'S INERTIAL SENSORS IN A SELF-CONTAINED METHOD. IF SUFFICIENT TIME WERE AVAILABLE, THE SELF-CONTAINED METHOD COULD ACHIEVE ACCURACIES COMMENSURATE WITH THE SENSOR ACCURACIES; HOWEVER, IN AN OPERATIONAL ENVIRONMENT IT IS USUALLY NECESSARY TO SACRIFICE SOME ACCURACY IN THE INTEREST OF ACHIEVING A MORE RAPID INITIATION. THIS DISSERTATION INVESTIGATES THE METHODS PRESENTLY AVAILABLE FOR INITIALIZATION OF AN INERTIAL PLATFORM IN AN AZIMUTH WANDER OR FREE AZIMUTH INSTRUMENTATION AND PRESENTS A NEW METHOD FOR RAPID INITIALIZATION. THE PARAMOUNT PROBLEM IS THE DETERMINATION OF THE INITIAL AZIMUTH ANGLE IN MINIMUM TIME IN THE PRESENCE OF RANDOM GYRO DRIFTS, RANDOM ACCELEROMETER DRIFTS, AND MEASUREMENT NOISE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 708 479 17/7 12/2
CALIFORNIA UNIV LOS ANGELES SCHOOL OF ENGINEERING AND APPLIED SCIENCE

ON THE OPTIMUM UTILIZATION OF INERTIAL COMPONENTS. (U)

DESCRIPTIVE NOTE: DOCTORAL THESIS,
APR 70 199P HOY,EUGENE CHIN ;
REPT. NO. 70-24
CONTRACT: F04701-69-C-0182, AF-AFOSR-699-67
PROJ: AF-9749
TASK: 974901
MONITOR: AFOSR 70-1849TR

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, DETECTORS), ACCELEROMETERS, MATHEMATICAL MODELS, GYROSCOPES, OPTIMIZATION, GUIDED MISSILE TRAJECTORIES, INERTIAL GUIDANCE, TOLERANCES(MECHANICS), ACCEPTABILITY, THESE(U)

A VARIETY OF PROBLEMS DEALING WITH THE OPTIMUM UTILIZATION OF INERTIAL SENSORS IS DISCUSSED. INERTIAL SENSORS, I.E., ACCELEROMETERS AND GYROSCOPES, PLAY AN IMPORTANT ROLE IN DETERMINING THE OVERALL PERFORMANCE OF A SYSTEM USING INERTIAL NAVIGATION. THE PERFORMANCE OF AN INERTIAL SYSTEM IS DETERMINED NOT ONLY BY THE BASIC CHARACTERISTICS OF THE INDIVIDUAL SENSORS, BUT ALSO BY THE MANNER IN WHICH THE SENSORS ARE EMPLOYED. FOR EXAMPLE, THE ORIENTATION OF THE SENSORS WITH RESPECT TO THE TRAJECTORY, AND THE TRAJECTORY ITSELF DETERMINE WHAT EFFECTS THE SENSOR ERRORS WILL HAVE ON THE SYSTEM PERFORMANCE. DIRECT ANALYTICAL SOLUTIONS TO THE OPTIMUM ORIENTATION PROBLEMS ARE DESIRED TO PROVIDE FRESH INSIGHTS INTO THE SITUATION AND TO SUPPLEMENT EXISTING ORIENTATION GUIDELINES. METHODS OF MOST EFFECTIVELY UTILIZING REDUNDANT DATA ARE DESIRED. BOTH BALLISTIC AND CRUISE INERTIAL SYSTEMS ARE CONSIDERED. TO FACILITATE THE OBTAINING OF DIRECT ANALYTICAL SOLUTIONS, ACCURACY CRITERIA AND ERROR MODELS ARE ESTABLISHED THAT ARE NOT ONLY SIGNIFICANT BUT ARE CONDUCIVE TO OBTAINING ANALYTICAL SOLUTIONS AS WELL. FOR OPTIMUM ORIENTATION PROBLEMS, ANALYTICAL EXPRESSIONS ARE FIRST DERIVED FOR THE ACCURACY CRITERIA IN TERMS OF THE ORIENTATION PARAMETERS. THEN, THE ORIENTATION PARAMETERS THAT OPTIMIZE THESE CRITERIA ARE FOUND. SIMILARLY, THE MOST MATHEMATICALLY TRACTABLE FORMS ARE SELECTED FOR THE EXAMINATION OF REDUNDANT SENSORS, (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 711 951 17/7
LITTON SYSTEMS INC WOODLAND HILLS CALIF AERO PRODUCTS DIV

FLIGHT EVALUATION OF INERTIAL/DME/DME SYSTEM. (U)

DESCRIPTIVE NOTE: REPT. NO. 10 (FINAL),
MAY 70 180P HOLM,R. J. ;
CONTRACT: FA-69-WA-2122
MONITOR: FAA-RD 70-24

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: ERRATA SHEET ENCLOSED.

DESCRIPTORS: (*INERTIAL NAVIGATION, FLIGHT TESTING), (*DISTANCE MEASURING EQUIPMENT, FLIGHT TESTING), POSITION FINDING, ACCURACY (U)

A LITTON LTN-51 INERTIAL NAVIGATION SYSTEM AUGMENTED BY TWO ARINC 568 DIGITAL DME'S WAS FLOWN IN AN FAA FLIGHT INSPECTION AIRCRAFT FOR EVALUATION OF UPDATED INERTIAL PERFORMANCE IN THE DOMESTIC AREA. THE LTN-51 INERTIAL COMPUTER RECEIVED RANGE INPUTS FOR TWO SEPARATE DME STATIONS. THE GEOGRAPHIC FIX OF THE TWO DME RANGES WAS USED TO UPDATE THE INERTIAL SYSTEM. DATA WAS RECORDED AUTOMATICALLY EVERY FOUR SECONDS AND PERFORMANCE VALIDATED BY COMPARISON WITH FLIGHT INSPECTION POSITION CALIBRATION. 150 SUCCESSFUL FLIGHT HOURS COVERING THE WESTERN UNITED STATES WERE ACHIEVED IN 2 1/2 MONTHS. DATA SHOWS DEVIATION WAS 1,102 FEET, 50%; 1,233 FEET, 68%; 2,530 FEET, 95%; AND 3,499 FEET, 100% (MEAN PERCENTILE POINTS). TERMINAL APPROACHES WERE ALSO DEMONSTRATED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 714 501 12/1 17/7
IOWA STATE UNIV AMES ENGINEERING RESEARCH INST

SUBOPTIMIZATION OF A KALMAN FILTER WITH DELAYED-STATES AS OBSERVABLES. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
OCT 70 84P CLINE,TERRY B. ;TRISKA,C. JAMES ;
REPT. NO. ISU-ERI-AMES-77000
CONTRACT: N00014-68-A-0162
PROJ: ERI-712-S

UNCLASSIFIED REPORT

DESCRIPTORS: (*CONTROL SYSTEMS, MATHEMATICAL MODELS), (*NAVIGATION SATELLITES, *INERTIAL NAVIGATION), SET THEORY, DIFFERENTIAL EQUATIONS, RECURSIVE FUNCTIONS, NAVIGATIONAL AIDS, MATRICES(MATHEMATICS), OPTIMIZATION (U)
IDENTIFIERS: AUTOMATIC, CONTROL, FILTERING THEORY, *KALMAN FILTERS, *CONTROL THEORY, COVARIANCE MATRIX, ESTIMATION THEORY (U)

THE COMPUTATIONAL REQUIREMENTS OF THE KALMAN FILTER MAY BECOME EXCESSIVE WHEN THE MEASUREMENT MODEL INCLUDES A CONNECTION WITH BOTH THE PRESENT STATE AND A PREVIOUS STATE. THREE ASPECTS OF THIS PROBLEM ARE STUDIED. A PERFORMANCE ANALYSIS IS PRESENTED AND A PERFORMANCE INDEX IS DEFINED AS AN AID IN EVALUATING THE PERFORMANCE OF TWO CLASSES OF SUBOPTIMAL FILTERS WHICH MAY BE USED TO SOLVE THIS PROBLEM. THE TWO CLASSES ARE SUBOPTIMALITY DUE TO MODELING VARIATIONS AND DUE TO ALTERNATE GAIN ALGORITHMS. A SUBOPTIMAL FILTER IS DERIVED WHICH BELONGS TO THE SECOND CLASS. THE SIMULATION OF A PROPOSED INTEGRATED INERTIAL/DOPPLER-SATELLITE NAVIGATION SYSTEM IS PERFORMED TO STUDY THE PERFORMANCE OF FILTERS BELONGING TO BOTH OF THE ABOVE CLASSES. (ATHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 716 263 17/7 14/2
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT
PARIS (FRANCE)

INERTIAL COMPONENT TESTING: PHILOSOPHY AND METHODS, (U)

70 583P DENHARD, W. G. ;
REPT. NO. AGARD-OGRAPH-128

UNCLASSIFIED REPORT
AVAILABILITY: PAPER COPY AVAILABLE FROM CIRCA PUBLICATIONS, INC. 415 FIFTH AVE, PELHAM, NEW YORK 10803. NO COPIES FURNISHED BY DDC OR NTIS.
SUPPLEMENTARY NOTE: NATO FURNISHED.

DESCRIPTORS: (*INSTRUMENTATION, TEST METHODS), (*INERTIAL NAVIGATION, INSTRUMENTATION), DETECTORS, STABILIZED PLATFORMS, GYROSCOPES, GAS BEARINGS, ACCELEROMETERS, INERTIAL GUIDANCE, TEST EQUIPMENT (U)

THIS VOLUME CONTAINS THE PROCEEDINGS OF THE LECTURE SERIES SPONSORED BY THE GUIDANCE AND CONTROL PANEL OF AGARD AND PRESENTED IN PARIS IN JUNE 1968. THE FOURTEEN CHAPTERS COVER COMPONENT TESTING, ASSEMBLY TESTING AND SYSTEM TESTING OF GYROS, REFERENCE PLATFORMS, ACCELEROMETERS AND THE DESIGN OF SUITABLE TEST EQUIPMENT. THE HISTORY AND ECONOMIC JUSTIFICATION OF GYRO TESTING IS ALSO DISCUSSED, TOGETHER WITH AN INDICATION OF FUTURE TRENDS. THE EFFECTS OF DESIGN SHORTCOMINGS AND THE VARIOUS TYPES OF GAS AND HYDROSTATIC MOTOR BEARINGS ON GYRO TESTING AND TEST SPECIFICATIONS ARE DESCRIBED. THE BOOK IS CONCLUDED BY THE EDITED PROCEEDINGS OF A DISCUSSION WHICH REVEALS THE TESTING SYSTEM PHILOSOPHY AND THE TEST SPECIFICATION AND INTERFACE PROBLEMS FACED BY DESIGNERS, TEST ENGINEERS, AND MANUFACTURERS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 717 058 9/2 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

A DIGITAL COMPUTING DEVICE FOR AN INERTIAL NAVIGATION SYSTEM, (U)

OCT 70 10P STOROZHENKO,V. O. ;
TEMCHENKO,M. E. ;
REPT. NO. FTD-HC-23-1504-68
PROJ: FTD-7230178

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. OF AKADEMIYA NAUK URSR, KIEV. DOPOVIDI. SERIYA A: FIZIKO-TEKHNICHNI TA MATEMATICHNI NAUKI, V29 N9 P827-829 1967.

DESCRIPTORS: (*NAVIGATION COMPUTERS, COMPUTER PROGRAMMING), (*INERTIAL NAVIGATION, EQUATIONS OF MOTION), NONLINEAR DIFFERENTIAL EQUATIONS, STABILITY, POSITION FINDING, POLAR REGIONS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE OPERATION OF A COMPUTER SERVING AN INERTIAL NAVIGATION SYSTEM WITH STABILIZATION IN THE HORIZONTAL PLANE REQUIRES THE SOLUTION OF A SYSTEM OF THREE NONLINEAR DIFFERENTIAL EQUATIONS INVOLVING, AS VARIABLES, THE LATITUDE AND LONGITUDE OF THE MOVING OBJECT, AND THE ANGLE WHICH CHARACTERIZES THE POSITION OF THE PLANE IN THE AZIMUTH WITH RESPECT TO THE GEOGRAPHICAL SYSTEM OF COORDINATES. UNFORTUNATELY, A COMPUTER DESIGNED TO DEAL DIRECTLY WITH THESE EQUATIONS INVOLVES A NUMBER OF TECHNICAL DIFFICULTIES LEADING TO SUBSTANTIAL ERRORS. BY INTRODUCING THE RODRIGUES-HAMILTON PARAMETERS, THE AUTHOR REDUCES THE COMPUTING FUNCTION ESSENTIALLY TO THE SOLUTION OF FOUR LINEAR DIFFERENTIAL EQUATIONS EQUIVALENT TO THE ORIGINAL SYSTEM. ONE APPARENT ADVANTAGE OF A COMPUTER SO DESIGNED IS THAT NO SHIFT TO A SECOND COORDINATE SYSTEM IS REQUIRED IN THE CASE OF NAVIGATION NEAR THE POLES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 718 715 17/7
SPERRY RAND CORP GREAT NECK N Y SPERRY GYROSCOPE DIV

JET-FLIGHT EVALUATION OF INERTIAL NAVIGATION OPERATIONS. VOLUME 2. (U)

DESCRIPTIVE NOTE: FINAL REPT.
JUL 68 317P
CONTRACT: FA-67-WA-1723
PROJ: FAA-350-101-03N
MONITOR: FAA-RD 68-36-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 1, AD-673 861. PREPARED IN COOPERATION WITH ARINC RESEARCH CORP., ANNAPOLIS, MD. REPT. NO. 558-01-1-879, AND UNITED AIR LINES, INC., ELK GROVE TOWNSHIP, ILL.

DESCRIPTORS: (*INERTIAL NAVIGATION, RELIABILITY), (*COMMERCIAL PLANES, INERTIAL NAVIGATION), CIVIL AVIATION, POSITION FINDING, AUTOMATIC PILOTS, FLIGHT PATHS, GROUND POSITION INDICATORS, GYRO COMPASSES, DOPPLER SYSTEMS, STATISTICAL DATA, JET TRANSPORT PLAN(U)
IDENTIFIERS: INERTIAL NAVIGATION, INS(INERTIAL NAVIGATION SYSTEMS), EVALUATION (U)

THIS REPORT DESCRIBES THE RESULTS OF A JET-FLIGHT EVALUATION OF INERTIAL NAVIGATION SYSTEM (INS) PERFORMANCE IN THE COMMERCIAL-AIRLINE OPERATIONAL ENVIRONMENT, BOTH DOMESTIC AND OVERWATER. A DESCRIPTION OF THE PROGRAM AND A DISCUSSION OF THE RESULTS ARE PRESENTED IN VOLUME I. VOLUME II PRESENTS THE RAW DATA ASSOCIATED WITH TWELVE TYPICAL DATA FLIGHTS AND COMPUTED VALUES OF INS 1 AND INS 2 ALONG-TRACK AND ACROSS-TRACK ERROR. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 719 613 12/2 17/7
CALIFORNIA UNIV LOS ANGELES SCHOOL OF ENGINEERING AND APPLIED SCIENCE

SYNTHESIS OF COMPUTATIONALLY EFFICIENT SEQUENTIAL LINEAR ESTIMATORS, (U)

JUN 66 9P PENTECOST,EUGENE E. ; STUBBERUD,ALLEN B. ;
CONTRACT: AF-AFOSR-699-65
PROJ: AF-9749
MONITOR: AFOSR TR-71-0462

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS, VAES3 N2 P242-249 MAR 67.
SUPPLEMENTARY NOTE: REVISION OF REPORT DATED 2 SEP 65.

DESCRIPTORS: (*DECISION THEORY, SEQUENTIAL ANALYSIS), (*INERTIAL NAVIGATION, MATHEMATICAL MODELS), LINEAR SYSTEMS, MATRICES(MATHEMATICS), OPTIMIZATION (U)
IDENTIFIERS: SEQUENTIAL ESTIMATION, KALMAN FILTERS, CONTROL THEORY, ESTIMATION THEORY (U)

THE KALMAN SEQUENTIAL LINEAR ESTIMATION THEORY, ALTHOUGH NOT ALWAYS UTILIZED BECAUSE THE NUMBER OF COMPUTATIONS REQUIRED FOR MANY SYSTEMS OF PRACTICAL IMPORTANCE BECOMES PROHIBITIVE, ALLOWS STRAIGHTFORWARD SYNTHESIS OF OPTIMAL ESTIMATORS FOR MANY COMPLEX SYSTEMS. SOME SYSTEMS DESIGNERS HAVE CHOSEN TO IGNORE VARIABLES AND BY SUCH A REDUCTION IN SYSTEM DIMENSION HAVE BEEN ABLE TO ECONOMIZE WITH REGARD TO THE NUMBER OF COMPUTATIONS. THE PURPOSE OF THIS PAPER IS TO DEMONSTRATE A METHOD WHICH ALLOWS ECONOMY OF COMPUTATION BY PARTITIONING THE SYSTEM STATE VECTOR; THE VARIABLES TO BE ELIMINATED ARE PLACED IN ONE SUBSYSTEM AND THE REMAINING VARIABLES IN ONE OR MORE ADDITIONAL SUBSYSTEMS. THE RESULTANT SYSTEM IS COMPUTATIONALLY MORE EFFICIENT IF SOME VARIABLES ARE ELIMINATED. THIS IS SO BECAUSE THE REMAINING STATES HAVE BEEN PARTITIONED INTO TWO OR MORE SUBSYSTEMS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 20M07

AD- 719 614 17/7
CALIFORNIA UNIV LOS ANGELES SCHOOL OF ENGINEERING AND APPLIED SCIENCE

OPTIMUM ALIGNMENT OF AN INERTIAL AUTONAVIGATOR, (U)

SEP 66 10P JURENKA, FRANK D. ; LEONDES, CORNELIUS T. ;
CONTRACT: AF-AFOSR-699-65
PROJ: AF-9749
MONITOR: AFOSR TR-71-0478

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS, V3 N6 P880-888 NOV 67.
SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH AUTONETICS, ANAHEIM, CALIF.

DESCRIPTORS: (*INERTIAL NAVIGATION, OPTIMIZATION), (*NAVIGATIONAL AIDS, AUTOMATIC PILOTS), GYRO COMPASSES, ACCELEROMETERS, DRIFT, AZIMUTH, ALIGNMENT, ERRORS (U)

THE PERFORMANCE OF AN INERTIAL AUTONAVIGATOR CAN ONLY BE AS GOOD AS THE ACCURACY TO WHICH THE SYSTEM IS INITIALLY ALIGNED. OPTICAL METHODS OF ALIGNMENT CAN BE PERFORMED WITH HIGH PRECISION; HOWEVER, THIS TECHNIQUE REQUIRES EXTERNAL EQUIPMENT AND IS SUBJECT TO SOME PHYSICAL CONSTRAINTS, SUCH AS LAND-BASED OPERATION. THE GENERAL PROBLEM DISCUSSED HERE IS THE USE OF AN AUTOMATIC AZIMUTH ALIGNMENT TECHNIQUE KNOWN AS GYROCOMPASSING. IN THE USE OF THE GYROCOMPASSING TECHNIQUE TO OBTAIN AZIMUTH ALIGNMENT, ACCURACIES ARE DEGRADED CONSIDERABLY BY TWO DOMINANT ERROR SOURCES, THE LEVEL AXIS CONTROLLING GYRO DRIFT RATE AND THE IMPERFECTIONS OF REFERENCE OR INDEPENDENT VELOCITY INFORMATION. CONSEQUENTLY, AN OPTIMUM PERFORMANCE CONTROLLER IS DEVELOPED FOR DRIVING THE SYSTEM IN THIS MECHANIZATION AND IS BASED ON A PRIORI KNOWLEDGE OF THE SECOND-ORDER STATISTICS OF THE SYSTEM ERROR SOURCES. THE PERFORMANCE CRITERIA WILL BE TO MINIMIZE THE MEAN SQUARE AZIMUTH ERROR. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 720 102 17/7
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT E V OBERPFAFFENHOFEN (WEST GERMANY)

ACCELEROMETER CALIBRATION IN THE LOW G RANGE BY MEANS OF MASS ATTRACTION, (U)

70 11P REINEL,KONRAD ;
REPT. NO. DFVLR-SONDERDRUCK-73

UNCLASSIFIED REPORT
AVAILABILITY: PAPER COPY AVAILABLE FROM AIAA, 1290 AVENUE OF THE AMERICAS, NEW YORK, N. Y. 10019. PC $2.00. MF $1.00. NO COPIES FURNISHED BY DDC OR NTIS.
SUPPLEMENTARY NOTE: SPONSORED IN PART BY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C. PUB. IN PROCEEDINGS OF AIAA GUIDANCE, CONTROL AND FLIGHT MECHANICS CONFERENCE, SANTA BARBARA, CALIF. 17-19 AUG 70, PAPER NO. 70-1030.

DESCRIPTORS: (*ACCELEROMETERS, *CALIBRATION), (*INERTIAL NAVIGATION, ACCELEROMETERS), GRAVITY, SATELLITES(ARTIFICIAL), RELIABILITY (U)

MASS ATTRACTION IS USED AS AN EQUIVALENT ACCELERATION INPUT TO CALIBRATE AN ACCELEROMETER. THE UPPER LIMIT OF THE ACCELERATION BY A REASONABLE MASS SIZE IS 10 TO THE MINUS 9TH POWER G IN ORBIT AND 10 TO THE MINUS 7TH POWER G IN THE LABORATORY. THE CALIBRATION HAS BEEN CARRIED OUT IN THE LABORATORY FOR AN ELECTROSTATIC SUSPENDED SINGLE-AXIS ACCELEROMETER (MESA) WITH A VARIABLE MASS ATTRACTION. THE TILTING OF THE TEST PAD WAS AVOIDED BY A VERTICAL MOVEMENT OF THE ATTRACTING MASS AND ALWAYS CHECKED BY A VERY SENSIBLE TILTMETER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 720 104 17/7
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT E V BRUNSWICK (WEST GERMANY)

ON THE PERFORMANCE AND THE ERROR MODEL OF A SINGLE-DEGREE-OF-FREEDOM STRAPDOWN GYROSCOPE. (U)

JUL 70 10P STIELER,BERNHARD ;
REPT. NO. DFVLR-SONDERDRUCK-80

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN ZEITSCHRIFT FUR FLUGWISSENSCHAFTEN, V18 HEFT 11 P421-429 1970. NO COPIES FURNISHED.
SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH NASA ELECTRONICS RESEARCH CENTER, CAMBRIDGE, MASS. SPONSORED IN PART BY THE NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D. C.

DESCRIPTORS: (*INERTIAL NAVIGATION, GYROSCOPES), (*GYROSCOPES, PERFORMANCE(ENGINEERING)), SIMULATION, MATHEMATICAL MODELS, TORQUE, DRIFTMETERS, DIFFERENTIAL EQUATIONS, INTEGRALS, NUMERICAL INTEGRATION, DIGITAL COMPUTERS, NAVIGATION COMPUTERS, WEST GERMANY (U)
IDENTIFIERS: ONE DEGREE OF FREEDOM, STRAPPED-DOWN GUIDANCE SYSTEMS, DEGREES OF FREEDOM (U)

THE PERFORMANCE OF STRAPDOWN GYROS AND THEIR DRIFT MODEL FOR CONSTANT AND VIBRATIONAL INPUTS ARE DISCUSSED. THIS STUDY AS BASIS FOR A GYRO DRIFT COMPENSATION IS A SYNTHESIS OF INFORMATION FROM DIFFERENT SOURCES WHICH IS COMPLETED BY SIMULATION TEST RESULTS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 720 381 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

BASIS OF THE MODEL OF AN IDEAL SPATIAL NEWTONMETER (ACCELEROMETER) IN THE THEORY OF INERTIAL NAVIGATION, (U)

DEC 70 30P ANDREEV,V. D. ;PARUSNIKOV, N. A. ;
REPT. NO. FTD-MT-24-303-70
PROJ: FTD-6050201
TASK: DIA-T65-05-20A

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED MACHINE TRANS. OF MEKHANIKA TVERDOGO TELA (USSR) N6 P15-25 1969, BY ROBERT D. HILL.

DESCRIPTORS: (*INERTIAL NAVIGATION, NAVIGATIONAL AIDS), (*NAVIGATIONAL AIDS, ACCELEROMETERS), MATHEMATICAL MODELS, EQUATIONS OF MOTION, INTEGRAL TRANSFORMS, NUMERICAL INTEGRATION, THEORY, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE MODEL OF AN IDEAL SPATIAL NEWTONMETER (ACCELEROMETER) SET ON A MOVING OBJECT IS EXAMINED. THE RELATIONSHIP OF THIS MODEL AND THE COMBINATION OF THREE REAL SINGLE-COMPONENT (LINEAR) NEWTONMETERS WITH NONCOPLANAR AXES OF SENSITIVITY IN THE SYSTEM OF INERTIAL NAVIGATION IS ANALYZED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 720 395 17/7
IOWA STATE UNIV AMES ENGINEERING RESEARCH INST

ERROR ANALYSIS OF AN INTEGRATED INERTIAL/ DOPPLER-SATELLITE SYSTEM WITH CONTINUOUS AND MULTIPLE SATELLITE COVERAGE. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 71 137P WINGER,D. J. ;BROWN,R. G. ;
REPT. NO. ERI-94900
CONTRACT: N00014-68-A-0162
PROJ: ERI-712-S

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON AUTOMATIC NAVIGATION AND CONTROL.

DESCRIPTORS: (*DOPPLER NAVIGATION, NAVIGATION SATELLITES), (*INERTIAL NAVIGATION, INTEGRATED SYSTEMS), MATHEMATICAL MODELS, EQUATIONS OF MOTION, DIFFERENTIAL EQUATIONS, STOCHASTIC PROCESSES, MATRICES(MATHEMATICS), FLIGHT TESTING, SIMULATION, POSITION FINDING, ERRORS, COMPUTER PROGRAMS, THESES (U)
IDENTIFIERS: KALMAN FILTERS, THEMIS PROJECT, COMPUTERIZED SIMULATION (U)

THE STUDY INVESTIGATES THE ACCURACY OF AN INTEGRATED NAVIGATION SYSTEM IN WHICH A MODEST QUALITY AIRBORNE INERTIAL NAVIGATION SYSTEM IS COUPLED WITH AN EXTENSIVE SYSTEM OF (DOPPLER) NAVIGATION SATELLITE. THE TWO SYSTEMS ARE INTEGRATED IN AN OPTIMAL FASHION BY USING THE DELAYED-STATE KALMAN FILTER. THE PERFORMANCE OF THE INTEGRATED SYSTEM WAS EVALUATED BY CONDUCTING VARIANCE ANALYSES ON A NUMBER OF COMPUTER-SIMULATED FLIGHTS IN WHICH AN AIRCRAFT WAS ASSUMED TO BE EQUIPPED WITH BOTH NAVIGATION SYSTEMS. THREE HYPOTHETICAL DOPPLER-SATELLITE CONFIGURATIONS WERE CONSIDERED IN THESE STUDIES; ALL OF THESE CONFIGURATIONS PROVIDED SUFFICIENT SATELLITE COVERAGE TO ENABLE CONTINUOUS DOPPLER MEASUREMENTS FROM TWO SATELLITES TO BE USED FOR THE KALMAN FILTER INPUT. A DOPPLER SATELLITE GENERALLY PROVIDES BETTER NAVIGATION INFORMATION IN ITS ALONG-TRACK DIRECTION THAN ITS CROSSTRACK DIRECTION, AND THIS IS REFLECTED IN THE INTEGRATED SYSTEM BY AN IMBALANCE IN THE QUALITY OF THE ESTIMATES OF THE TWO LEVEL CHANNEL ERRORS. THREE SATELLITE ALTITUDES WERE CONSIDERED AND IT WAS FOUND THAT THE ACCURACY OF THE INTEGRATED SYSTEM DEGRADES WITH INCREASED SATELLITE ALTITUDE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 720 903 14/2 17/7 8/5
LAMONT-DOHERTY GEOLOGICAL OBSERVATORY PALISADES N Y

DEVELOPMENTS IN NAVIGATION AND MEASUREMENT OF GRAVITY AT SEA, (U)

JUN 70 33P TALWANI,MANIK ;
REPT. NO. LDGO-1613
CONTRACT: N00014-67-A-0108-0004, NSF-GA-1434

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN GEOEXPLORATION, V8 P151-183 1970.

DESCRIPTORS: (*GRAVITY, MEASURING INSTRUMENTS), (*NAVIGATIONAL AIDS, DESIGN), (*INERTIAL NAVIGATION, INSTRUMENTATION), SHIP AUXILIARY EQUIPMENT, NAVIGATION SATELLITES, ACCELEROMETERS (U)
IDENTIFIERS: AN/SRN-9, *GRAVIMETRY (U)

THE PAPER REVIEWS RECENT DEVELOPMENTS IN METHODS OF NAVIGATION AND OF MEASUREMENT OF GRAVITY. THE U.S. NAVY'S SATELLITE NAVIGATION METHOD IS DESCRIBED AND VARIOUS SYSTEMS FOR INTERPOLATING BETWEEN SATELLITE FIXES ARE DISCUSSED. CROSS-COUPLING AND OFF-LEVELING ERRORS FOR SURFACE SHIP GRAVIMETERS ARE EXAMINED. THE PRINCIPLES OF OPERATION OF THE RECENTLY DEVELOPED VIBRATING STRING AND FORCE BALANCE TYPE GRAVIMETERS ARE DESCRIBED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 722 476 9/2 17/7 16/4.2
TULANE UNIV NEW ORLEANS LA SYSTEMS LAB

INVESTIGATION OF MINUTEMAN D17B COMPUTER REUTILIZATION, (U)

JAN 71 54P BECK,CHARLES H. ;
CONTRACT: F44620-70-C-0050
MONITOR: AFOSR TR-71-0115

UNCLASSIFIED REPORT

DESCRIPTORS: (*DIGITAL COMPUTERS, DESIGN), (*INERTIAL NAVIGATION, *NAVIGATION COMPUTERS), (*SURFACE TO SURFACE MISSILES, GUIDED MISSILE COMPUTERS), DATA PROCESSING, MEMORY DEVICES, INTERFACES, TELEMETERING DATA, CONTROL SEQUENCES (U)
IDENTIFIERS: MINICOMPUTERS, MINUTEMAN, D17B COMPUTERS (U)

A LARGE NUMBER OF NS-10Q INERTIAL GUIDANCE SYSTEMS HAVE BEEN DECLARED EXCESS BY THE USAF WHICH CONTAIN D17B DIGITAL COMPUTERS. THIS REPORT DESCRIBES THE CAPABILITIES OF THESE COMPUTERS AND MANY APPROPRIATE APPLICATIONS IN WHICH THE D17B--A HIGHLY RELIABLE AND VERSATILE SERIAL-BINARY MINICOMPUTER--CAN BE BENEFICIALLY EMPLOYED. TYPICAL AREAS OF APPLICATION ARE CONTROL, DATA ACQUISITION, AND ON-LINE COMMUNICATIONS. A SINGLE SYSTEM DESIGN WILL SUFFICE FOR THE APPLICATION OF SEVERAL D17B'S TO SIMILAR TASKS. WHILE SUCH MODIFICATIONS ARE VERY INEXPENSIVE, THE REQUIRED INTERFACING MUST STILL BE DEVELOPED. THIS INTERFACING IS THE KEY TO FLEXIBLE USE OF THESE MINICOMPUTERS; TYPICAL I/O DEVICES INCLUDE: TYPEWRITERS, TELETYPES, FLEXOWRITERS, MAGNETIC AND PAPER TAPE UNITS, PRINTERS, AND CARD READERS. DESPITE THE DIFFICULTIES OF LIMITED DOCUMENTATION DURING THE EARLY PHASES OF THIS INVESTIGATION AND THE ASSOCIATED FRUSTRATION, THE D17B IS NOW PERFORMING USEFUL FUNCTIONS IN THE SYSTEMS LABORATORY AT MINIMAL COST. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 724 868 17/7 8/5
TUFTS UNIV MEDFORD MASS DEPT OF CIVIL ENGINEERING

A PROGRAM OF STUDY ON LONG TERM EARTH TILTS. (U)

DESCRIPTIVE NOTE: FINAL REPT. AUG 65-31 JAN 69,
FEB 70 21P TSUTSUMI,KENTARO ;
CONTRACT: AF 19(628)-5526
PROJ: AF-7639
TASK: 763907
MONITOR: AFCRL 70-0268

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*NAVIGATIONAL AIDS, CALIBRATION), ACCURACY, TEST METHODS, TEST EQUIPMENT, METEOROLOGICAL PHENOMENA (U)
IDENTIFIERS: GROUND MOTION, GROUND MOTION (U)

THE PURPOSE OF THIS INVESTIGATION WAS TO DETERMINE THE CHARACTERISTICS OF LOCAL APPARENTLY RANDOM LONG PERIOD GROUND TILTS. INSTRUMENTS WERE BUILT AND PLACED AT AN EXISTING TEST SITE BUILDING AT WESTON, MASS. TO CONTINUOUSLY MONITOR AND RECORD THE GROUND TILTS. THESE TILT RECORDINGS WERE THEN COMPARED WITH SOME OF THE MANY KNOWN SOURCES OF DISTURBANCES FOR DETERMINING ANY CORRELATIONS BETWEEN THE SOURCES AND THE TILTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 725 950 17/7 1/3
GRUMMAN AEROSPACE CORP BETHPAGE N Y RESEARCH DEPT

A STATISTICAL ANALYSIS OF THE A-6A INERTIAL NAVIGATION SYSTEM. (U)

DESCRIPTIVE NOTE: RESEARCH MEMO.,
JUN 71 22P GRAN,RICHARD ;
REPT. NO. RM-511
MONITOR: GIDEP 347.00.00.00-K4-130

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, STATISTICAL ANALYSIS), (*ATTACK BOMBERS, NAVIGATIONAL AIDS), NOISE, GYRO COMPASSES, DRIFT, VECTOR ANALYSIS, MATRICES(MATHEMATICS), ANALYSIS OF VARIANCE, ERRORS, AIRCRAFT CARRIERS (U)
IDENTIFIERS: A-6 AIRCRAFT, A-6A AIRCRAFT, CLOSED LOOP SYSTEMS, CONTROL, CONTROL SYSTEMS, SINS, COMPUTER AIDED ANALYSIS (U)

THE REPORT DESCRIBES A STATISTICAL ANALYSIS OF THE GYRO-COMPASS MODE OF THE A-6A INERTIAL NAVIGATION SYSTEM. THE INERTIAL SYSTEM IS ASSUMED TO HAVE VARIOUS STOCHASTIC PERTURBATIONS CAUSED BY GYROSCOPE DRIFTS, ACCELEROMETER DRIFT, AND A WHITE MEASUREMENT NOISE FROM THE SHIP INERTIAL NAVIGATION SYSTEM (SINS). THE RESULT OF THE ANALYSIS IS THE VARIANCE IN THE ESTIMATE OF THE GYROSCOPIC DRIFT DUE TO THE ASSUMED STOCHASTIC PROCESSES. THE ANALYSIS OF THE SYSTEM AS PROVIDED BY THE GROUND SUPPORT DEPARTMENT SHOWED THAT THE SYSTEM WAS UNSTABLE AS IT STOOD. A CHANGE IN ONE OF THE FEEDBACK GAINS WAS MADE SO AS TO STABILIZE THE GYRO-COMPASS LOOP. THEN, AN ANALYSIS OF THE RESULTING LOOP SHOWED A MAXIMUM ERROR (1 SIGMA) OF 9.9 DEGREES/HR DUE TO ALL OF THE ASSUMED NOISES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 726 802 17/7 21/8
CALIFORNIA UNIV LOS ANGELES SCHOOL OF ENGINEERING AND APPLIED SCIENCE

A SIMPLIFIED TECHNIQUE FOR ERROR ANALYSIS OF ROCKET BOOST INERTIAL NAVIGATION SYSTEMS,
(U)

SEP 66 7P STEAR,EDWIN B. ;LEMAY, JOSEPH L. ;NESBIT,RICHARD A. ;
CONTRACT: AF-AFOSR-699-65
PROJ: AF-9749
MONITOR: AFOSR TR-71-1994

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN AIAA JNL., V5 N1 P145-150 JAN 67.
SUPPLEMENTARY NOTE: REVISION OF REPORT DATED 2 APR 65. PREPARED IN COOPERATION WITH AEROSPACE CORP., EL SEGUNDO, CALIF. AND BECKMAN INSTRUMENTS, INC., SANTA MONICA, CALIF.

DESCRIPTORS: (*INERTIAL NAVIGATION, ERRORS), (*BOOSTER ROCKETS, INERTIAL NAVIGATION), LAUNCH VEHICLES, ROCKET TRAJECTORIES, INJECTION GUIDANCE, LOW ORBIT TRAJECTORIES, DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS
(U)

A DISCUSSION IS GIVEN OF LINEAR PERTURBATION EQUATIONS FOR ERROR ANALYSES OF INERTIAL NAVIGATION SYSTEMS USED IN ROCKET BOOST FLIGHTS. IT IS SHOWN THAT A TIME-INVARIANT SET OF LINEAR PERTURBATION EQUATIONS RESULTS UNDER APPROPRIATE CONDITIONS BY JUDICIOUS SELECTION OF COORDINATE SYSTEMS. THESE EQUATIONS ARE DERIVED AND DISCUSSED. CLOSED-FORM SOLUTIONS ARE GIVEN IN BOTH EXACT AND APPROXIMATE FORMS. THE ADVANTAGES OF THESE EQUATIONS OVER MORE COMMONLY USED LINEAR, TIME-VARYING EQUATIONS (THAT RESULT FROM USE OF A DIFFERENT COORDINATE SYSTEM) ARE THAT THEY MAKE ANALOG SIMULATION ATTRACTIVE (EVEN WITH EXACT FORCING-FUNCTION PROFILES), AND THEY PROVIDE MUCH MORE ANALYTICAL INSIGHT INTO THE ERROR SENSITIVITIES. THE BASIC ACCURACY OF THE TIME-INVARIANT EQUATIONS IS ILLUSTRATED BY MEANS OF AN EXAMPLE. (AUTHOR)
(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 727 467 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

POSSIBLE PRINCIPLES OF THE CONSTRUCTION OF INERTIAL NAVIGATION SYSTEMS, (U)

JAN 71 15P DEVYANIN,E. A. ;
REPT. NO. FTD-MT-24-302-70
PROJ: FTD-6050201
TASK: DIA-T65-05-20A

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED MACHINE TRANS. OF MEKHANIKA TVERDOGO TELA (USSR) N6 P10-14 1969, BY K. L. DION.

DESCRIPTORS: (*INERTIAL NAVIGATION, MATHEMATICAL ANALYSIS), STABILIZED PLATFORMS, GRAVITY, EQUATIONS OF MOTION, TRANSFORMATIONS(MATHEMATICS), ERRORS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

CERTAIN POSSIBLE LAYOUTS OF INERTIAL NAVIGATIONAL SYSTEMS WITH THREE NEWTONOMETERS AND A DEVICE TO MEASURE THE DISTANCE TO THE SURFACE OF THE EARTH ARE EXAMINED. ANALYSIS IS REDUCED TO THE FOLLOWING ASSUMPTIONS: THE EARTH IS HELD TO BE A SPHERE, ITS FIELD OF GRAVITY IS CENTRAL; IT IS PROPOSED THAT AN OBJECT MOVES AT A CONSTANT DISTANCE FROM ITS SURFACE; INSTRUMENT ERRORS IN THE NAVIGATION SYSTEM ARE NOT CONSIDERED. IN THE FOLLOWING HYPOTHESIS EQUATION OF THE IDEAL OPERATION AND EQUATIONS OF THE ERRORS OF THE NAVIGATIONAL SYSTEMS, DIFFERING FROM KNOWN ERRORS, ARE OBTAINED. THE EQUATIONS OF ERRORS ARE ANALYZED FOR VERY SIMPLE MOTIONS OF THE OBJECT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 728 116 17/7 12/1
SOUTHERN METHODIST UNIV DALLAS TEX INFORMATION AND CONTROL SCIENCES CENTER

ESTIMATION OF MULTI-INPUT SYSTEMS WITH 'NOISELESS' OUTPUTS, (U)

NOV 70 22P BROWN,RICHARD J. ;SAGE, ANDREW P. ;
CONTRACT: F44620-68-C-0023
PROJ: AF-9559
MONITOR: AFOSR TR-71-2212

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN INTERNATIONAL JNL. OF SYSTEMS SCIENCE, V1 N4 P381-401 1971.

DESCRIPTORS: (*INERTIAL NAVIGATION, DOPPLER SYSTEMS), (*ADAPTIVE CONTROL SYSTEMS, MATHEMATICAL MODELS), LINEAR SYSTEMS, MATRIX ALGEBRA, SET THEORY, WHITE NOISE, ERRORS, ANALYSIS OF VARIANCE, ALGORITHMS (U)
IDENTIFIERS: KALMAN FILTERS, *CONTROL THEORY, DISCRETE SYSTEMS, ESTIMATION THEORY (U)

A PROCEDURE IS PRESENTED FOR LINEAR DISCRETE SYSTEM STATE ESTIMATION IN WHICH THE OBSERVATION DOES NOT CONTAIN ADDITIVE WHITE NOISE. THE ORDER OF THE SYSTEM FOR ESTIMATION IS REDUCED ACCORDING TO THE NUMBER OF NOISELESS OUTPUTS AND NOISELESS OUTPUT DIFFERENCES. (HERE NOISELESS IMPLIES THE ABSENCE OF WHITE NOISE). THE ADVANTAGE OF THIS APPROACH IS ITS GENERAL APPLICATION. UNLIKE EARLIER METHODS, IT IS NOT NECESSARY FOR THE NOISE STATES TO BE SEPARABLE OR EVEN DISTINGUISHABLE FROM OTHER SYSTEM STATES. A SYSTEMATIC APPROACH TO THE FORMULATION OF THE REQUIRED ESTIMATION MODEL FROM A GENERAL SYSTEM MODEL IS PRESENTED. FOR THE MODIFIED ESTIMATION MODEL, REQUIRED FILTERING ALGORITHMS ARE DERIVED WHICH ARE OF ESSENTIALLY THE SAME COMPLEXITY AS THE USUAL WHITE NOISE ALGORITHMS. DIRECT ESTIMATION OF THE ORIGINAL SYSTEM STATES, USING THE REDUCED ORDER SYSTEM FOR CALCULATION OF GAINS AND THE REQUIRED ERROR VARIANCES, IS DESCRIBED. MODELLING ERRORS OFTEN OCCUR IN REPRESENTING PHYSICAL SYSTEMS, AND ERROR ANALYSIS ALGORITHMS ARE DERIVED. THE USE OF THE ESTIMATION AND ERROR ANALYSIS ALGORITHMS IS DEMONSTRATED BY EXAMPLES AND THE RESULTS COMPARED WITH THE USUAL DISCRETE (AUGMENTED STATES) KALMAN FILTER APPROACH. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 728 339 12/1 17/7
SOUTHERN METHODIST UNIV DALLAS TEX INFORMATION AND CONTROL SCIENCES CENTER

ESTIMATION USING STOCHASTIC FEEDBACK WITH APPLICATIONS TO INTEGRATED NAVIGATION SYSTEMS, (U)

SEP 70 13P BROWN,RICHARD J. ;SAGE, ANDREW P. ;
CONTRACT: F44620-68-C-0023
PROJ: AF-9559
MONITOR: AFOSR TR-71-2238

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONICS VAES-7 N2 P355-366 MAR 71.

DESCRIPTORS: (*ADAPTIVE CONTROL SYSTEMS, MATHEMATICAL MODELS), (*INERTIAL NAVIGATION, INTEGRATED SYSTEMS), LINEAR SYSTEMS, ANALYSIS OF VARIANCE, STOCHASTIC PROCESSES, FEEDBACK, WHITE NOISE, OPTIMIZATION (U)
IDENTIFIERS: KALMAN FILTERS, *CONTROL THEORY, ESTIMATION THEORY, FEEDBACK CONTROL (U)

THE PAPER DISCUSSES AN APPROACH TO LINEAR ESTIMATION THROUGH USE OF A 'CONTROL' FEED BACK INTO THE SYSTEM TO CANCEL OUT THE EFFECT OF DISTURBANCES OF ERROR SIGNALS. ALTHOUGH THIS APPROACH HAS VERY RESTRICTED APPLICATION, IT HAS FOUND IMPORTANT USAGE IN INTEGRATED NAVIGATION SYSTEMS WHERE ONE SUBSYSTEM IS AN INERTIAL MEASUREMENT SYSTEM. THIS APPROACH IS SHOWN TO BE SUBOPTIMAL AND IS COMPARED WITH THE OPTIMAL WITH RESPECT TO ESTIMATION ACCURACY AND SENSITIVITY TO MODELING ERRORS. THE FEEDBACK APPROACH TO ESTIMATION ACCURACY AND SENSITIVITY TO MODELING ERRORS. THE FEEDBACK APPROACH TO ESTIMATION IS SHOWN TO BE SIMILAR TO ERROR ESTIMATION AND CORRECTION APPLIED. FOR DISCRETE ESTIMATION USING THE FEEDBACK APPROACH IT IS SHOWN THAT ERROR VARIANCE AND KALMAN GAINS FOR ONE-STAGE PREDICTION SHOULD BE USED. TWO EXAMPLES ARE CONSIDERED WHICH COMPARE THE FEEDBACK APPROACH TO THE OPTIMUM ESTIMATION APPROACH. THE SYSTEM OF THE FIRST EXAMPLE IS QUITE SIMPLE, BUT PROVIDES SIMPLE ANALYTICAL COMPARISONS AXIS INERTIAL GUIDANCE SYSTEM AND AN INDEPENDENT POSITION MEASURING SYSTEM. ACCURACY AND SENSITIVITY TO MODELING ERRORS ARE COMPARED. OTHER ADVANTAGES AND DISADVANTAGES OF THE TWO ESTIMATION APPROACHES ARE DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 729 486 5/9 19/3 17/7
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

DIRECTIONAL GYRO ATTACHMENT (PRISTAVKA GPK), (U)

JUL 71 8P ZIMIN,K. ;SHABAROV,L. ;
REPT. NO. FSTC-HT-23-1264-71
PROJ: FSTC-T7023012301

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF STARSHINA-SERZHANT (USSR) N2 P20-22 1971.

DESCRIPTORS: (*GYRO STABILIZERS, *TRAINING DEVICES), (*TANKS(COMBAT VEHICLES), INERTIAL NAVIGATION), MILITARY TRAINING, STEERING, ELECTRICAL EQUIPMENT, VARIABLE SPEED DRIVES, CONTROL PANELS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

AN ATTACHMENT TO TANK OR TANK TRAINER DIRECTIONAL GYROS FOR TRAINING USE IS DESCRIBED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 732 881 17/7
BALLISTIC RESEARCH LABS ABERDEEN PROVING GROUND MD

THE EFFECT OF GRAVITY ON A LIQUID-FILLED GYROSCOPE. (U)

DESCRIPTIVE NOTE: MEMORANDUM REPT.,
MAR 71 18P D'AMICO,WILLIAM P. ;
REPT. NO. BRL-MR-2097-REV
PROJ: RDT/E-1T-061102-A-33-D

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REVISION OF REPORT DATED MAR 71, AD-725 571.

DESCRIPTORS: (*GYROSCOPES, EQUATIONS OF MOTION), (*INERTIAL NAVIGATION, GYRO STABILIZERS), GRAVITY, FORCE(MECHANICS), MOMENTS, STABILITY (U)

THE EFFECT OF GRAVITY AS A SIMPLE VERTICAL BODY FORCE WAS INCLUDED IN THE STEADY STATE PRESSURE DISTRIBUTION OF A RAPIDLY SPINNING LIQUID. FOR THE SIMPLE CASE OF A COMPLETELY FILLED CYLINDER, THE CLASSICAL LIQUID-FILLED GYROSCOPE STABILITY PROBLEM WAS CONSIDERED. ANALYSIS SHOWED THAT THE LIQUID EIGENFREQUENCIES WERE IDENTICAL TO THE STEWARTSON CASE AND THAT A NEW, BUT SECOND ORDER, LIQUID MOMENT TERM RESULTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 733 430 17/7 1/3
MOORE SCHOOL OF ELECTRICAL ENGINEERING PHILADELPHIA PA

INERTIAL NAVIGATION TASK. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
OCT 71 50P FEGLEY,KENNETH A. ;
REPT. NO. 72-07
CONTRACT: DA-28-043-AMC-02411(E)
PROJ: DA-1-H-162202-A-219
MONITOR: ECOM 02411-22

UNCLASSIFIED REPORT

DESCRIPTORS: (*HELICOPTERS, *INERTIAL NAVIGATION), ARMY AIRCRAFT, STABILIZED PLATFORMS, SENSORS, GYRO COMPASSES, DOPPLER SYSTEMS, ALIGNMENT, CALIBRATION (U)
IDENTIFIERS: CLOSED LOOP CONTROL SYSTEMS, KALMAN FILTERS, *STRAPPED DOWN GUIDANCE SYSTEMS, COMPUTER AIDED DESIGN (U)

THE REPORT IS THE FINAL REPORT FOR THE TASK ON RESEARCH IN THE AREA OF INERTIAL NAVIGATION. THE REPORT SUMMARIZES THE RESULTS OF THE MAIN OBJECTIVES WHICH WERE TO DETERMINE THE FEASIBILITY OF USING A STRAPDOWN INERTIAL SYSTEM ABOARD A HELICOPTER; TO SIMULATE SYSTEMS WHICH EMPLOY INERTIAL ELEMENTS; AND TO DETERMINE IMPROVED TECHNIQUES TO APPLY AIDED INERTIAL NAVIGATION TO ARMY AIRCRAFT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 733 753 1/2 17/7
TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MASS

THE IMPACT OF INERTIAL NAVIGATION ON AIR SAFETY. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAY 71 26P HERSHKOWITZ,R. M. ;
O'MATHUNA,D. ;BRITTING,K. R. ;
REPT. NO. TSC-FAA-71-5

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIR TRAFFIC, AVIATION SAFETY), (*AVIATION SAFETY, *INERTIAL NAVIGATION), STABILIZED PLATFORMS, GYRO STABILIZERS, FLIGHT PATHS, ERRORS, MATHEMATICAL MODELS, NAVIGATION COMPUTERS (U)
IDENTIFIERS: *COLLISION RISK, COMPUTERIZED SIMULATION (U)

AN ANALYSIS OF INERTIAL NAVIGATION SYSTEM PERFORMANCE DATA WAS CARRIED OUT TO ASSESS THE PROBABLE IMPACT OF INERTIAL NAVIGATION ON THE AIRCRAFT COLLISION RISK IN THE NORTH ATLANTIC REGION. THESE DATA WERE USED TO CALCULATE THE COLLISION RISK BETWEEN TWO AIRCRAFT FLYING AT THE SAME NOMINAL FLIGHT LEVEL ON ADJACENT TRACKS. THE INERTIAL SYSTEM'S ERROR SOURCES ARE TREATED IN A STATISTICAL SENSE TO INFER THE EN ROUTE ERROR BEHAVIOR FROM THE TERMINAL ERROR DATA. COLLISION RISK ESTIMATES ARE DERIVED FOR EASTERLY AND WESTERLY TRANSATLANTIC FLIGHTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 733 758 17/7 1/2
TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MASS

OCEANIC SURVEILLANCE AND NAVIGATION ANALYSIS, FY 71. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT., JUN 71 83P HERSHKOWITZ,RONALD M. ;
REPT. NO. TSC-FAA-71-13

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *CIVIL AVIATION), (*AVIATION SAFETY, AIR TRAFFIC), (*AIR TRAFFIC CONTROL SYSTEMS, ATLANTIC OCEAN), AVIATION ACCIDENTS, FLIGHT PATHS, SEPARATION, MODELS(SIMULATIONS), STANDARDS (U)

THE REPORT SUMMARIZES THE OCEANIC SURVEILLANCE AND NAVIGATION ANALYSIS PERFORMED AT TRANSPORTATION SYSTEMS CENTER UNDER PPA FA-04 FOR FY 71. THREE MAJOR EFFORTS ARE REVIEWED AND DISCUSSED HEREIN: SUMMARY OF THE NORTH ATLANTIC SYSTEMS PLANNING GROUP COLLISION RISK MODEL; A STUDY OF THE IMPACT OF INERTIAL NAVIGATION ON AIR SAFETY; AN INVESTIGATION OF THE MODELING TECHNIQUES REQUIRED TO ASSESS THE EFFECT OF AIR TRAFFIC CONTROL SATELLITE SURVEILLANCE ON SEPARATION STANDARDS IN THE NORTH ATLANTIC REGION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 734 051 17/7
MASSACHUSETTS INST OF TECH CAMBRIDGE MEASUREMENT SYSTEMS LAB

ASSESSMENT OF THE IMPACT OF GRADIOMETER TECHNIQUES ON THE PERFORMANCE OF INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 FEB-31 JUL 71, SEP 71 145P BRITTING,KENNETH R. ;MADDEN, STEPHEN J. , JR.;HILDEBRANT,RICHARD A. ;
REPT. NO. RF-78
CONTRACT: F19628-71-C-0105
PROJ: AF-8607
TASK: 860702
MONITOR: AFCRL 71-0465

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, RELIABILITY), ERRORS, NAVIGATION COMPUTERS, STABILIZED PLATFORMS, GRAVITY, ACCELERATION, RANDOM VARIABLES, CORRELATION TECHNIQUES, MATHEMATICAL MODELS, COMPUTER PROGRAMS (U)
IDENTIFIERS: COMPUTER AIDED ANALYSIS, COMPUTERIZED SIMULATION (U)

A PARAMETRIC STUDY IS PERFORMED TO COMPARE THE GEODETIC INDUCED ERRORS IN INERTIAL NAVIGATION SYSTEMS WITH THE ERRORS INTRODUCED BY THE 'MAJOR INERTIAL INSTRUMENT UNCERTAINTIES. THREE PERFORMANCE CLASSES OF INERTIAL SYSTEMS ARE STUDIED - PRODUCTION, STATE-OF-THE-ART, AND FUTURE. IT IS FOUND THAT THE GEODETIC INDUCED ERRORS HAVE A PROPORTIONALLY GREATER EFFECT ON THE VELOCITY PERFORMANCE THAN ON THE POSITION PERFORMANCE. EVEN FOR THE PRODUCTION SYSTEMS, THE GEODETIC ERRORS ARE A LARGE PERCENTAGE OF THE TOTAL VELOCITY ERROR (ABOUT 50%). AN INERTIAL/GRADIOMETER SYSTEM IS SIMULATED IN WHICH THE DEFLECTIONS OF THE VERTICAL ARE COMPUTED AND USED FOR COMPENSATION OF THE INERTIAL SYSTEM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 734 630 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

INERTIAL NAVIGATION SYSTEMS, (U)

OCT 71 225P GORENSHTEIN, I. A. ;SHULMAN, I. A. ;
REPT. NO. FTD-HC-23-327-71
PROJ: AF-6050
TASK: 605020, DIA-T65-05-20

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF MONO. INERTSYALNYE NAVIGATSIONNYE SISTEMY, N.P., 1970 P1-164.

DESCRIPTORS: (*INERTIAL NAVIGATION, REVIEWS), INSTRUMENTATION, SENSORS, NAVIGATIONAL AIDS, ACCELEROMETERS, ALGORITHMS, ELECTROMAGNETIC FIELDS, STABILIZED PLATFORMS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE BOOK PRESENTS THE THEORETICAL PRINCIPLES UNDERLYING INERTIAL NAVIGATION AND DESCRIBES THE BASIC FUNCTIONAL ELEMENTS OF INERTIAL NAVIGATION SYSTEMS (INS). GENERAL AND SPECIFIC REPRESENTATIONS OF THE ALGORITHM FOR DETERMINING THE RUNNING COORDINATES OF AN OBJECT ARE EXAMINED AS APPLIED TO CERTAIN PRACTICALLY IMPORTANT METHODS OF CONSTRUCTION INS, THEIR CLASSIFICATION, ANALYSIS OF ERRORS, PREPARATION FOR OPERATION, AND ALSO PROBLEMS OF PROTECTING INS FROM EXTERNAL SOURCES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 734 920 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

ERRORS IN A SYSTEM FOR THE AUTONOMOUS DETERMINATION OF THE COORDINATES OF A MOVING OBJECT IN THE PRESENCE OF DRY FRICTION. (U)

OCT 71 10P BOICHUK,O. P. ;
REPT. NO. FTD-HC-23-880-71
PROJ: AF-7343

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. OF AKADEMIYA NAUK USSR, KIEV. DOPOVIDI. SERIYA A: FISIKO-TEKHNICHNI TA MATEMATICHNI NAUOKI, N7 P620-624 1970.

DESCRIPTORS: (*INERTIAL NAVIGATION, ACCELEROMETERS), ERRORS, STABILITY, MATHEMATICAL ANALYSIS, GYROSCOPES, FRICTION, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

AN INVESTIGATION OF A ONE COMPONENT VARIANT OF AN INERTIAL NAVIGATION SYSTEM WITH INTEGRAL HORIZON CORRECTION IS GIVEN. THE PROBLEM OF DETERMINING PLATFORM FLUCTUATION IN THE PRESENCE OF DRY FRICTION IN THE ACCELEROMETER IS FORMULATED, AND ATTENTION IS GIVEN TO THE ERRORS IN AUTONOMOUS COORDINATE DETERMINATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 735 015 17/7
LITTON SYSTEMS INC WOODLAND HILLS CALIF AERO PRODUCTS DIV

LIGHT EVALUATION OF INERTIAL/DME/DME/ MAP DISPLAY SYSTEM. (U)

DESCRIPTIVE NOTE: REPT. NO. 11 (FINAL), AUG 71 174P HOLM,R. J. ;
CONTRACT: FA-70-WA-2379
MONITOR: FAA-RD 71-46

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPT. NO. 10 (FINAL) AD-711 951.

DESCRIPTORS: (*INERTIAL NAVIGATION, DISPLAY SYSTEMS), (*POSITION FINDING, DISPLAY SYSTEMS), (*DISPLAY SYSTEMS, MAP PROJECTION), DISTANCE-MEASURING EQUIPMENT, AIRCRAFT EQUIPMENT, ACCURACY, FLIGHT TESTING, MAPS (U)
IDENTIFIERS: *MAP DISPLAYS, AVIONICS, EVALUATION (U)

A MAP DISPLAY DRIVEN BY AN INS/DME/DME NAVIGATION SYSTEM WAS FLOWN IN A CONVAIR 580 OVER THE UNITED STATES AREA FOR EVALUATION OF MAP PRESENTATION, MAP FILM CONTENT, COCKPIT NAVIGATION USE, ATC INTERFACE, AND AREA NAV IN DEPARTURE, ENROUTE AND APPROACH OPERATIONS. THE MAP DISPLAY WAS DEMONSTRATED AND EVALUATED. MAP FILM CONTENT INCLUDED HI ALTITUDE, LOW ALTITUDE, AREA CHARTS, JEPPESEN CHARTS, R NAV, JNC TOPOGRAPHY PLUS VOR AND ILS APPROACH PLATES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 735 331 17/7
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

SELECTED APPROACHES TO MEASUREMENT PROCESSING AND IMPLEMENTATION IN KALMAN FILTERS. (U)

DESCRIPTIVE NOTE: RESEARCH AND DEVELOPMENT TECHNICAL REPT.,
NOV 71 35P KNIGHT,J. ;LIGHT,W. ;
FISHER,M. ;
REPT. NO. ECOM-3510
PROJ: DA-1-F-162202-AA-91
TASK: 1-F-162202-AA-9102

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *LORAN), MATHEMATICAL MODELS, SIMULATION, ALGORITHMS, PROGRAMMING(COMPUTERS) (U)
IDENTIFIERS: SIGNAL PROCESSING, *KALMAN FILTERS (U)

SELECTED IMPLEMENTATIONS OF KALMAN FILTERS FOR A LORAN/INERTIAL NAVIGATION SYSTEM ARE PRESENTED. THE APPROACHES DIFFER IN THE TECHNIQUES EMPLOYED FOR PROCESSING MEASUREMENTS OF THE SYSTEM. SIMULATION RESULTS ARE COMPARED AND INDICATE THE RELATIVE DIFFERENCES IN POSITION ACCURACIES OF EACH TYPE OF FILTER. FROM THESE RESULTS, RECOMMENDATIONS ARE MADE AS TO FUTURE KALMAN MECHANIZATIONS AND EVALUATION CRITERIA. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 736 515 17/7
NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATLANTIC CITY N J

INERTIAL LOCATOR TEST AND EVALUATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 69-SEP 71,
FEB 72 81P WALLS,JOHN E. ;
REPT. NO. FAA-NA-72-32
PROJ: FAA-212-301-03X
MONITOR: FAA-RD 72-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, POSITION FINDING), INSTRUMENTATION, AIRCRAFT, RADIO EQUIPMENT, RADIO NAVIGATION, DATA PROCESSING, FLIGHT TESTING (U)
IDENTIFIERS: EVALUATION (U)

A FEASIBILITY MODEL OF AN INERTIAL LOCATOR EQUIPMENT (ILE) WAS DESIGNED TO PROVIDE AIRCRAFT POSITION INFORMATION AND ON-BOARD COMPUTER DATA PROCESSING FOR FLIGHT INSPECTION OF VOR, TACAN, VORTAC, AND ILS FACILTIES. FOLLOWING EQUIPMENT INSTALLATION AND PRELIMINARY FLIGHT TESTS AT THE CONTRACTOR'S FLIGHT FACILITY LOCATED ON HANSCOM FIELD, CONTRACTOR/NAFEC DEVELOPMENTAL TESTS WERE CONDUCTED AT ATLANTIC CITY, NEW JERSEY, USING NAFEC'S THEODOLITE AND RADAR TRACKING AND COMPUTER FACILITIES. THE DEVELOPMENTAL TEST EFFORT CONCENTRATED ON SYSTEM PERFORMANCE IN ACCOMPLISHING ILS FLIGHT INSPECTION. THIS REPORT EVALUATES ILE PERFORMANCE BASED ON DATA COLLECTED DURING DEVELOPMENTAL TESTING. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 737 336 17/7 12/1
IOWA STATE UNIV AMES ENGINEERING RESEARCH INST

KALMAN FILTER WITH COMPLEMENTARY CONSTRAINT AND INTEGRATED NAVIGATION SYSTEMS APPLICATIONS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FEB 72 153P OTT,L. E. ;BROWN,R. G. ;
REPT. NO. ERI-72022
CONTRACT: N00014-68-A-0162
PROJ: ERI-712-S

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON PROJECT THEMIS, AUTOMATIC NAVIGATION AND CONTROL.

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*ADAPTIVE CONTROL SYSTEMS, MATHEMATICAL MODELS), ELECTROMAGNETIC WAVE FILTERS, DIFFERENTIAL EQUATIONS, MATRICES(MATHEMATICS), TRANSFER FUNCTIONS, WHITE NOISE, SIGNAL-TO-NOISE RATIO, DATA PROCESSING, OPTIMIZATION, THESES (U)
IDENTIFIERS: WIENER FILTERS, RICCATI EQUATION, SIGNAL PROCESSING, KALMAN FILTERS, KALMAN-BUCY FILTERS, THEMIS PROJECT, *CONTROL THEORY (U)

THE REPORT PRESENTS A METHOD OF NAVIGATION SYSTEM INTEGRATION THAT YIELDS AN OPTIMAL SYSTEM REGARDLESS OF THE PARTICULAR REDUNDANCY IN AVAILABLE SENSOR DATA. THE PROPOSED MECHANIZATION IS BASED ON THE CRITERION THAT THE STATISTICS OF THE SIGNAL ARE UNKNOWN. THIS RESULTS IN THE CONCEPT OF DISTORTIONLESS OR COMPLEMENTARY FILTERING; AN EXTENSIVE REVIEW OF THIS CONCEPT IS PRESENTED. WHEN THE MEASUREMENT ERRORS FOR THE KALMAN FILTER ARE INDEPENDENT, IT IS SHOWN THAT THE INPUTS CAN BE PROCESSED SEQUENTIALLY, EVEN WITH THE COMPLEMENTARY CONSTRAINT IMPOSED. THUS, IF THERE IS AN INPUT THAT IS NOT AVAILABLE, IT IS SIMPLY PASSED OVER, AND AN OPTIMAL ESTIMATE IS STILL OBTAINED FROM THE REMAINING INPUTS. THIS EVEN ALLOWS FOR A FAILURE IN THE INERTIAL NAVIGATION UNIT ITSELF, WHEREAS IN MOST HYBRID INERTIAL SYSTEMS TO DATE THIS WOULD BE IMPOSSIBLE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 738 025 17/7
IOWA STATE UNIV AMES ENGINEERING RESEARCH INST

AN INCREMENTAL VELOCITY MEASUREMENT ALGORITHM FOR USE IN INERTIAL NAVIGATION ALIGNMENT. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FEB 72 97P VANALLEN,R. L. ;BROWN,R. G. ;
REPT. NO. ISU-ERI-AMES-72023
CONTRACT: N00014-68-A-0162
PROJ: ERI-712-S

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON PROJECT THEMIS, AUTOMATIC NAVIGATION AND CONTROL.

DESCRIPTORS: (*INERTIAL NAVIGATION, ALIGNMENT), (*NAVIGATIONAL AIDS, MATHEMATICAL MODELS), DIFFERENTIAL EQUATIONS, RECURSIVE FUNCTIONS, MATRICES(MATHEMATICS), STOCHASTIC PROCESSES, ACCELEROMETERS, GYRO STABILIZERS, WHITE NOISE, COMPUTER PROGRAMS, CURVE FITTING (U)
IDENTIFIERS: *KALMAN FILTERS, THEMIS PROJECT (U)

IN ANY INERTIAL NAVIGATION SYSTEM THE PLATFORM MUST BE INITIALLY ALIGNED IN SOME KNOWN FRAME OF REFERENCE PRIOR TO OPERATION IN THE NAVIGATION MODE. SELF-ALIGNMENT METHODS ARE PREFERRED IN MOST APPLICATIONS, AND THE USUAL PROCEDURE IS TO ALIGN THE PLATFORM LOCALLY LEVEL WITH ONE ACCELEROMETER AXIS POINTING NORTH. IN THE CURRENT GENERATION OF AIRCRAFT INERTIAL SYSTEMS THE SENSED ACCELERATION IS IN THE FORM OF INCREMENTAL VELOCITY PULSES. A NEW APPROACH TO THE ALIGNMENT PROBLEM IS CONSIDERED IN THIS REPORT WHEREBY THE INCREMENTAL VELOCITY PULSES ARE MODELED DIRECTLY AS THE MEASUREMENT SEQUENCE. THIS LEADS TO THREE IMPORTANT CHANGES IN THE FILTER MODEL: APERIODIC SAMPLING IS OBTAINED; MEASUREMENT NOISE DUE TO GRANLARITY IS ELIMINATED; AND A DELAYED STATE APPEARS IN THE MEASUREMENT EQUATION. THIS LATTER CONDITION FORCES THE USE OF A MODIFIED FORM OF THE KALMAN RECURSIVE EQUATIONS. RESULTS OF MONTE CARLO SIMULATIONS FOR ONE SET OF NOISE PARAMETERS ARE GIVEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 739 492 22/3 17/7
AEROSPACE CORP EL SEGUNDO CALIF ENGINEERING SCIENCE OPERATIONS

TECHNIQUES FOR GENERATING A 'REAL WORLD' EPHEMERIS. (U)

DESCRIPTIVE NOTE: REPT. FOR 1 JAN 71-1 JAN 72, JUL 71 118P PERSON,J. A. ;BRUCE,R. W. ;GORE,R. C. ;
REPT. NO. TR-0172(2311)-4
CONTRACT: F04701-71-C-0172
MONITOR: SAMSO TR-71-237

UNCLASSIFIED REPORT

DESCRIPTORS: (*LOW ORBIT TRAJECTORIES, MATHEMATICAL MODELS), (*SATELLITES(ARTIFICIAL), INERTIAL NAVIGATION), ATMOSPHERE MODELS, GRAVITY, DRAG, EPHEMERIDES, SPECIAL FUNCTIONS(MATHEMATICAL), COMPUTER PROGRAMS (U)
IDENTIFIERS: GEOPOTENTIAL (U)

THE REPORT DOCUMENTS THE PROCEDURE FOR GENERATING A REAL WORLD EPHEMERIS TAPE TO BE USED BY THE AEROSPACE CORPORATION AND SELECTED CONTRACTORS IN PHASE 0 OF THE AUTONOMOUS NAVIGATION SYSTEM (ANS) CONTRACT. A REAL WORLD GEOPOTENTIAL MODEL WAS DEVELOPED BY MODIFYING A STATE-OF-THE-ART REFERENCE GEOPOTENTIAL, USING KAULA'S DEGREE VARIANCES AS A GUIDE. TO OBTAIN REAL WORLD ATMOSPHERE DATA, THE ACCELERATION PROFILE EXPERIENCED BY THE FIRST IN A RECENT SERIES OF LOW ALTITUDE SATELLITES TO HAVE AN ON-BOARD LOW-G ACCELEROMETER WAS SUITABLY SCALED. THE RESULTING EPHEMERIS IS DISPLAYED AND SUBJECTED TO VARIOUS CONSISTENCY TESTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 744 318 17/7 1/2
MASSACHUSETTS INST OF TECH CAMBRIDGE CHARLES STARK DRAPER LAB

AIRBORNE FLIGHT INSPECTION INERTIAL LOCATOR EQUIPMENT DEVELOPMENT AND FLIGHT EVALUATION. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
MAY 71 320P DROHAN,WILLIAM A. ;HURSH, JOHN W. ;JOHNSON,WILLIAM M. ;MAMON,GLENN ;
REPT. NO. CSDL-R-705
CONTRACT: FA-65-WA-1314
MONITOR: FAA-RD 71-88

UNCLASSIFIED REPORT

DESCRIPTORS: (*INSTRUMENT LANDINGS, INERTIAL NAVIGATION), (*CIVIL AVIATION, *LANDING AIDS), DISTANCE MEASURING EQUIPMENT, FLIGHT TESTING, GLIDE PATH SYSTEMS, RADIO TRANSMISSION, FLIGHT INSTRUMENTS, RELIABILITY(ELECTRONICS) (U)
IDENTIFIERS: VORTAC, VOR, TACAN (U)

DEVELOPMENT AND FLIGHT RESULTS ARE PRESENTED FROM A PROGRAM TO TEST FEASIBILITY OF USING AN INERTIAL SYSTEM TO PROVIDE THE AIRCRAFT POSITION REFERENCE FOR PERFORMING BASIC FLIGHT INSPECTION OF ILS AND VORTAC FACILITIES. AN INERTIAL LOCATOR EQUIPMENT WAS DESIGNED, CONSTRUCTED AND INTEGRATED INTO THE SEAL FLIGHT INSPECTION SYSTEM. NUMEROUS FLIGHTS WERE MADE AT BOTH THE BEDFORD FLIGHT FACILITY OF THE M. I. T. CHARLES STARK DRAPER LABORATORY AND AT NAFEC IN ATLANTIC CITY, NEW JERSEY. METHODS FOR THE UTILIZATION OF EXTERNALLY DERIVED INFORMATION (POST-LANDING CHECK POINT FOR ILS MODE AND DME RANGE FOR VORTAC MODE) WERE INCORPORATED IN THE SYSTEM. THE USE OF THE CORRECTED DATA MODE IN BOTH TYPES OF INSPECTION MISSIONS DEMONSTRATED IMPROVEMENT OVER REAL-TIME INERTIAL PERFORMANCE, YIELDING ACCEPTABLE RESULTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 754 989 17/7
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT E V BRUNSWICK (WEST GERMANY)

INERTIAL NAVIGATION SYSTEM BASED ON TWO SCHULER GYROPENDULUMS AND ONE AZIMUTH GYRO, (U)

71 21P STIELER,B. ;
REPT. NO. DFVLR-SONDERDRUCK-246

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN JAHRBUCH DER DGLR, P244-262 1971.
SUPPLEMENTARY NOTE: SUMMARIES IN FRENCH AND GERMAN.

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), GYROSCOPES, DETECTORS, STABILIZED PLATFORMS, WEST GERMANY (U)
IDENTIFIERS: TWO DEGREES OF FREEDOM (U)

AN INERTIAL NAVIGATION SYSTEM IS DESCRIBED AND ANALYZED WHICH IS BASED ON THREE TWO-DEGREE-OF-FREEDOM GYROSCOPIC SENSORS. TWO OF THE SENSORS ARE SCHULER GYROPENDULUMS WITH THEIR SPIN VECTORS POINTING UP OR DOWN, RESPECTIVELY. THE THIRD SENSOR IS AN AZIMUTH GYRO WITH ITS SPIN VECTOR POINTING NORTHERLY, PARALLEL TO THE EARTH AXIS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 20M07

AD- 757 274 17/7 1/2
TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MASS

OCEANIC SURVEILLANCE AND NAVIGATION ANALYSIS, FY 72. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
AUG 72 76P GAGNE,GILBERT A. ;
HERSHKOWITZ,RONALD M. ;
REPT. NO. TSC-FAA-72-26
MONITOR: FAA-RD 72-142

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-733 758.

DESCRIPTORS: (*INERTIAL NAVIGATION, CIVIL AVIATION), (*AVIATION SAFETY, AIR TRAFFIC), (*AIR TRAFFIC CONTROL SYSTEMS, ATLANTIC OCEAN), AVIATION ACCIDENTS, FLIGHT PATHS, SEPARATION, MODELS(SIMULATIONS), STANDARDS (U)

THE REPORT SUMMARIZES THE OCEANIC SURVEILLANCE AND NAVIGATION ANALYSIS PERFORMED, AT OR UNDER THE DIRECTION OF, THE TRANSPORTATION SYSTEMS CENTER UNDER PPA FA-204 FOR FY72. A METHODOLOGY HAS BEEN DEVELOPED BY SYSTEMS CONTROL, INC. FOR RELATING THE SAFETY (COLLISION RISK) OF THE NORTH ATLANTIC ORGANIZED TRACK SYSTEM IN THE LATERAL DIMENSION TO THE GENERAL CHARACTERISTICS OF THE ON-BOARD NAVIGATION SYSTEM, THE INDEPENDENT SATELLITE SURVEILLANCE SYSTEM AND THE ATC PROCEDURES. THE INITIATION OF THIS EFFORT BY TSC WAS REPORTED IN TR DOT-TSC-FAA-71-13. THE ANALYSIS AND RESULTS ARE DETAILED HEREIN. EXTENSIONS OF THIS METHODOLOGY TO THE LATITUDE AND VERTICAL DIMENSIONS ARE ALSO DISCUSSED AND PRELIMINARY RESULTS ARE PRESENTED. A STUDY HAS ALSO BEEN INITIATED TO INVESTIGATE AND EVALUATE VARIOUS CONFIGURATIONS OF AIDED INERTIAL NAVIGATION SYSTEM IN THE NAT REGION. THE REQUIREMENTS, GOALS AND CONTRACT AWARD FOR THE STUDY ARE REVIEWED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 758 127 17/7
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT
PARIS (FRANCE)

INERTIAL NAVIGATION COMPONENTS AND
SYSTEMS. (U)

DESCRIPTIVE NOTE: CONFERENCE PROCEEDINGS NO. 116.
FEB 73 413P
REPT. NO. AGARD-CP-116

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PAPERS PRESENTED AT THE MEETING OF THE GUIDANCE AND CONTROL PANEL OF AGARD (15TH), HELD IN FLORENCE, ITALY, 2-5 OCTOBER 1972. NATO FURNISHED.

DESCRIPTORS: (*INERTIAL NAVIGATION, SYMPOSIA), INERTIAL GUIDANCE, INSTRUMENTATION, GYROSCOPES, OPTIMIZATION, STABILIZED PLATFORMS, GYRO COMPASSES, ALIGNMENT, CALIBRATION, COST EFFECTIVENESS, AIR TO SURFACE MISSILES (U)

THE OBJECTIVE OF THE MEETING IS TO PROVIDE UP-DATED INFORMATION ON INERTIAL NAVIGATION COMPONENT AND SYSTEM PROGRESS, AND DISCUSS APPLICATIONS AND TEST RESULTS REALIZED SINCE THE LAST TWO MEETINGS HELD IN 1968. THE PAST FOUR YEARS HAVE SEEN AN EXPONENTIAL INCREASE IN THE USE OF INERTIAL TECHNOLOGY TO SATISFY MILITARY AND CIVILIAN AIR NAVIGATION REQUIREMENTS, TACTICAL MID-COURSE MISSILE GUIDANCE REQUIREMENTS, AND A WIDE VARIETY OF TRANSPORTATION SYSTEMS. DURING THIS PERIOD, TECHNIQUES SUCH AS STRAPDOWN AND ELECTROSTATICALLY SUSPENDED CONFIGURED INSTRUMENTS HAVE MATURED AND THEIR AVAILABILITY HAS BEEN CONCLUSIVELY ESTABLISHED. THERE HAVE ALSO BEEN 'UNCONVENTIONAL' TECHNIQUES PRODUCED WHICH SHOULD BE OF INTEREST TO THE COMMUNITY. AN IMPORTANT ASPECT TO THE REVIEW IS DISCUSSION OF CONCEPTS AND TECHNIQUES WHICH EMPHASIZE THE TRADE-OFFS DEALING WITH COST VERSUS PERFORMANCE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 70M07

AD- 762 508 14/5 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO ADVANCED WEAPONS STANDARDS DIV

PHOTOGRAPHIC RECORDING AND ANALYSIS OF SPATIALLY MODULATED COHERENT WAVEFRONTS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
FEB 70 96P HINEBAUGH,ROBERT LEE ;
REPT. NO. 70LWR-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: MASTER'S THESIS.

DESCRIPTORS: (*PHOTOGRAPHIC RECORDING SYSTEMS, *INERTIAL NAVIGATION), STAR TRACKERS, PHOTOGRAPHY, GAS LASERS, TRANSFER FUNCTIONS, EXPERIMENTAL DESIGN, THESES (U)
IDENTIFIERS: OPTICAL TRANSFER FUNCTIONS, SPATIAL FILTERING, HELIUM NEON LASERS (U)

A METHOD OF PRODUCING SPATIAL FILTERS BY RECORDING STRAIGHT LINE FRINGE PATTERNS PRODUCED BY INTERFERRING TWO LASER BEAMS ON SPECTROSCOPIC PLATES IS DISCUSSED. TECHNIQUES USED TO OBTAIN MAXIMUM MODULATION, MAXIMUM TRANSMISSION, AND EXTREMELY STRAIGHT FRINGES ARE INCLUDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 768 354 17/7 9/2 1/3
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

APPLICATION OF THE AVIONICS MULTIPROCESSOR TO INERTIAL NAVIGATION. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
JUN 73 165P HAUGEN,JAMES A. ;
REPT. NO. GGC/EE/73-5

UNCLASSIFIED REPORT

DESCRIPTORS: (*NAVIGATION COMPUTERS, *INERTIAL NAVIGATION), DATA PROCESSING, MULTIPLE OPERATION, INPUT OUTPUT DEVICES, SPECIFICATIONS, COMMAND AND CONTROL SYSTEMS, AIRCRAFT EQUIPMENT, COMPUTER PROGRAMMING, TEST METHODS, THESES (U)
IDENTIFIERS: *COMPUTERS, *MULTIPLE OPERATION, *AVIONICS (U)

THE BURROUGHS AVIONICS MULTIPROCESSOR SYSTEM WAS DEVELOPED AS A FLEXIBLE AVIONICS COMPUTER SYSTEM. ITS FLEXIBILITY WAS OBTAINED THROUGH MICROPROGRAMMABILITY AND MODULARITY. ONE OF ITS POSSIBLE APPLICATION AREAS IS INERTIAL NAVIGATION. THE GOAL WAS TO FIND THE BEST SYSTEM CONFIGURATION AND TO MICROPROGRAM IT FOR INERTIAL NAVIGATION. AFTER EXAMINING THE SYSTEM ORGANIZATION AND DEVELOPING APPLICATION SPECIFICATIONS, IT WAS DECIDED THAT NAVIGATION COMPUTER EMULATION WAS THE BEST WAY TO APPLY THE SYSTEM TO NAVIGATION DATA PROCESSING. THIS EMULATOR IS DEVELOPED AND A TESTING SEQUENCE SET UP. A PROGRAM WHICH SOLVES THE INERTIAL NAVIGATION EQUATIONS IS ALSO DEVELOPED FOR THE EMULATOR. A PROGRAM TEST SEQUENCE IS GIVEN, INCLUDING TWO SIMULATED TEST FLIGHT PATHS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 770 072 17/7
AEROSPACE SYSTEMS INC BURLINGTON MASS

NORTH ATLANTIC (NAT) AIDED INERTIAL NAVIGATION SYSTEM SIMULATION. VOLUME I. TECHNICAL RESULTS. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 72-JAN 73, JUL 73 196P HOFFMAN,WILLIAM C. ; HOLLISTER,WALTER M. ;BRITTING,KENNETH R. ;
CONTRACT: DOT-TSC-473
MONITOR: FAA-RD,TSC 73-112-VOL-1,FAA-73-23-VOL-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 2, AD-770 073.

DESCRIPTORS: *INERTIAL NAVIGATION, *AIR TRAFFIC CONTROL SYSTEMS, HYBRID SYSTEMS, ERRORS, SIMULATION, COMPUTERIZED SIMULATION, ATLANTIC OCEAN, AIR TRAFFIC, KALMAN FILTERING, RADIO NAVIGATION, DOPPLER NAVIGATION, DOPPLER RADAR (U)
IDENTIFIERS: NORTH ATLANTIC AIR TRAFFIC (U)

CURRENT AIR TRAFFIC OPERATIONS OVER THE NORTH ATLANTIC (NAT) AND THE APPLICATION OF HYBRID NAVIGATION SYSTEMS TO OBTAIN MORE ACCURATE PERFORMANCE ON THESE NAT ROUTES ARE REVIEWED. A DIGITAL COMPUTER SIMULATION PROGRAM (NATNAV - NORTH ATLANTIC NAVIGATION) IS DEVELOPED TO EVALUATE THE PERFORMANCE OF NAVIGATION SYSTEMS FOR FUTURE COMMERCIAL NAT AIRCRAFT OPERATIONS. ERROR MODELS ARE DEVELOPED FOR AIDED-INERTIAL NAVIGATION SYSTEMS WITH EXTERNAL MEASUREMENTS FROM DOPPLER RADAR, OMEGA, SATELLITE-RANGING OR AIR DATA. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 770 073 17/7 9/2
AEROSPACE SYSTEMS INC BURLINGTON MASS

NORTH ATLANTIC (NAT) AIDED INERTIAL NAVIGATION SYSTEM SIMULATION. VOLUME II. COMPUTER PROGRAM NATNAV USER'S MANUAL. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 72-JAN 73, JUL 73 147P HOFFMAN, WILLIAM C. ;BOWIE, KATHRYN G. ;
CONTRACT: DOT-TSC-473
MONITOR: FAA-RD,TSC 73-112-VOL-2,FAA-73-23-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 1, AD-770 072.

DESCRIPTORS: *INERTIAL NAVIGATION, *AIR TRAFFIC CONTROL SYSTEMS, *COMPUTER PROGRAMS, COMPUTERIZED SIMULATION, INSTRUCTION MANUALS, HYBRID SYSTEMS, AIR TRAFFIC, ATLANTIC OCEAN, ERRORS, RADIO NAVIGATION, DOPPLER NAVIGATION, DOPPLER RADAR, KALMAN FILTERING, FORTRAN (U)
IDENTIFIERS: NORTH ATLANTIC AIR TRAFFIC, NATNAV COMPUTER PROGRAM, FORTRAN 4 PROGRAMMING LANGUAGE, CDC 3800 COMPUTERS (U)

A USER'S MANUAL IS PROVIDED FOR PROGRAM NATNAV (NORTH ATLANTIC NAVIGATION), A DIGITAL COMPUTER SIMULATION PROGRAM DEVELOPED TO EVALUATE THE PERFORMANCE OF NAVIGATION SYSTEMS FOR FUTURE COMMERCIAL NAT AIRCRAFT OPERATIONS. ERROR MODELS FOR AIDED-INERTIAL NAVIGATION SYSTEMS WITH EXTERNAL MEASUREMENTS FROM DOPPLER RADAR, OMEGA, SATELLITE-RANGING OR AIR DATA ARE SIMULATED. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 20M07

AD- 770 559 17/7
NAVAL WEAPONS LAB DAHLGREN VA

INERTIAL NAVIGATION UTILIZING SATELLITE RANGE AND DOPPLER OBSERVATIONS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 73 61P FELL,PATRICK JAMES ;
REPT. NO. NWL-TR-2975

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, AIRCRAFT, RANGE FINDING, NAVIGATION SATELLITES, ESTIMATES (U)
IDENTIFIERS: ESTIMATION THEORY (U)

THE APPLICATION OF LINEAR ESTIMATION THEORY FOR THE IMPROVEMENT OF INERTIAL NAVIGATION SYSTEM ESTIMATES OF AIRCRAFT POSITION AND VELOCITY IS DESCRIBED. THE TECHNIQUE USES SATELLITE RANGE AND RANGE RATE (DOPPLER) OBSERVATIONS AND VEHICLE BORNE ALTIMETER MEASUREMENTS FOR THE CORRECTION OF INERTIAL NAVIGATION SYSTEM OUTPUTS AND FOR THE ESTIMATION OF VARIOUS OTHER QUANTITIES SUCH AS FREQUENCY BIAS. SATELLITE ORBIT UNCERTAINTY IS INTRODUCED INTO THE SOLUTION THROUGH THE MEAN ANOMALY UNCERTAINTY IN EACH OBSERVED SATELLITE'S COMPUTED ORBIT. A SPECIFIC EXAMPLE IS GIVEN WHICH USES OBSERVATIONS FROM TWO SATELLITES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 773 525 17/7 12/1
IOWA STATE UNIV AMES ENGINEERING RESEARCH INST

PROJECT THEMIS - AUTOMATIC NAVIGATION AND CONTROL. (U)

DESCRIPTIVE NOTE: FINAL REPT. SEP 67-AUG 73,
DEC 73 27P BROWN,R. G. ;
REPT. NO. ISU-ERI-AMES-73281
CONTRACT: N00014-68-A-0162
PROJ: ERI-712-S

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPORT DATED FEB 72, AD-737 336.

DESCRIPTORS: *INERTIAL NAVIGATION, *CONTROL THEORY, KALMAN FILTERING, ESTIMATES, DIFFERENTIAL EQUATIONS, DATA PROCESSING, REPORTS (U)
IDENTIFIERS: THEMIS PROJECT, ESTIMATION THEORY (U)

THE REPORT SUMMARIZES THE TECHNICAL ACCOMPLISHMENTS OF THE THEMIS PROGRAM ON AUTOMATIC NAVIGATION AND CONTROL AT IOWA STATE UNIVERSITY FOR THE 1967-73 PERIOD. BRIEF STATEMENTS DESCRIBING MAJOR TECHNICAL ACCOMPLISHMENTS ARE GIVEN AS WELL AS A COMPLETE LIST OF TECHNICAL REPORTS, PATENTS AND JOURNAL PAPERS, THE FUTURE DIRECTION OF THE PROGRAM IS DISCUSSED, AND A SUMMARY OF THE BENEFITS DERIVED BY THE DEPARTMENT OF DEFENSE AND IOWA STATE UNIVERSITY ARE PRESENTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 779 724 17/7 12/1
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

KALMAN FILTER DESIGN FOR AN INERTIAL NAVIGATION SYSTEM AIDED BY NON-SYNCHRONOUS NAVIGATION SATELLITE CONSTELLATIONS. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
MAR 74 174P BUTLER,RONALD RAY ;RHUE,
GEORGE TRUITT ;
REPT. NO. GA/EE/74M-1

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *KALMAN FILTERING, NAVIGATION SATELLITES, CONTROL THEORY, OPTIMIZATION, INTEGRATED SYSTEMS, NAVIGATION, THESES (U)
IDENTIFIERS: DESIGN (U)

THE REPORT IS A KALMAN FILTER DESIGN STUDY FOR THE PROPOSED INTEGRATED NAVIGATION SATELLITE/ INERTIAL SYSTEM (INI). PRIMARY EMPHASIS IS PLACED UPON DETERMINATION OF THE 'BEST' FILTER STATE VARIABLE VECTOR AND INVESTIGATION OF VARIOUS MEASUREMENT RATES USING EXTERNAL RANGE MEASUREMENTS FROM A SET OF 27 NON-SYNCHRONOUS SATELLITES. THE INI SYSTEM ERRORS ARE ASSUMED TO BE REPRESENTED BY A 44 STATE LINEAR SYSTEM MODEL, AND THE FILTER OPERATES WITHOUT BENEFIT OF AN ALTIMETER. A ONE-HOUR INI FLIGHT AT CONSTANT SPEED AND ALTITUDE OVER A GREAT CIRCLE PATH IS SIMULATED ON THE DIGITAL COMPUTER AND FILTER DESIGNS ARE COMPARED BY PLOTTING THE SYSTEM POSITION, VELOCITY, AND ATTITUDE ERROR COVARIANCES VERSUS TIME. A 15 STATE FILTER WITH WEAK COUPLING TERMS REMOVED IS DETERMINED TO PROVIDE THE BEST TRADEOFF BETWEEN ACCURACY AND COMPUTATIONAL BURDEN. FILTER PERFORMANCE IS COMPARED AT 5, 15, 30, 60 AND 90 SECOND MEASUREMENT UPDATE RATES. ADDITIONALLY, 'OPTIMAL' SEQUENCING OF SATELLITE OBSERVABLES IS SHOWN TO PROVIDE IMPROVED PERFORMANCE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 783 638 17/7
INTERMETRICS INC CAMBRIDGE MASS

CIRIS TRANSPONDER DEPLOYMENTS FOR TESTING INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
AUG 74 217P WIDNALL,WILLIAM S. ;KU,
RICHARD T. ;
REPT. NO. IR-89-74
CONTRACT: F29601-73-C-0089
PROJ: AF-6886
MONITOR: AFSWC TR-74-22

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *INERTIAL NAVIGATION, TRANSPONDERS, DEPLOYMENT, TEST EQUIPMENT, ACCURACY, ERRORS, RANGE FINDING, PRECISION, POSITION FINDING, VELOCITY, ATTITUDE INDICATORS, KALMAN FILTERING, FLIGHT TESTING (U)

THE COMPLETELY INTEGRATED REFERENCE INSTRUMENTATION SYSTEM (CIRIS) SYSTEM AT HOLLOMAN AIR FORCE BASE PROVIDES A HIGHLY PRECISE REFERENCE FOR THE FLIGHT TESTING OF NAVIGATION AND GUIDANCE SYSTEMS. CIRIS SUBSYSTEMS INCLUDE AN INERTIAL NAVIGATION SYSTEM (INS), A DOPPLER VELOCITY SENSOR, AND A PRECISION RANGING SYSTEM. THIS REPORT EVALUATES THE EFFECT OF THE DEPLOYMENT OF THE TRANSPONDERS OF THE PRECISION RANGING SYSTEM ON CIRIS POSITION/VELOCITY/ATTITUDE ACCURACY AND ON THE ESTIMATION OF SOURCES OF ERROR IN AN INS UNDER TEST. POSITION ACCURACY WITH BASIC TWO AND THREE TRANSPONDER DEPLOYMENTS IS EXPLORED WITH A SIMPLE POSITION FIX ERROR ANALYSIS. POSITION/VELOCITY/ATTITUDE ACCURACY FOR A VARIETY OF MULTI-TRANSPONDER DEPLOYMENTS IS EVALUATED USING THE CIRIS POST-FLIGHT PROCESSOR ON SIMULATED CIRIS FLIGHT DATA. THE PERFORMANCE IMPROVEMENT WITH DOPPLER DATA IS PRESENTED. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 785 392 17/7 15/5
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

A DESCRIPTION OF A LIFE CYCLE COST MODEL FOR INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 74 50P MEITZLER,THOMAS D. ;GENET, RUSSELL M. ;
REPT. NO. AGMC-74-014II

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *AVIONICS, *LIFE CYCLES, INVENTORY ANALYSIS, COST ANALYSIS, LOGISTICS PLANNING, INVENTORY CONTROL, MATHEMATICAL MODELS, COMPUTER PROGRAMS, FORTRAN (U)
IDENTIFIERS: *LOGISTICS MANAGEMENT, FORTRAN 4 PROGRAMMING LANGUAGE (U)

THE PURPOSE OF THIS REPORT IS TO DOCUMENT A MATHEMATICAL MODEL THAT HAS BEEN USED TO EVALUATE THE POTENTIAL LIFE CYCLE COSTS OF INERTIAL NAVIGATION SYSTEMS. THE MODEL HAS BEEN PREVIOUSLY PUBLISHED; HOWEVER, BECAUSE OF SENSITIVE DATA, IT HAD A LIMITED DISTRIBUTION. THIS REPORT INCLUDES DEFICITIONS OF ALL INPUT AND OUTPUT PARAMETERS, EXPLANATIONS OF ALGORITHMS FOR THE MODEL, A SAMPLE RUN USING FICTITIOUS DATA AND A PROGRAM LISTING WHICH INCLUDES A SENSITIVITY STUDY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 785 443 17/7 15/5
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF SYSTEMS AND LOGISTICS

DEPOT REQUIREMENTS FOR BASE LEVEL DATA ON AIRCRAFT INERTIAL PLATFORMS. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
AUG 74 140P PLUNKETT,WILFRED H. ;MOORE, RICHARD N. ;
REPT. NO. SLSR-2-74B

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *STABILIZED PLATFORMS, *MAINTENANCE, MAINTAINABILITY, COST ANALYSIS, MAINTENANCE PERSONNEL, DEPOTS, LOGISTICS, THESES (U)
IDENTIFIERS: *BASE LEVEL MAINTENANCE, *DEPOT MAINTENANCE (U)

SOME OF THE MOST EXPENSIVE AIRCRAFT COMPONENTS TO MAINTAIN ARE STABILIZED PLATFORMS USED IN AIRCRAFT INERTIAL SYSTEMS. IN THE MAJORITY OF USAF AIRCRAFT EQUIPPED WITH AN INERTIAL SYSTEM, THE INERTIAL PLATFORM RANGES FROM THE SECOND TO THE EIGHTH MOST EXPENSIVE COMPONENT TO MAINTAIN. FOR MOST OF THESE AIRCRAFT, DEPOT LEVEL MAINTENANCE CONSTITUTES FROM 55 TO 90% OF THE TOTAL INERTIAL PLATFORM SUPPORT COSTS. SEVERAL RECENT PROGRAMS TO IMPROVE RELIABILITY AND REDUCE SUPPORT COSTS OF AIRCRAFT INERTIAL SYSTEMS HAVE BEEN HAMPERED BY THE QUALITY AND TYPE OF BASE LEVEL PERFORMANCE AND MAINTENANCE DATA AVAILABLE TO THE AEROSPACE GUIDANCE AND METROLOGY CENTER (AGMC), USAF'S INERTIAL PLATFORM CENTRAL REPAIR DEPOT. THIS STUDY WAS AN ATTEMPT TO DETERMINE AGMC'S SPECIFIC REQUIREMENTS FOR BASE LEVEL DATA. (MODIFIED AUTHOR ABSTRACT) (U)

AD-A049 100 DEFENSE DOCUMENTATION CENTER ALEXANDRIA VA F/G 17/7
INERTIAL NAVIGATION.(U)
JAN 78
UNCLASSIFIED DDC/BIB-77-14 NL

2 of 3
AD A049 100

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 785 733 17/7
ROCKWELL INTERNATIONAL CORP ANAHEIM CALIF AUTONETICS DIV

MICRON FAST REACTION AND HIGH TEMPERATURE OPERATION DEVELOPMENT. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 JUL 73-30 JUN 74,
JUN 74 118P BUMP,H. L. ;KLINCHUNCH,J. F. ;ANDREWS,A. P. ;
REPT. NO. C73-1058/201
CONTRACT: DAAB07-73-C-0188
MONITOR: ECOM 0188-F-73

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *INERTIAL NAVIGATION, *GYROSCOPES, REACTION TIME, HIGH TEMPERATURE, ALIGNMENT, DAMPING, GYRO COMPASSES (U)
IDENTIFIERS: MICRON NAVIGATION SYSTEM (U)

THE OBJECTIVE OF THE PROGRAM IS TO PROVIDE A FAST REACTION CAPABILITY AND TO INVESTIGATE A HIGH TEMPERATURE OPERATION CAPABILITY FOR THE MICRON SYSTEM. CHANGES WERE MADE TO THE MICRON SYSTEM GYROS AND ELECTRONICS TO ALLOW THE FAST REACTION TIME NEEDED. AN ECOM MOTOR AND SPIN MOTOR POWER SUPPLY WERE DEVELOPED AND TESTED. THE REDESIGNED MOTOR ACHIEVED THE GOAL OF 80F/MIN ROTOR WARM-UP RATE, A 9 SEC SPIN UP CAPABILITY, A 20 SEC POLHODE DAMPING CAPABILITY AND A 30 SEC RAPID SPON-DOWN CAPABILITY. IN ADDITION, ROTOR GAP MODELING WAS SHOWN TO BE A FEASIBLE METHOD FOR SOLVING THE RAPID TURNAROUND PROBLEM. THE RESULTS OF HIGH TEMPERATURE TESTING OF THE ELECTRONICS ARE GIVEN AND DISCUSSED. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 787 187 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

GYROSCOPE PERFORMANCE PREDICTION ANALYSIS PROJECT STATUS AND REVIEW OF PREVIOUS EFFORTS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
DEC 69 20P GENET,RUSSELL M. ;
REPT. NO. AGMC-74-022

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *GYROSCOPES, LIFE EXPECTANCY, MAINTENANCE, ACCEPTANCE TESTS, FLOATS, DISCRIMINATE ANALYSIS (U)

A REPORT ON THE STATUS OF A PROJECT TO PREDICT GYROSCOPE PERFORMANCE IS GIVEN. STATISTICAL ANALYSIS WAS USED TO COMBINE THE RESULTS FROM SEVERAL INDEPENDENT TESTS TO FORM AN OPTIMAL SINGLE PREDICTION. DIFFICULTIES AND TECHNICAL PROBLEMS ARE DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 787 189 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

A PLAN FOR ASSESSING CHANGES IN THE SUPPORT COST AND RELIABILITY OF THE G-200 GYROSCOPE AND LN-12 PLATFORM. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JAN 73 23P GENET,RUSSELL M. ;MARTIN, RICHARD ;BESTEDA,ROOSEVELT ;
REPT. NO. AGMC-74-023

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *GYROSCOPES, *COST ANALYSIS, STABILIZED PLATFORMS, JET FIGHTERS, BEARINGS, MODIFICATION, MAINTENANCE (U)
IDENTIFIERS: G-200 GYROSCOPES, IN-12 INERTIAL SYSTEMS, F-4 AIRCRAFT (U)

AFTER A NEW AND IMPROVED GYROSCOPE BEARING WAS INTRODUCED INTO A REPAIR PROCESS, THIS PLAN WAS DRAWN UP FOR ASSESSING THE IMPACT OF THE NEW BEARING ON THE SUPPORT COSTS AND RELIABILITY OF THE GYROSCOPE. THE PLAN WAS SUBSEQUENTLY IMPLEMENTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 801 527 9/2
AEROSPACE CORP EL SEGUNDO CALIF

DIGITAL COMPUTER PROGRAM FOR ERROR ANALYSIS OF INERTIAL-NAVIGATION SYSTEMS, (U)

AUG 66 255P FEESS, W. A. ;
REPT. NO. TR-669(6540)-7
CONTRACT: AF 04(695)-669
MONITOR: SSD TR-66-154

UNCLASSIFIED REPORT

DESCRIPTORS: (*DIGITAL COMPUTERS, *ERRORS), (*INERTIAL NAVIGATION, *MATHEMATICAL ANALYSIS), COMPUTER PROGRAMMING, GUIDED MISSILES, INPUT OUTPUT DEVICES, DRAG, GYROSCOPES, ACCELEROMETERS, GUIDANCE, SENSITIVITY, EQUATIONS OF MOTION, TRAJECTORIES (U)
IDENTIFIERS: IBM 7094 COMPUTERS, IBM 7090 COMPUTERS (U)

THE THEORY AND ASSUMPTION USED IN DEVELOPING EQUATIONS FOR THE ERROR ANALYSIS OF A GENERAL CLASS OF INERTIAL NAVIGATION SYSTEMS ARE DESCRIBED. THE COMPUTER PROGRAM DEVELOPED FOR THEIR SOLUTION IS DESCRIBED FROM A USER'S POINT OF VIEW. ITS APPLICATION INCLUDES THE SYNTHESIS AND/OR ANALYSIS OF INERTIAL NAVIGATION SYSTEMS USED IN BALLISTIC MISSILE OR TERRESTRIAL SPACE MISSIONS. THE PROGRAM IS DESIGNED TO ALLOW STUDIES OF BOTH PURE INERTIAL AND AIDED INERTIAL NAVIGATION SYSTEMS, THE LATTER BEING THE PROCESS OF UPDATING NAVIGATION DATA VIA DATA FROM EXTERNAL SENSORS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 804 340 17/7 1/3
BOEING CO RENTON WASH

COMMERCIAL SUPERSONIC TRANSPORT PROGRAM. PHASE IIB REPORT. INERTIAL NAVIGATION SYSTEM PERFORMANCE SPECIFICATION. (U)

JUN 65 18P
REPT. NO. D6-17865
CONTRACT: FA-SS-65-20

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *JET TRANSPORT PLANES), INSTRUMENTATION, SUPERSONIC AIRCRAFT, POSITION FINDING, ATTITUDE CONTROL SYSTEMS, DIGITAL COMPUTERS, DISPLAY SYSTEMS, SPECIFICATIONS, PERFORMANCE(ENGINEERING), RELIABILITY(ELECTRONICS), MAINTAINABILITY, INSTALLATION, ALIGNMENT, QUALITY CONTROL (U)
IDENTIFIERS: SUPERSONIC TRANSPORTS (U)

THIS SPECIFICATION ESTABLISHES PRELIMINARY PERFORMANCE, DESIGN, AND CONSTRUCTION REQUIREMENTS APPLICABLE TO THE INERTIAL NAVIGATION SYSTEM FOR THE SUPERSONIC TRANSPORT. THE REQUIREMENTS WILL BE UPDATED AS THE ARINC INERTIAL NAVIGATION SYSTEM CHARACTERISTICS IS DEVELOPED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 804 438 17/7
BOEING CO RENTON WASH

COMMERCIAL SUPERSONIC TRANSPORT PROGRAM. PHASE II-C. INTERIM AIRCRAFT PERFORMANCE ASSESSMENT REPORT. INERTIAL NAVIGATION SYSTEM PERFORMANCE SPECIFICATION(U)

DESCRIPTIVE NOTE: COMPLETE REVISION.
NOV 65 18P
REPT. NO. D6-17865
CONTRACT: FA-SS-66-5

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), SPECIFICATIONS, JET TRANSPORT PLANES, DIGITAL COMPUTERS, PERFORMANCE(ENGINEERING), DISPLAY SYSTEMS, MAINTAINABILITY, ENVIRONMENTAL TESTS, INTERFACES, MEASUREMENT, ADAPTERS, CONTROL SYSTEMS, POWER (U)
IDENTIFIERS: SUPERSONIC TRANSPORTS (U)

THIS SPECIFICATION ESTABLISHES PRELIMINARY PERFORMANCE, DESIGN, AND CONSTRUCTION REQUIREMENTS APPLICABLE TO THE INERTIAL NAVIGATION SYSTEM FOR THE SUPERSONIC TRANSPORT. THE REQUIREMENTS WILL BE UPDATED AS THE ARINC INERTIAL NAVIGATION SYSTEM CHARACTERISTIC IS DEVELOPED. SYSTEM PERFORMANCE REQUIREMENTS ESTABLISHED HEREIN ARE DESIGN OBJECTIVES TO BE APPLIED TO THE PROTOTYPE AIRPLANES. APPLICATION OF THE REQUIREMENTS TO PRODUCTION AIRPLANE DESIGN WILL BE ESTABLISHED AFTER PROTOTYPE FLIGHT TESTING. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 804 707 17/2.1 17/7 1/3
BOEING CO SEATTLE WASH SUPERSONIC TRANSPORT DIV

SUPERSONIC TRANSPORT DEVELOPMENT PROGRAM. PHASE III PROPOSAL. BOEING MODEL 2707. COMMUNICATIONS/ NAVIGATION SUBSYSTEM SPECIFICATION. (U)

SEP 66 395P BARTON,HOWARD G. ;
REPT. NO. D6A10122-1
CONTRACT: FA-SS-66-5

UNCLASSIFIED REPORT

DESCRIPTORS: (*COMMUNICATION AND RADIO SYSTEMS, *SPECIFICATIONS), (*RADIO NAVIGATION, JET TRANSPORT PLANES), (*INERTIAL NAVIGATION, JET TRANSPORT PLANES), TRANSPONDERS, INTERCOMMUNICATION SYSTEMS, MAPPING, SUPERSONIC AIRCRAFT, INSTRUMENTATION, VERY HIGH FREQUENCY, STATIC DISCHARGERS, LIGHTNING ARRESTERS, MAGNETIC RECORDING SYSTEMS, TELEVISION EQUIPMENT, RADAR, AVIATION SAFETY, HIGH FREQUENCY, METEOROLOGICAL RADAR, DIRECTION FINDING, RADIO EQUIPMENT, GLIDE PATH SYSTEMS, RADIO BEACONS, DISTANCE MEASURING EQUIPMENT, RADIO ALTIMETERS, INSTRUMENT PANELS, DISPLAY SYSTEMS (U)
IDENTIFIERS: SUPERSONIC TRANSPORTS (U)

THIS SPECIFICATION DEFINES THE OBJECTIVES, CRITERIA, AND CONFIGURATION, AND ESTABLISHES THE REQUIREMENTS FOR PERFORMANCE, DESIGN, TEST, AND QUALIFICATION OF THE NAVIGATION AND COMMUNICATION SUBSYSTEM FOR THE PROTOTYPE MODEL SUPERSONIC TRANSPORT AIRPLANE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 814 916 17/7
AEROSPACE CORP EL SEGUNDO CALIF

DIGITAL COMPUTER PROGRAM FOR ERROR ANALYSIS OF INERTIAL NAVIGATION SYSTEMS, (U)

APR 67 95P FEESS,W. A. ;BLUMENSTEIN, STANLEY ;KATZ,BERNARD ;
REPT. NO. TR-669(6540)-7-REV-1
CONTRACT: AF 04(695)-669, AF 04(695)-1001
MONITOR: SSD TR-66-154

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REVISION OF REPORT DATED AUG 66.

DESCRIPTORS: (*INERTIAL NAVIGATION, COMPUTER PROGRAMS), (*ERRORS, ANALYSIS), INSTRUMENTATION, MATRICES(MATHEMATICS), DATA PROCESSING, FREE FLIGHT TRAJECTORIES, VECTOR SPACES (U)

THIS ARTICLE IS A COLLECTION OF REVISED PAGES TO THE DOCUMENT, SUBMITTED IN AUGUST, 1966, ENTITLED 'DIGITAL COMPUTER PROGRAM FOR ERROR ANALYSIS OF INERTIAL GUIDANCE SYSTEMS.' IN ADDITION TO REVISIONS SEVERAL ADDITIONS HAVE ALSO BEEN MADE. THE INPUT TRAJECTORY TAPE FORMAT HAS BEEN CHANGED MAKING TWO ADDITIONAL INPUT CONSTANTS FOR ALL ERROR ANALYSES NECESSARY. THE GYRO NON-G-SENSITIVE DRIFT ERROR SOURCES ARE ACTIVE DURING ALL FREE FLIGHTS UNLESS CHANGED BY INPUT. THE ACCELEROMETER BIAS ERROR SOURCES CAN NOW BE ACTIVATED OR DE-ACTIVATED BY INPUT. IN ADDITION, A NOTE HAS BEEN ADDED ON THE OUTPUT THAT DESCRIBES THE STATE OF THESE ERROR SOURCES. THE CAPABILITY HAS BEEN ADDED TO ALLOW THE ABORTING OF THE TRAJECTORY TAPE TO ENTER INTO A FREE FLIGHT AND ALLOW RESUMPTION OF THE TRAJECTORY TAPE AFTER AN INTEGRAL NUMBER OF ORBITS. A NOTE HAS BEEN ADDED ON THE OUTPUT TO DENOTE TRAJECTORY ABORT TIMES. THE TABLE OF TGOP ENTRIES HAS BEEN EXPANDED FROM 12 TO 50 TO ALLOW ADDITIONAL OUTPUTS. TO USE THE TGOP TABLE FOR PHASE CHANGES, NEGATIVE ENTRIES OF TIME ARE NOW REQUIRED. ADDITIONAL INPUT IS AVAILABLE TO ALLOW A STRAPDOWN SYSTEM TO ROTATE AT A CONSTANT RATE DURING EQUATIONS OF MOTION PROPAGATION. OUTPUT IN A CO-ORDINATE SYSTEM OTHER THAN ECI OR LOCAL HORIZONTAL IS NOW AVAILABLE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 824 448 17/7 9/2
IBM FEDERAL SYSTEMS DIV OWEGO N Y ELECTRONICS SYSTEMS CENTER

SYNERGISTIC NAVIGATION SYSTEM STUDY. (U)

DESCRIPTIVE NOTE: PHASE 2 OF FINAL REPT.,
SEP 67 198P JOHNSON,MARYLINDA ;KLEMENTIS, KENNETH A. ;VILLONE,ARNOLD L. ;
REPT. NO. IBM-67-162-0013
CONTRACT: N00014-66-C-0192

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, DATA PROCESSING), (*DOPPLER NAVIGATION, DATA PROCESSING), (*LORAN, *DATA PROCESSING), DETECTORS, NAVIGATION COMPUTERS, OPTIMIZATION, ERRORS, MATHEMATICAL MODELS, FLIGHT PATHS, SENSITIVITY, COMPUTER PROGRAMMING, MATRICES(MATHEMATICS), MISSION PROFILES (U)
IDENTIFIERS: KALMAN FILTERS (U)

THE PURPOSES OF THE SYNERGISTIC NAVIGATION SYSTEM STUDY ARE: TO DETERMINE THE PORTION OF THEORETICALLY AVAILABLE IMPROVEMENTS WHICH CAN BE REALIZED WHEN PRACTICAL IMPLEMENTATION IS CONSIDERED; TO ASSESS THE COST OF THE GAINS IN TERMS OF COMPUTER EXECUTION TIME AND STORAGE REQUIREMENTS; AND TO RECOMMEND AN OPTIMAL FILTER DESIGN FOR FLIGHT TEST VERIFICATION. HAVING CONCLUDED IN THE PHASE I EFFORT THAT MAJOR NAVIGATION ACCURACY IMPROVEMENTS WERE POSSIBLE THROUGH OPTIMAL DATA PROCESSING TECHNIQUES, IT WAS NECESSARY IN THE PHASE II EFFORT TO EXPLORE MANY AREAS OF UNCERTAINTY. THESE AREAS INCLUDE THE SENSITIVITY OF THE CONCEPT TO UNKNOWN ERROR MAGNITUDES AND DISTRIBUTIONS, TO MANEUVERING FLIGHT PATHS, TO APPROXIMATIONS REQUIRED IN IMPLEMENTING THE CONCEPT, AND TO IMPLICATIONS UPON DATA PROCESSING EQUIPMENT. THE MAJOR CONCLUSION IS THAT A SIGNIFICANT IMPROVEMENT OVER CONVENTIONAL FILTER DESIGN IS MAINTAINED UNDER BROAD VARIATION IN A PRIORI STATISTIC. SEVERAL ADDITIONAL CONCLUSIONS ARE DRAWN REGARDING SYSTEM PERFORMANCE VERSUS FREQUENCY OF POSITION FIXES, THE DEPENDENCE OF SYSTEM PERFORMANCE ON FLIGHT PATH AND THE RELATIVE EFFECTS ON OPEN AND CLOSED LOOP COMPENSATION BY THE FILTER CYCLE UPDATE TIME. A FINAL CONCLUSION WAS THAT CLOSED LOOP COMPENSATION IS PREFERRED, AND THAT A FILTER CYCLE UPDATE TIME OF 30 SECONDS IS SATISFACTORY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 827 804 17/7 1/3
BOEING CO SEATTLE WASH SUPERSONIC TRANSPORT DIV

SUPERSONIC TRANSPORT DEVELOPMENT PROGRAM. PHASE III. BOEING MODEL 2707. COMMUNICATIONS/NAVIGATION/RADAR SUBSYSTEM SPECIFICATION, (U)

DEC 66 399P BARTON,HOWARD G. ;
REPT. NO. D6A10122-1
CONTRACT: FA-SS-66-5

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PARTIAL REVISION OF REPT. NO. D6A10490-1.

DESCRIPTORS: (*JET TRANSPORT PLANES, *SUPERSONIC AIRCRAFT), (*RADIO NAVIGATION, *INERTIAL NAVIGATION), (*COMMUNICATION SYSTEMS, *RADAR EQUIPMENT), VERY HIGH FREQUENCY, MAPPING, HIGH FREQUENCY, COMMUNICATION SATELLITES(ACTIVE), STATIC DISCHARGERS, VOCODERS, CLEAR AIR TURBULENCE, PROTECTIVE TREATMENTS, LIGHTNING, DATA PROCESSING, LOW FREQUENCY, DIRECTION FINDING, DISTANCE MEASURING EQUIPMENT, INSTRUMENTATION, INTERCOMMUNICATION SYSTEMS, WEATHER, TELEVISION EQUIPMENT (U)
IDENTIFIERS: *SUPERSONIC TRANSPORTS (U)

THIS SPECIFICATION DEFINES THE OBJECTIVES, CRITERIA, AND CONFIGURATION, AND ESTABLISHES THE REQUIREMENTS FOR PERFORMANCE, DESIGN, TEST, AND QUALIFICATION OF THE COMMUNICATIONS/NAVIGATION/RADAR SUBSYSTEM FOR THE PROTOTYPE MODEL SUPERSONIC TRANSPORT AIRPLANE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 833 677 17/7 12/1
NAVAL WEAPONS CENTER CHINA LAKE CALIF

SELF-ALIGNMENT OF A GIMBALLESS INERTIAL NAVIGATION SYSTEM. (U)

DESCRIPTIVE NOTE: ALGORITHM STUDY,
MAR 68 28P NEAL,S. R. ;NUFFER,H. D.
;
REPT. NO. NWC-TP-4463
MONITOR: GIDEP 347.00.00.00-X7-55

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, ALGORITHMS), (*GUIDED MISSILES, *ALIGNMENT), LAUNCHING, APPROXIMATION(MATHEMATICS), ERRORS, GUIDED MISSILES, MATRICES(MATHEMATICS), DETECTORS, ATTITUDE CONTROL SYSTEMS, SAMPLING, DIGITAL COMPUTERS (U)
IDENTIFIERS: STRAPPED-DOWN GUIDANCE SYSTEMS (U)

A COMPUTING ALGORITHM FOR THE FIXED-BASE SELF-ALIGNMENT OF A GIMBALLESS INERTIAL NAVIGATION SYSTEM IS DERIVED BY THE APPLICATION OF LINEAR ESTIMATION THEORY. SIMULATION RESULTS INDICATE THAT THE INITIAL DIRECTION COSINE MATRIX CAN BE ALIGNED IN 20 SECONDS WITH NOT MORE THAN 10 ARCSECONDS OF ERROR IN AZIMUTH OR LEVEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 838 749 17/7 1/3
NAVAL AVIONICS FACILITY INDIANAPOLIS IND

DISCUSSION OF VARIOUS ALIGNMENT METHODS. (U)

MAY 64 10P

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, ALIGNMENT), (*NAVAL AIRCRAFT, INERTIAL NAVIGATION), INSTRUMENTATION, FLIGHT INSTRUMENTS, GYRO COMPASSES, TEST METHODS, OPERATION, STABILIZED PLATFORMS, AIRCRAFT CARRIERS (U)

THE DISCUSSION IS CONCERNED WITH THE OPERATIONAL PROCEDURES THAT ARE REQUIRED TO COMPLETELY INITIALIZE AN AIRCRAFT INERTIAL SYSTEM SO THAT IT CAN ACCOMPLISH ITS MISSION AS A WEAPON SYSTEM USING VARIOUS ALIGNMENT METHODS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 848 230 17/7 9/2
NORTRONICS HAWTHORNE CALIF

COST REDUCTION STUDY OF A COMPUTER FOR INERTIAL NAVIGATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUL 67-DEC 67.
MAY 68 301P
REPT. NO. NORT-68-8
CONTRACT: F29600-67-C-0062
MONITOR: AVNI TDR-68-001

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*NAVIGATION COMPUTERS, COSTS), FEASIBILITY STUDIES, EFFECTIVENESS, DESIGN, INTEGRATED CIRCUITS, COMPUTER PROGRAMMING, MODULES(ELECTRONICS), SPARE PARTS, RELIABILITY(ELECTRONICS), TRAINING, PACKAGING, POWER SUPPLIES, COST EFFECTIVENESS, COMPUTER PROGRAMS (U)
IDENTIFIERS: COSTS, REDUCTION (U)

A SIX MONTH STUDY WAS CONDUCTED TO DETERMINE THE FEASIBILITY OF REDUCING THE COST OF THE NDC-1050A, AN EXISTING INERTIAL NAVIGATION COMPUTER. THE GOAL OF THE STUDY WAS TO OBTAIN AT LEAST A ONE-THIRD REDUCTION IN COST. THE OUTCOME OF THE STUDY IS A COMPUTER, DESIGNATED THE NDC-1050D, WHICH FEATURES A MEDIUM SCALE INTEGRATION (MSI) APPROACH IN ITS LOGIC SECTIONS, A LOW COST HYBRID (NDRO/DRO) MEMORY, AN INTEGRATED CONTROL/DISPLAY PANEL, AND A HIGHLY EFFICIENT POWER SUPPLY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 848 285 17/7 15/5
AIR FORCE AVIONICS LAB HOLLOMAN AFB N MEX DETACHMENT 1

COST-OF-OWNERSHIP PHILOSOPHY APPLIED TO INERTIAL NAVIGATION SYSTEMS, (U)

SEP 67 21P LAUBENDORFER,W. J. ;PLANK, R. V. ;DENEZZA,E. J. ;

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT MEETING OF AGARD AD HOC PANEL ON GUIDANCE AND CONTROL (5TH), SYMPOSIUM ON INERTIAL NAVIGATION, OXFORD, (ENGLAND), 21-22 SEP 67.

DESCRIPTORS: (*INERTIAL NAVIGATION, COSTS), (*AIR FORCE EQUIPMENT, COSTS), INSTRUMENTATION, PERFORMANCE(ENGINEERING), RELIABILITY, MAINTAINABILITY, ACCEPTABILITY, AIR FORCE PROCUREMENT (U)

IT IS CONTENTION OF THIS PAPER THAT WHILE PERFORMANCE SHOULD BE GIVEN PRIME EMPHASIS, THE ECONOMICS OF USING INERTIAL NAVIGATION EQUIPMENT SHOULD ALSO BE GIVEN SERIOUS CONSIDERATION. SOME MEMBERS OF THE INDUSTRIAL INERTIAL COMMUNITY NOW ARE CONSIDERING THE USE OF THEIR EQUIPMENT FROM NOT ONLY A PERFORMANCE BUT FROM ALSO A COST TOTALITY ASPECT. FOR MANY YEARS, OVER-SIMPLIFIED EXPRESSIONS WERE APPLIED TO DETERMINE SYSTEM ACCEPTABILITY - ACCEPTABLE OR NON-ACCEPTABLE - WITH LITTLE REGARD TO SYSTEM RELIABILITY. CONSEQUENTLY, WHAT CAN EASILY HAPPEN, AND WHAT HAS HAPPENED IN THE PAST, IS THAT EQUIPMENTS WHICH APPEAR VERY ATTRACTIVE FROM AN INITIAL COST STANDPOINT, CAN REQUIRE SIGNIFICANT FUNDING IN SUPPORT OF OPERATIONAL USE. THIS PAPER SUPPORTS THE NEED FOR A TOTAL PERFORMANCE (INCLUDING RELIABILITY AND MAINTAINABILITY) COST-OF-OWNERSHIP APPROACH TOWARD INERTIAL NAVIGATION SYSTEM DESIGN AND SELECTION. IN ADDITION, A CONCEPT ENTITLED COPE - AN ACRONYM FOR COST-OF-OWNERSHIP AND PERFORMANCE IS PRESENTED, DEFINED AND APPLIED TO INERTIAL NAVIGATION SYSTEM DESIGN AND SELECTION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 848 383 17/7 16/4
NAVAL WEAPONS CENTER CHINA LAKE CALIF

NAVIGATIONAL ERROR ANALYSES FOR A BALLISTIC MISSILE. (U)

DESCRIPTIVE NOTE: TECHNICAL PUBLICATION,
DEC 68 169P NUFFER,HAROLD D. ;
REPT. NO. NWC-TP-4415
PROJ: A-36-533-205/216-1/F009-03-03
MONITOR: GIDEP 347.00.00.00-X7-74

UNCLASSIFIED REPORT

DESCRIPTORS: (*GUIDED MISSILES, *INERTIAL NAVIGATION), ERRORS, INSTRUMENTATION, NUMERICAL ANALYSIS, COMPUTER PROGRAMS, ACCELEROMETERS, GYROSCOPES, CELESTIAL MECHANICS, STABILIZED PLATFORMS (U)
IDENTIFIERS: STRAPPED DOWN GUIDANCE SYSTEMS (U)

NAVIGATIONAL ERRORS FOR TWO BALLISTIC MISSILE NAVIGATIONAL SYSTEMS-ONE GIMBALED AND ONE STRAPPED-DOWN-ARE ANALYZED. EQUATIONS ARE DERIVED FOR STUDYING NAVIGATIONAL ERRORS RESULTING FROM SENSOR ERRORS. NAVIGATIONAL ERRORS AT END OF GUIDANCE (BURNOUT) ARE DETERMINED AND THEN PROPAGATED TO THE TARGET BY ORBIT-SENSITIVITY EQUATIONS. FORTRAN V PROGRAM LISTING FOR EACH SYSTEM ARE PRESENTED IN APPENDIXES A AND B, RESPECTIVELY. FLOW CHARTS FOR BOTH SYSTEMS ARE GIVEN IN APPENDIX C. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 849 450 17/7 13/10.1 17/8
INSTITUTE OF MODERN LANGUAGES INC WASHINGTON D C
TRANSLATION AND INTERPRETATION DIV

MEANS OF NAVIGATION OF NUCLEAR-POWERED SUBMARINES, (U)

JAN 69 140P KHOLOSTOV,D. I. ;
CONTRACT: N62306-69-M-0748
MONITOR: NOO CONTRACT TRANS-15

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *NUCLEAR POWERED SHIPS), (*LORAN, SUBMARINES), NAVIGATION COMPUTERS, SUBMARINE PERISCOPES, RADIO NAVIGATION, SONAR, CELESTIAL NAVIGATION, STAR TRACKERS, POSITION FINDING, NAVIGATION SATELLITES, ERRORS, CORRECTIONS, FIRE CONTROL SYSTEMS, ANALOG COMPUTERS, ECHO RANGING, SEXTANTS, BALLISTIC MISSILE SUBMARINES, UNITED STATES, REVIEWS, USSR (U)
IDENTIFIERS: SINS, STARDAC, TRANSLATIONS (U)

CONTENTS: ASTRONAVIGATIONAL MEANS FOR CORRECTING SHIP INERTIAL NAVIGATION SYSTEMS; RADIO ENGINEERING CORRECTION EQUIPMENT FOR SHIPS' INERTIAL NAVIGATION SYSTEMS; NAVIGATION HYDROACOUSTIC AND TELEVISION MEANS OF OBSERVATION; MEANS TO INSURE NAVIGATION; AUTOMATED SYSTEMS FOR ATOMIC SUBMARINE MANEUVER CONTROL; AUTOMATED WEAPONS CONTROL SYSTEM; PROSPECTS FOR THE DEVELOPMENT OF ATOMIC SUBMARINE NAVIGATION MEANS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 851 067 17/7
ANALYTIC SCIENCES CORP READING MASS

THE KALMAN FILTER IN TRANSFER ALIGNMENT OF AIRBORNE INERTIAL GUIDANCE SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
OCT 68 45P SUTHERLAND,ARTHUR A. , JR.;
GELB,ARTHUR ;
CONTRACT: N60530-67-C-1052
PROJ: A36533205/2161/F0090303
MONITOR: NWC,GIDEP TP-4653,347.00.00.00-X7-83

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *STABILIZED PLATFORMS), INFORMATION THEORY, CORRECTIONS, INERTIAL GUIDANCE, AIRBORNE, MANEUVERABILITY, CALIBRATION, ALIGNMENT (U)
IDENTIFIERS: KALMAN FILTERS (U)

THE PROBLEM OF TRANSFERRING ALIGNMENT BETWEEN TWO AIRBORNE INERTIAL NAVIGATOR PLATFORMS IS TREATED USING THE KALMAN FILTER APPROACH. THE IMPORTANT PARAMETERS ARE IDENTIFIED AND EXERCISED OVER A REASONABLE RANGE TO ESTABLISH ACCURACY TRADE-OFFS. SUGGESTIONS ARE PROVIDED FOR IMPROVING THE ACCURACY OF KALMAN FILTER TRANSFER ALIGNMENT THROUGH MORE COMPLEX MANEUVERS OF THE CARRYING AIRCRAFT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 856 793 22/4 17/7 9/2
MCDONNELL DOUGLAS CORP ST LOUIS MO

OPERATION AND SERVICE MANUAL FOR COMPUTER EFC TEST CONSOLE 52E270023, VOLUME III, PART I. (U)

APR 68 446P
REPT. NO. B5-10-64-VOL-3-PT-1
CONTRACT: F04695-67-C-0023

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 3, PART 2, SECTION 4, AD-856 794.

DESCRIPTORS: (*MANNED SPACECRAFT, INERTIAL NAVIGATION), (*SPACE STATIONS, INERTIAL NAVIGATION), (*INERTIAL NAVIGATION, TEST EQUIPMENT), INSTRUCTION MANUALS, INSTRUMENTATION, NAVIGATION COMPUTERS (U)
IDENTIFIERS: GEMINI, *GEMINI B PROJECT, *MANNED ORBITING LABORATORIES, *MOL(MANNED ORBITING LABORATORIES) (U)

THE PURPOSE OF THIS VOLUME IS TO FAMILIARIZE PERSONNEL WITH THE OPERATION AND SERVICE INSTRUCTIONS FOR THE INERTIAL GUIDANCE SYSTEM (IGS) BENCH TEST EQUIPMENT (BTE), 52E270023-143 AND THE COMPUTER BTE DOLLY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 856 794 22/4 17/7 9/2
MCDONNELL DOUGLAS CORP ST LOUIS MO

OPERATION AND SERVICE MANUAL FOR COMPUTER EFC TEST CONSOLE 52E270023, VOLUME III, PART II, SECTION IV, LIST OF SUBASSEMBLIES AND DIAGRAMS. (U)

APR 68 362P
REPT. NO. B5-10-64-VOL-3-PT-2-SECT-4
CONTRACT: F04695-67-C-0023

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 3, PART 1, AD-856 793.

DESCRIPTORS: (*MANNED SPACECRAFT, INERTIAL NAVIGATION), (*SPACE STATIONS, INERTIAL NAVIGATION), (*INERTIAL NAVIGATION, TEST EQUIPMENT), INSTRUCTION MANUALS, INSTRUMENTATION, NAVIGATION COMPUTERS, DIAGRAMS (U)
IDENTIFIERS: GEMINI, *GEMINI B PROJECT, *MANNED ORBITING LABORATORIES, *MOL(MANNED ORBITING LABORATORIES) (U)

THIS VOLUME CONTAINS A LIST OF SUBASSEMBLIES AND DIAGRAMS FOR THE BTE 52E270023-143. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 872 255 17/7
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

FLIGHT TEST REPORT OF AN/ASN-82 INERTIAL NAVIGATION SYSTEM, (U)

MAR 70 105P CLARK,RAYMOND ;
REPT. NO. ECOM-3268
PROJ: DA-1-H-162202-A-219
TASK: 1-H-162202-A-21901

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, FLIGHT TESTING), STABILIZED PLATFORMS, GYRO COMPASSES, NAVIGATION COMPUTERS, DIGITAL DIFFERENTIAL ANALYZERS, MAINTAINABILITY, TEST METHODS, RELIABILITY(ELECTRONICS), POWER SUPPLIES (U)
IDENTIFIERS: AN/ASN-82, FLIGHT REFERENCE STABILIZATION SYSTEMS, FRSS(FLIGHT REFERENCE STABILIZATION SYSTEMS)(U)

A LIGHTWEIGHT, LOW-COST R AND D AIRCRAFT INERTIAL NAVIGATION SYSTEM IS EVALUATED FOR USE IN ARMY AIRCRAFT. A BRIEF DESCRIPTION OF THE SYSTEM IS FOLLOWED BY A SUMMARY OF THE METHODS OF LABORATORY, TRUCK, AND FLIGHT TESTING EMPLOYED. TEST RESULTS ARE PRESENTED AND SHOW THAT THE SYSTEM MEETS THE DESIGN GOALS OF 2 TO 4 NAUTICAL MILES/HOUR. PROBLEM AREAS UNCOVERED DURING THE TESTS ARE DISCUSSED IN DETAIL AND AREAS OF SUGGESTED FUTURE EFFORT ARE OUTLINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 887 569 17/7 1/3
TELEDYNE SYSTEMS CO NORTHRIDGE CALIF

FLIGHT REFERENCE AND STABILIZATION SYSTEM (FRSS). (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 64-15 MAR 71,
AUG 71 72P STUDEBAKER,JOHN F. ;
CONTRACT: AF 33(615)-1885
PROJ: AF-8222
TASK: 822202
MONITOR: AFFDL TR-71-42

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, RELIABILITY), (*HELICOPTERS, NAVIGATIONAL AIDS), GYRO COMPASSES, ACCELEROMETERS, GIMBALS, SERVOMECHANISMS, NAVIGATION COMPUTERS, STATISTICAL DATA, COSTS, FLIGHT TESTING (U)
IDENTIFIERS: FLIGHT REFERENCE AND STABILIZATION SYSTEMS, FRSS(FLIGHT REFERENCE AND STABILIZATION SYSTEMS) (U)

A COMPLETE FLIGHT REFERENCE AND STABILIZATION SYSTEM WAS DESIGNED. FOUR UNITS WERE FABRICATED AND TESTED. SEVERAL TEST PROGRAMS WERE CONDUCTED. IN-HOUSE LABORATORY AND FLIGHT TESTS DEMONSTRATED PERFORMANCE IN THE 2 TO 4 NMPH RANGE. TESTS WERE CONDUCTED BY THE BRITISH AIRCRAFT COMPANY AND THE ROYAL NAVY. ENGINEERING EVALUATION TESTS WERE CONDUCTED AT HOLLOMAN AIR FORCE BASE, CENTRAL INERTIAL GUIDANCE TEST FACILITY. VALIDATION TESTS WERE INITIATED AND TERMINATED BEFORE COMPLETION AT HOLLOMAN AIR FORCE BASE, INERTIAL GUIDANCE TEST FACILITY. A PRODUCTION COST ESTIMATE WAS MADE FOR 1000 UNITS BASED ON THE COST OF THE INITIAL ENGINEERING MODELS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 890 488 17/7
NORTHROP CORP NORWOOD MASS PRECISION PRODUCTS DEPT

A FLIGHTWORTHY BREADBOARD SYSTEM FOR COMPUTING STABILITY, ATTITUDE, AND HEADING FROM BODY-MOUNTED SENSORS. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAR 69-DEC 70,
OCT 71 108P DERUYCK,AURALE R. ;
CONTRACT: F33615-69-C-1453
PROJ: AF-8222
TASK: 822212
MONITOR: AFFDL TR-71-130

UNCLASSIFIED REPORT

DESCRIPTORS: (*GYROSCOPES, DESIGN), (*INERTIAL NAVIGATION, GYROSCOPES), DETECTORS, STABILIZATION SYSTEMS, STABILIZED PLATFORMS, INTEGRATORS, ACCELERATION (U)
IDENTIFIERS: STRAPPED DOWN NAVIGATION SYSTEMS (U)

A THREE-YEAR DEVELOPMENT EFFORT HAS CULMINATED IN A FLIGHTWORTHY BREADBOARD MODEL OF A 'STRAPDOWN' FLIGHT-ATTITUDE AND HEADING-REFERENCE SYSTEM WHICH IS FUNCTIONALLY EQUIVALENT TO A SLAVED, FOUR-GIMBAL (NO-GIMBAL-LOCK), ALL-ATTITUDE PLATFORM. STRAPPED-DOWN RATE GYROS, LINEAR ACCELEROMETERS, AND MAGNETIC SENSOS PROVIDE THE THREE-AXIS, BODY-REFERENCED, INERTIAL AND MAGNETIC INFORMATION FROM WHICH A UNIQUE, SOLID-STATE, TIME-SHARED COORDINATE TRANSFORMER DERIVES THE ANGULAR RATE, LINEAR ACCELERATION, AND MAGNETIC FIELD COMPONENT SIGNALS WITH RESPECT TO THE CONVENTIONAL, EARTH-REFERENCED AZIMUTH, ELEVATION AND BANK AXES. THE EULERIAN ANGULAR RATE SIGNALS ARE OPERATED UPON BY INTEGRATING AND INTERFACING FUNCTIONS WHICH PROVIDE THE DESIRED ATTITUDE ANGLE OUTPUT INFORMATION IN TWO SIGNAL FORMATS: (1) A DC ANALOG FORMAT FOR FEEDBACK TO THE RESOLVERS IN THE COORDINATE TRANSFORMATION ARRAYS, AND (2) A THREE-WIRE SYNCHRO FORMAT TO DRIVE A CONVENTIONAL, BALL-TYPE, AIRCRAFT ATTITUDE INDICATOR. IN ADDITION, HEADING AND VERTICALITY REFERENCE SIGNALS ARE DERIVED FROM THE SENSED ACCELERATION AND MAGNETIC FIELD INFORMATION, AND THESE SIGNALS ARE USED TO SLAVE THE ATTITUDE ANGLE INTEGRATORS TO THE LOCAL VERTICAL AND MAGNETIC NORTH. LOGIC AND STORAGE FUNCTIONS ARE ALSO PROVIDED FOR AUTOMATICALLY CUTTING OUT THE ACCELERATION CONTROL OF THE VERTICALITY SLAVING FUNCTION UNDER CERTAIN ACCELERATION CONDITIONS (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 891 992 17/7 12/1
NAVAL AVIONICS FACILITY INDIANAPOLIS IND

PERFORMANCE SENSITIVITY ANALYSIS OF A KALMAN FILTER USING ADJOINT FUNCTIONS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FEB 72 61P CLARK,RONALD R. ;
REPT. NO. NAFI-TR-1767
PROJ: A360-5537/231-B/1F08-234-602

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), (*ADAPTIVE CONTROL SYSTEMS, MATHEMATICAL MODELS), PARTIAL DIFFERENTIAL EQUATIONS, MATRICES(MATHEMATICS), SENSITIVITY, NUMERICAL ANALYSIS, PERTURBATION THEORY (U)
IDENTIFIERS: AUTOMATIC, CONTROL, *CONTROL THEORY, *KALMAN FILTERS, SENSITIVITY ANALYSIS (U)

A METHOD IS PROPOSED FOR DETERMINING THE PERFORMANCE SENSITIVITY OF A KALMAN FILTER WITH RESPECT TO SMALL VARIATIONS IN THE PARAMETERS OF BOTH A 'REAL WORLD' REFERENCE MODEL AND AN ASSUMED FILTER MODEL. IT IS SHOWN THAT A SIZABLE REDUCTION IN COMPUTATIONAL EFFORT MAY BE ACHIEVED USING THE ADJOINT METHOD PRESENTED HERE TO CALCULATE THE LOCAL PERFORMANCE SENSITIVITIES FOR A LARGE NUMBER OF PARAMETERS RATHER THAN USING MORE DIRECT METHODS. IN THE REPORT, EQUATIONS FOR THE COVARIANCE FUNCTIONS OF THE COMBINED FILTER AND REFERENCE SYSTEM ARE FOUND AND ADJOINT EQUATIONS CORRESPONDING TO THE LINEAR PERTURBATION EQUATIONS OF THE SYSTEM COVARIANCE FUNCTIONS DETERMINED. AN EXPRESSION IS FOUND FOR THE CHANGE IN A PERFORMANCE INDEX IN TERMS OF THE ADJOINT FUNCTIONS AND SMALL, POSSIBLY TIME-VARYING, CHANGES IN THE PARAMETERS OF THE COMBINED SYSTEM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 900 046 9/2 17/7
NORTHROP CORP HAWTHORNE CALIF ELECTRONICS DIV

MULTILATERATION SOFTWARE DEVELOPMENT. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUL 71-FEB 72,
MAY 72 326P WEINBERG,JOHN D. ;KNOBBE,
EDWARD J. ;KOPITZKE,EDMUND R. ;CALBI,VITO ;
BITTNER,M. ;
REPT. NO. NORT-72-37
CONTRACT: F33615-71-C-1936
PROJ: AF-5201
TASK: 520119
MONITOR: AFAL TR-72-80

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH
MAGNAVOX RESEARCH LAB., TORRANCE, CALIF.
INCLUDES ENVELOPE WITH PROCESSOR MAP.

DESCRIPTORS: (*COMPUTER PROGRAMMING, *INERTIAL
NAVIGATION), (*RADIO NAVIGATION, *DATA PROCESSING),
(*NAVIGATION, ALGORITHMS), CONTROL SYSTEMS, INTERFACES,
INTEGRATED SYSTEMS, MULTIPLE OPERATION,
MATRICES(MATHEMATICS), INTEGRAL EQUATIONS, PLOTTING
BOARDS, POSITION FINDING, ALIGNMENT, ALTIMETERS,
TRANSMITTER RECEIVERS, FLOW CHARTING (U)
IDENTIFIERS: AVIONICS, *COMMON SOFTWARE, COMPUTER
PROGRAMS, INERTIAL MEASUREMENT UNITS, KALMAN
FILTERING, MODULES(MATHEMATICS), MULTILATERATION,
PREPROCESSORS, SIGNAL PROCESSING (U)

THIS REPORT DOCUMENTS THE INITIAL RESULTS OF A SOFTWARE DEVELOPMENT DIRECTED AT IDENTIFYING A COMMON NAVIGATION SYSTEM DATA PROCESSOR WHICH WOULD BE MORE OR LESS EQUALLY APPLICABLE--WITH APPROPRIATE TAILORING--TO ANY RADIO-INERTIAL, RADIO-AUTONOMOUS, RADIO-DEAD RECKONING, OR BAROMETRIC-INERTIAL NAVIGATION SYSTEM. A FUNCTIONAL PROCESSOR HAS BEEN DEFINED WHICH IS POTENTIALLY APPLICABLE FOR USE FOR ANY OF A WIDE CLASS OF MILITARY AND CIVIL MISSIONS, AND RADIO AND INERTIAL EQUIPMENT TYPES. TO ACHIEVE THIS GENERALITY AND FLEXIBILITY, ALGORITHMS WERE SELECTED PRIMARILY ON THE BASIS OF THEIR (1) SYSTEM-TO-SYSTEM GENERALITY, (2) MUTUAL COMMONALITY, (3) FUNCTIONAL MODULARITY AND (4) COMPACTNESS OF EXPRESSION. THESE QUALITIES WILL FACILITATE THE EVENTUAL REALIZATION OF EASILY PROGRAMMABLE, INTERCHANGEABLY COMMON, NAVIGATION SYSTEM SOFTWARE UNITS.

(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 902 091 17/7
AUTONETICS ANAHEIM CALIF

MICRO-NAVIGATOR (MICRON) PHASE 1A.
VOLUME I. TECHNICAL REPORT. (U)

DESCRIPTIVE NOTE: FINAL REPT. APR 71-MAY 72,
JUL 72 479P EBERT,WALTER A. ;ANDREWS,
A. P. ;BOLTINGHOUSE,J. C. ;BUSSE,D. W. ;
BRASHER,T. F. ;
REPT. NO. C72-492/201
CONTRACT: F33615-71-C-1398
PROJ: AF-666A
MONITOR: AFAL TR-72-182-VOL-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 2, AD-902 092L.

DESCRIPTORS: (*INERTIAL NAVIGATION, GYROSCOPES), ELECTRODES, CIRCULAR ERROR PROBABLE, MODULATION, DRIFT, ERRORS, VELOCITY, COSTS, SIMULATORS, CALIBRATION, TORQUE, ELECTROSTATICS, SPECIFICATIONS, ENVIRONMENTAL TESTS (U)
IDENTIFIERS: ELECTROSTATIC GYROSCOPES, *MICRONAVIGATORS, READOUTS, STRAPPED DOWN GUIDANCE SYSTEMS (U)

MICRO NAVIGATOR (MICRON) WILL BE A LOW COST, STRAPDOWN, INERTIAL NAVIGATION SYSTEM. THIS SYSTEM IS BASED ON THE MICRO ELECTROSTATIC GYRO (MESG). THE MESG IS A SMALL TWO-AXIS INSTRUMENT THAT FEATURES A WHOLE ANGLE READOUT. IT CONTAINS ONLY ONE MOVING PART, A SOLID SPHERICAL ROTOR, ONE CENTIMETER IN DIAMETER. THE ROTOR IS ELECTROSTATICALLY SUSPENDED BETWEEN ELECTRODES INSIDE A CERAMIC ENVELOPE. THE MICRON PHASE 1A PROGRAM WAS A MAJOR STEP IN THE DEVELOPMENT OF MICRON. THE OBJECTIVES OF THIS PROGRAM WERE: (1) TO DESIGN, FABRICATE AND TEST THE MESG THAT WILL BE USED IN THE EXPERIMENTAL DEMONSTRATION MODEL OF THE MICRON SYSTEM (EDS), AND (2) TO PREPARE A PRELIMINARY DESIGN AND A MODEL SPECIFICATION FOR THE EDS. ENVIRONMENTAL AND PERFORMANCE EVALUATION TESTS WERE CONDUCTED WITH MESG'S OF THE DESIGN THAT EXISTED AT THE BEGINNING OF THE PROGRAM. THESE TESTS INCLUDED TEMPERATURE SENSITIVITY, COLD SOAK, VIBRATION, SHOCK, AND ANGULAR RATE TESTS. AREAS REQUIRING IMPROVEMENT WERE IDENTIFIED. DESIGN CHANGES, INCLUDING A STIFFER SUSPENSION SERVO, WERE MADE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 902 092 17/7 9/2
AUTONETICS ANAHEIM CALIF

MICRO-NAVIGATOR (MICRON) PHASE 1A.
VOLUME II. N57A MODEL SPECIFICATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 71-MAY 72,
JUL 72 116P BRASHER, THOMAS F. ;
REPT. NO. C71-672/201-VOL-2
CONTRACT: F33615-71-C-1398
PROJ: AF-666A
MONITOR: AFAL TR-72-182-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 3, AD-521 680L.

DESCRIPTORS: (*INERTIAL NAVIGATION, GYROSCOPES), DIGITAL COMPUTERS, DISPLAY SYSTEMS, ERRORS, CONTROL PANELS, CIRCULAR ERROR PROBABLE, INTERFACES, ELECTROSTATICS, COMPUTER PROGRAMS, ACCELEROMETERS, ELECTRODES, SPECIFICATIONS, FLOW CHARTING, SPINNING(MOTION), INPUT OUTPUT DEVICES, DRIFT (U)
IDENTIFIERS: INERTIAL MEASURMENT UNITS, *MICRONAVIGATORS, STRAPPED DOWN GUIDANCE SYSTEMS (U)

THIS MODEL SPECIFICATION DEFINES AN INERTIAL NAVIGATION SYSTEM DESIGNATED THE N57A. IT INCLUDES A STRAPDOWN INERTIAL MEASURING UNIT (IMU), A DIGITAL COMPUTER, AND A CONTROL AND DISPLAY PANEL. THIS SYSTEM WILL BE USED TO DEMONSTRATE THE PERFORMANCE CAPABILITY OF THE MICRON CONCEPT. THE N57A WILL INCORPORATE ONLY PART OF THE ADVANCED PACKAGING TECHNIQUES THAT WILL BE USED ON THE ULTIMATE MICRON SYSTEM AND THEREFORE THE N57A WILL BE LARGER. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 902 093 17/7
AUTONETICS ANAHEIM CALIF

MICRO-NAVIGATOR (MICRON) PHASE 1A.
VOLUME IV. APPENDICES B THROUGH U. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 71-MAY 72,
JUL 72 238P EBERT,WALTER A. ;ANDREWS,
A. P. ;BOLTINGHOUSE,J. C. ;BUSSE,D. W. ;
BRASHER,T. F. ;
REPT. NO. C71-672/201-VOL-4
CONTRACT: F33615-71-C-1398
PROJ: AF-666A
MONITOR: AFAL TR-72-182-VOL-4

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 1, AD-902 091L.

DESCRIPTORS: (*INERTIAL NAVIGATION, GYROSCOPES), ELECTROSTATICS, ERRORS, ALIGNMENT, CIRCULAR ERROR PROBABLE, BERYLLIUM, DISPLAY SYSTEMS, CONTROL SYSTEMS, VELOCITY, PROPAGATION, SPINNING(MOTION), CALIBRATION, ACCELEROMETERS, EQUATIONS, SPECIFICATIONS, DRIFT, THERMAL PROPERTIES, NOISE, DEMODULATORS, GAIN, TORQUE(U)
IDENTIFIERS: ELECTROSTATIC GYROSCOPES, *MICRONAVIGATORS, READOUTS, ROTORS, STRAPPED DOWN GUIDANCE SYSTEMS (U)

THE 20 APPENDICES IN THIS VOLUME SUPPLEMENT VOLUME 1. THE MAJOR APPENDICES ARE APPENDIX B, NAVIGATION AND ALIGNMENT PROGRAM REQUIREMENTS AND APPENDIX C, ERROR BUDGET. THE PROGRAM REQUIREMENTS DEFINE MODES OF OPERATION, MECHANIZATION EQUATIONS, AND INPUT/OUTPUT PROCESSING. THE ERROR BUDGET CONTAINS AN ERROR MODEL AND ERROR ALLOCATIONS TO MEET THE PERFORMANCE GOAL OF ONE NM/HR CEP RATE. OTHER APPENDICES INCLUDE ERROR ANALYSES, STUDIES OF THE PROPERTIES OF BERYLLIUM ROTORS, AND TEST DATA. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 908 193 17/7
AUTONETICS ANAHEIM CALIF

OPTIMUM RESET OF SHIP'S INERTIAL NAVIGATION SYSTEM, (U)

65 21P BONA,B. E. ;SMAY,R. J. ;
REPT. NO. X4-1981/3111
MONITOR: GIDEP 347.00.00.00-C1-184

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, SHIPS), STAR TRACKERS, CELESTIAL NAVIGATION, LORAN, AZIMUTH, OPTIMIZATION, ERRORS, SIMULATION, LINEAR SYSTEMS (U)
IDENTIFIERS: DECCA NAVIGATION, LINEAR FILTERS, LORAN C, *SINS (U)

OPTIMUM LINEAR FILTER AND CONTROL THEORY IS APPLIED TO THE PRACTICAL PROBLEM OF SUPPLEMENTING AN INERTIAL NAVIGATION SYSTEM WITH DISCRETE REFERENCE INFORMATION. THE INFORMATION TAKES THE FORM OF POSITION OBTAINED FROM LORAN C, OR DECCA FOR EXAMPLE, AND OCCASIONAL AZIMUTH FIXES OBTAINED FROM STAR SIGHTINGS. IN PARTICULAR, OPTIMUM USE OF THIS INFORMATION IS DISCUSSED FOR THE SHIP'S INERTIAL NAVIGATION SYSTEM (SINS) INSTALLATIONS INTENDED FOR MISSILE CARRYING SUBMARINES AND WARSHIPS. A MODEL REPRESENTATIVE OF THE SINS DYNAMICS IS FORMULATED APPROPRIATE FOR APPLICATION OF OPTIMUM FILTER AND CONTROL THEORY. INTERPRETATION OF THE OPTIMUM CONTROL DICTATED IN PART BY THE AUGMENTED SINS MODEL IS DISCUSSED. SIMULATION STUDIES THAT SHOW THE RELATIVE TRANSIENT BEHAVIOR AND THE STABILIZING EFFECT OF THE CLOSED-LOOP FILTER AND CONTROL PROCESS ARE ALSO PRESENTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 20M07

AD- 909 490 17/7 15/5
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

A DISCUSSION OF MEASURES OF FIGHTER AIRCRAFT INERTIAL NAVIGATION SYSTEM POSITION ACCURACY AND A SUGGESTION FOR FIELD MAINTENANCE REJECTION CRITERIA. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
MAY 71 30P GENET,RUSSELL M. ;
REPT. NO. AGMC-XMP-36

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, *MAINTENANCE), TERMINAL GUIDANCE, TEST METHODS, POSITION FINDING, ACCURACY, ACCEPTABILITY, MISS DISTANCE, CIRCULAR ERROR PROBABLE, GYROSCOPES, JET FIGHTERS, COSTS, ECONOMICS (U)
IDENTIFIERS: F-4 AIRCRAFT (U)

THE EVOLUTION AND USES OF DIFFERENT MEASURES OF THE POSITION ACCURACIES OF FIGHTER AIRCRAFT INERTIAL NAVIGATION SYSTEMS ARE DISCUSSED FROM AN ELEMENTARY STATISTICAL VIEWPOINT. THIS STATISTICAL VIEWPOINT IS THEN APPLIED TO THE PROBLEM OF DETERMINING WHEN AN INERTIAL NAVIGATION SYSTEM SHOULD BE REJECTED BY THE FIELD USER AND SENT TO A CENTRAL DEPOT FOR REPAIR. THE CASE WHERE AN INERTIAL NAVIGATION SYSTEM IS IMPROPERLY OPERATING DUE TO A FIELD ADJUSTABLE GYRO BIAS IS ALSO COVERED, AND A STATISTICAL METHOD FOR SEPARATING THESE CASES FROM 'INCURABLE DRIFTER' CASES REQUIRING DEPOT MAINTENANCE IS GIVEN. FINALLY, A NEW DEFINITION FOR SPECIFYING THE ACCURACY OF AIRCRAFT INERTIAL NAVIGATION SYSTEMS IS GIVEN THAT MAY PROMOTE BETTER UNDERSTANDING BETWEEN GUIDANCE SYSTEM USERS AND DEVELOPERS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 909 512 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

GYROSCOPE MEASUREMENT AND CLASSIFICATION: A PURELY EMPIRICAL APPROACH FOR APPLICATION TO THE USE/REPAIR CYCLE. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
SEP 69 18P GENET,RUSSELL M. ;
REPT. NO. AGMC-XMP-7

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED TO THE INST. OF ELECTRICAL AND ELECTRONIC ENGINEERS GUIDANCE STANDARDS COMMITTEE, 16 SEP 69.

DESCRIPTORS: (*GYROSCOPES, MAINTENANCE), (*INERTIAL NAVIGATION, MAINTENANCE), TEST METHODS, CLASSIFICATION, OPTIMIZATION, STATISTICAL TESTS (U)

THE PAPER DISCUSSES THE MAJOR DIFFERENCES BETWEEN INERTIAL INSTRUMENT MEASUREMENTS MADE DURING RESEARCH AND DEVELOPMENT, AND THOSE MADE DURING REPAIR ONCE THE INSTRUMENT ENTERS FIELD USE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 909 620 17/7 15/5
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

AN INTRODUCTION TO THE THEORY AND IMPROVEMENT OF MULTI-LEVEL TESTS IN REPAIR PROCESSES. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 72 49P GENET,RUSSELL M. ;
REPT. NO. AGMC-XMP-43

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, MAINTENANCE), (*REPLACEMENT THEORY, SPARE PARTS), (*OBSOLESCENCE THEORY, INERTIAL NAVIGATION), MANAGEMENT PLANNING AND CONTROL, CHECKOUT PROCEDURES, ACCEPTABILITY, PERFORMANCE(ENGINEERING), FAILURE, FAILURE(ELECTRONICS), TEST METHODS, TESTS, TEST EQUIPMENT, DECISION MAKING, COST EFFECTIVENESS, LOGISTICS, MAINTENANCE PERSONNEL, CALIBRATION, ECONOMICS, ANALYSIS OF VARIANCE, THEORY (U)

THE THEORY OF TESTS AS USED IN A MULTI-LEVEL REPAIR PROCESS IS DISCUSSED, AND PROCEDURES FOR REVIEWING AND IMPROVING TESTS ARE REVIEWED. THE APPROACHES SUGGESTED ARE PRIMARILY APPLICABLE TO ITEMS WHERE WEAR OUT IS NOT THE PREDOMINANT FAILURE MODE, AND THE BASIC MAINTENANCE APPROACH IS THE ISOLATION AND REPLACEMENT OF FAILED PARTS RATHER THAN COMPLETE OVERHAUL. THE THEORY WAS DEVELOPED IN CONJUNCTION WITH TEST IMPROVEMENT EFFORTS AT THE AEROSPACE GUIDANCE AND METROLOGY CENTER IN NEWARK, OHIO WHERE INERTIAL GUIDANCE SYSTEMS RECEIVE DEPOT REPAIR. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 911 088 17/7
MASSACHUSETTS INST OF TECH CAMBRIDGE CHARLES STARK DRAPER LAB

ADVANCED INERTIAL TECHNOLOGIES. VOLUME 1. (U)

DESCRIPTIVE NOTE: ANNUAL TECHNICAL REPT. 16 FEB 72-16 FEB 73,
MAY 73 179P
REPT. NO. R-748
CONTRACT: F33615-72-C-1335
PROJ: AF-6095
TASK: 609502
MONITOR: AFAL TR-73-124-VOL-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 2, REPT. NO. R-820, AD-B000 382L.

DESCRIPTORS: (*INERTIAL NAVIGATION, INSTRUMENTATION), GAS BEARINGS, GYROSCOPES, SERVOMECHANISMS, PHASE LOCKED SYSTEMS, ANALOG-TO-DIGITAL CONVERTERS, DIGITAL TO ANALOG CONVERTERS, DIGITAL SYSTEMS, INTERFACES, PULSE DURATION MODULATION, MODULATORS, TRANSFORMATIONS(MATHEMATICS), SPUTTERING, DEPOSITION, ETCHING, RADAR, IMAGE MOTION COMPENSATION, PLANNING (U)
IDENTIFIERS: AVIONICS, HYPHA COMPUTATIONS, MOTION COMPENSATION, PHASE-TO-DIGITAL CONVERTERS, SIGNAL PROCESSING, SINE COSINE GENERATORS (U)

THIS REPORT DESCRIBES A FIRST-YEAR EXPLORATORY DEVELOPMENT PROGRAM OF STUDY, DESIGN, FABRICATION, AND TEST OF ADVANCED INERTIAL SENSING INSTURMENT TECHNOLOGY AND OTHER NAVIGATION SYSTEM TECHNOLOGY. ACTIVITIES COVERED INCLUDE: (1) RESEARCH IN SPIN-AXIS GAS AND BALL BEARINGS, SPUTTER-ETCH AND SPUTTER-DEPOSITION TECHNIQUES, AND BALL-RETAINER MATERIALS AND PROCESSING; (2) INVESTIGATION OF NEW TECHNIQUES FOR SIGNAL PROCESSING AND CONVERSION WHICH INCLUDE HYPHA PHASE-LOCKED-LOOP PROCESSING AND THE USE OF A MICROPROCESSOR TO PERFORM ATTITUDE TRANSFORMATIONS; AND (3) ANALYSIS OF THE PROBLEM OF RADAR MOTION COMPENSATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 913 719 17/7 9/5 9/1 1/4
BELL AEROSPACE CO BUFFALO N Y

DEVELOPMENT OF UNCONVENTIONAL GYRO (NUTATRON TECHNIQUE) FOR TACTICAL AIRCRAFT INERTIAL SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL REPT. OCT 70-MAR 73, SEP 73 208P HOFMEYER,GILES M. ;METZGER, ERNEST H. ;
REPT. NO. 6006-950005
CONTRACT: F33615-71-C-1092, F33615-72-C-1137
PROJ: AF-6095
TASK: 609501
MONITOR: AFAL TR-73-312

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, JET FIGHTERS), (*GYROSCOPES, DRIFT), DETECTORS, INERTIAL GUIDANCE, INERTIA, FEEDBACK, BALL BEARINGS, ELECTRONIC EQUIPMENT, THERMAL STABILITY, INSTRUMENTATION, CORRELATORS, PHASE DETECTORS, SENSITIVITY, PERFORMANCE(ENGINEERING), SYNCHROS, ALIGNMENT, TORQUE, COILS, AUTOMATIC, CHECKOUT EQUIPMENT, AIRBORNE, ERRORS, ACCURACY, GIMBALS, PRECESSION (U)
IDENTIFIERS: AVIONICS (U)

THIS REPORT COVERS THE LATEST PHASE OF THE NUTATRON ANGULAR RATE SENSOR DEVELOPMENT EFFORT, CULMINATING IN THE DELIVERY OF TWO PROTOTYPE SENSOR AND AN ELECTRONIC TEST SET TO THE U.S. AIR FORCE CENTRAL INERTIAL GUIDANCE TEST FACILITY (CIGTF) AT HOLLOMAN AFB. THE OBJECTIVES OF THE NUTATRON PROGRAM IS TO LEAD TO ANGULAR RATE SENSOR FOR TACTICAL FIGHTER NAVIGATION SYSTEMS, OFFERING FAST REACTION FROM A COLD START, LOW TEMPERATURE COEFFICIENTS AND GOOD LONG TERM STABILITY. THE NUTATRON CONCEPT FEATURES AN AUTOMATIC DRIFT COMPENSATION TECHNIQUE, ELIMINATING THE REQUIREMENT FOR HIGH TOLERANCE, HIGHLY STABLE PARTS AND MATERIALS. THE REPORT TABULATES THE ATTAINED PERFORMANCE PARAMETERS, DISCUSSES THE RESULTS AND UNDERLYING REMAINING ERROR MECHANISMS AND CONCLUDES IN RECOMMENDATIONS TO FURTHER IMPROVE PERFORMANCE. THE ELECTROMECHANICAL AND ELECTRONIC MODIFICATIONS MADE UNDER THIS PHASE ARE DISCUSSED AND THEIR IMPACT ON PERFORMANCE DESCRIBED. REPORTS AFAL-TR-65-170, AFAL-TR-67-54, AND AFAL-TR-69-76, GIVE THE RESULTS OF THE PREVIOUS EFFORTS OF THIS UNCONVENTIONAL ANGULAR RATE SENSOR (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 916 344 17/7 17/3 1/4
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

FLIGHT TEST REPORT OF AN/ASN-114 INERTIAL NAVIGATION SYSTEM. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
DEC 73 28P CLARK,RAYMOND F. ;
REPT. NO. ECOM-4183
PROJ: DA-1-X-163207-DB-96
TASK: 1-X-163207-DB-9604

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, FLIGHT TESTING), (*DIRECTION FINDING,ACCURACY), AVIONICS, LIGHT WEIGHT, LOW COSTS, ERRORS, FLIGHT PATHS, CARGO AIRCRAFT, PITCH(MOTION), ROLL, DRIFT, GROUND SPEED, ATTITUDE INDICATORS, ACCELEROMETERS, GYROSCOPES, STABILIZED PLATFORMS, GIMBALS, DIGITAL SYSTEMS, TORQUE (U)
IDENTIFIERS: AN/ASN-114, C-47 AIRCRAFT (U)

THE AN/ASN-114 INERTIAL NAVIGATION SET (INS) IS A SENSOR FOR AIRCRAFT POSITIONS, VELOCITY, ATTITUDE, AND HEADING INFORMATION. THE SYSTEM DEVELOPS NAVIGATIONAL DATA FROM SELF-CONTAINED, INERTIAL SENSORS, CONSISTING OF A VERTICAL ACCELEROMETER, TWO HORIZONTAL ACCELEROMETERS AND TWO TWO-AXIS DISPLACEMENT GYROSCOPES. THE SENSING ELEMENTS ARE MOUNTED IN A FOUR GIMBAL, GYRO STABILIZED INERTIAL PLATFORM. THE SET PROVIDES PITCH, ROLL, AND HEADING IN BOTH ANALOG (SYNCHRO) AND DIGITAL FORM. IN ADDITION, THE FOLLOWING OUTPUTS ARE PROVIDED ON A SERIAL DIGITAL CHANNEL IN ARINC 571 FORMAT: (1) PRESENT POSITION -- LATITUDE, LONGITUDE, ALTITUDE; (2) AIRCRAFT ATTITUDE -- PITCH, ROLL, HEADING, DRIFT ANGLE, WANDER ANGLE; (3) AIRCRAFT VELOCITY -- NORTH-SOUTH VELOCITY, EAST-WEST VELOCITY, VERTICAL VELOCITY, GROUND SPEED, TRACK ANGLE; (4) STEERING INFORMATION -- DISTANCE-TO-GO, TRACK ANGLE ERROR, CROSS TRACK DISTANCE, DESIRED TRACK, DRIFT ANGLE PLUS TRACK ANGLE ERROR. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 918 213 17/7
ANALYTIC SCIENCES CORP READING MASS

MICRO-NAVIGATOR (MICRON) ANALYSIS. MODELING, CALIBRATION AND SIMULATION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. APR 72-JAN 73, MAR 74 105P BLASCHKE, TED C. ;SHIELDS, JAMES D. ;
REPT. NO. TASC-TR-358-3
CONTRACT: F33615-72-C-1982
MONITOR: AFAL TR-73-374

UNCLASSIFIED REPORT

DESCRIPTORS: (*GYROSCOPES, CALIBRATION), (*INERTIAL NAVIGATION, STRAPPED DOWN SYSTEMS), (*ATTITUDE INDICATORS, ERRORS), (*COMPUTERIZED SIMULATION, ROTORS), SIMULATION, DIGITAL COMPUTERS, MATHEMATICAL MODELS, DRIFT, PERFORMANCE(ENGINEERING), COMPUTER PROGRAMS, ITERATIONS, TORQUE, CALIBRATION, MODELS, ELECTRODES, CAPACITANCE, SHAPE, ELECTROSTATICS (U)
IDENTIFIERS: *ELECTROSTATIC GYROSCOPES, *MICRONAVIGATORS (U)

THREE ASPECTS RELATED TO THE DEVELOPMENT OF THE STRAPDOWN MICRO-NAVIGATOR (MICRON) SYSTEM HAVE BEEN INVESTIGATED. BY COMPARING THE PRESENT MICRO-ELECTROSTATIC GYRO (MESG) DRIFT RATE AND ATTITUDE READOUT ERROR MODELS WITH A PREVIOUSLY DEVELOPED MATHEMATICAL MODELING THEORY, EXPRESSIONS FOR MANY OF THE MODEL COEFFICIENTS WERE DERIVED AND THE CORRESPONDING ERROR MECHANISMS WERE DEFINED. THE EQUATIONS FOR THE SIMULTANEOUS CALIBRATION OF BOTH THE MESG DRIFT RATE AND ATTITUDE READOUT ERROR MODEL COEFFICIENTS FROM A SINGLE SET OF DATA HAVE BEEN DERIVED. THE APPROACH TO BE USED IN THE SUBSEQUENT DEVELOPMENT OF AN OPERATIONAL UNIFIED CALIBRATION TECHNIQUE FROM THESE EQUATIONS HAS BEEN DEFINED. A PERFORMANCE ANALYSIS PROGRAM HAS BEEN DEVELOPED AND CODED. THIS PROGRAM SIMULATES THE PROMINENT MESG ERROR MECHANISMS AND DUPLICATES THE MICRON MECHANIZATION EQUATIONS. THE PROGRAM HAS BEEN USED TO INVESTIGATE MECHANIZATION AND ITERATION RATE DEPENDENT NAVIGATION ERRORS IN THE MICRON SYSTEM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 920 805 1/3 17/7 17/2
BOEING COMMERCIAL AIRPLANE CO SEATTLE WASH

SST TECHNOLOGY FOLLOW - ON PROGRAM-PHASE II. ADEDS INTERFACE DESCRIPTION. (U)

DESCRIPTIVE NOTE: FINAL REPT. ON TASK 6,
MAR 74 198P GIROIR,L. ;MARTIN,A. ;
PAULSON,V. ;PEAL,R. ;
REPT. NO. D6-60297
CONTRACT: DOT-FA72WA-2893
MONITOR: FAA-SS 73-20

UNCLASSIFIED REPORT

DESCRIPTORS: (*SUPERSONIC TRANSPORTS, *TELEVISION DISPLAY SYSTEMS), (*INERTIAL NAVIGATION, SUPERSONIC TRANSPORTS), INTERFACES, NAVIGATION COMPUTERS, COMPUTER PROGRAMS, LOW LIGHT LEVELS, TELEVISION SYSTEMS, INSTRUMENT LANDINGS, FLIGHT TESTING, DATA ACQUISITION, DIGITAL COMPUTERS, DIGITAL SYSTEMS, MAGNETIC TAPE, FLIGHT CONTROL SYSTEMS, ROLL, PITCH(MOTION), ALTITUDE, ANALOG SYSTEMS, RADIO ALTIMETERS, RADIO NAVIGATION, DATA TRANSMISSION SYSTEMS (U)
IDENTIFIERS: *SST TECHNOLOGY FOLLOW ON PROGRAM, ADEDS(ADVANCED ELECTRONIC DISPLAY SYSTEM), ADVANCED ELECTRONIC DISPLAY SYSTEM (U)

THE ADVANCED ELECTRONIC DISPLAY SYSTEM (ADEDS) TASK OF THE SST TECHNOLOGY FOLLOW-ON PROGRAM INCLUDES THE FORMAL DEFINITION AND DOCUMENTATION OF THE SIGNAL INTERFACE MECHANIZATION. THIS REPORT DEFINES THE SIGNAL INTERFACES AS MECHANIZED FOR THE FLIGHT TEST AIRPLANE INSTALLATION. INCLUDED IS THE DEFINITION OF INTERFACES BETWEEN: ELEMENTS OF THE DISPLAY SYSTEM, THE DISPLAY SYSTEM AND ANCILLARY SENSOR SYSTEMS, ELEMENTS OF THE NAVIGATION SYSTEM, THE DISPLAY AND NAVIGATION SYSTEMS, THE NAVIGATION SYSTEM AND ANCILLARY SENSOR SYSTEMS, AND THE NAVIGATION SYSTEM AND OTHER ELEMENTS OF THE ADVANCED GUIDANCE AND CONTROL SYSTEM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A000 413 17/7 14/2
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

TESTING THE TESTS OR THE QUALITY OF DIAGNOSTIC AND FUNCTIONAL TESTS USED IN THE REPAIR OF INERTIAL SYSTEMS AT THE AEROSPACE GUIDANCE AND METROLOGY CENTER. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
APR 74 8P NEVILLE,ALBERT R. , JR.;
GENET,RUSSELL M. ;
REPT. NO. AGMC-74-009-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *TEST METHODS, *MAINTENANCE, *INERTIAL NAVIGATION, AIR FORCE EQUIPMENT, METROLOGY, RELIABILITY, ERRORS, AVIONICS . (U)

THE PAPER DISCUSSES THE EVALUATION AND IMPROVEMENT OF TESTS USED DURING THE REPAIR OF INERTIAL NAVIGATION SYSTEMS AT THE AEROSPACE GUIDANCE AND METROLOGY CENTER (AGMC) AT NEWARK AIR FORCE STATION, IN NEWARK, OHIO. THE HIGHLY SIGNIFICANT IMPACT OF BOTH DIAGNOSTIC AND FUNCTIONAL TESTS ERRORS ON THE EFFICIENCY OF THE OVERALL REPAIR PROCESS IS DISCUSSED. AN EVALUATION PROGRAM AT AGMC TO 'TEST THE TESTS' IS DESCRIBED. THE RESULTS SHOULD BE GENERALLY APPLICABLE TO ANY REPAIR PROCESS THAT USES DIAGNOSTIC TESTS COMBINED WITH SELECTIVE REPLACEMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A001 647 17/7
ANALYTIC SCIENCES CORP READING MASS

AN/ASN-90 SYSTEMS IMPROVEMENT PROGRAM. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. OCT 72-JUN 74,
OCT 74 85P SHARPLEY,WILLIAM K. ;SHIPP,
ROBERT F. ;
REPT. NO. TASC-TR-353-10
CONTRACT: F33615-73-C-1146
PROJ: AF-6095
TASK: 609502
MONITOR: AFAL TR-74-250

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *INERTIAL NAVIGATION, AIRCRAFT,
SYSTEMS ENGINEERING, AVIONICS, RELIABILITY,
TACTICAL AIRCRAFT, ATTACK AIRCRAFT, FIGHTER
AIRCRAFT (U)
IDENTIFIERS: AN/ASN-90, A-7 AIRCRAFT, A-7D
AIRCRAFT (U)

STATUS IS REPORTED ON THE DEVELOPMENT OF TOOLS FOR THE ANALYSIS OF OPERATIONAL PERFORMANCE AND OPERATIONAL MAINTENANCE OF A COMPLEX AVIONICS SYSTEM, AND THE COST-OF-OWNERSHIP IMPLICATIONS OF IMPROVEMENT ALTERNATIVES. RESULTS OF THE APPLICATION OF THESE TOOLS TO THE AN/ASN-90 INERTIAL MEASUREMENT SET, AS USED IN THE A-7D AIRCRAFT, ARE ALSO REPORTED. THESE RESULTS WERE OBTAINED AS PART OF TASC'S CONTINUING PARTICIPATION IN THE KT-73 INERTIAL NAVIGATION SYSTEMS TECHNICAL INTERCHANGE TASK GROUP (TITG) CHAIRED BY THE AIR FORCE ITEM MANAGER AT THE OKLAHOMA CITY AIR LOGISTICS CENTER. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A004 663 17/7
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

INERTIAL NAVIGATION THEORY (AUTONOMOUS SYSTEMS), (U)

DEC 74 617P ANDREEV,V. D. ;
REPT. NO. FTD-HC-23-893-74

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF MONO. TEORIYA INERTSIALNOI NAVIGATSII, N.P., 1966 P1-579.

DESCRIPTORS: *INERTIAL NAVIGATION, THEORY, INERTIAL SYSTEMS, ERRORS, TRANSLATIONS, USSR (U)

THE MAIN ATTENTION IS DEVOTED TO THE EQUATIONS OF IDEAL OPERATIONS (UNPERTURBED FUNCTIONING) OF INERTIAL SYSTEMS, WHICH DETERMINE THEIR STRUCTURE, AND TO EQUATIONS OF INERTIAL NAVIGATION SYSTEM ERRORS, AN ANALYSIS OF WHICH PERMITS EVALUATION OF THE OPERATING STABILITY OF THE SYSTEM AND ESTABLISHMENT OF THE RELATIONSHIP BETWEEN THE ERRORS OF THE ELEMENTS AND THE ACCURACY OF DETERMINING THE NAVIGATIONAL PARAMETERS OF THE OBJECT: THE CURRENT COORDINATES OF POSITION AND ITS ORIENTATION IN SPACE. PROBLEMS OF AUTONOMOUS PREPARATION OF INERTIAL SYSTEMS FOR OPERATION ARE ALSO CONSIDERED. THE BOOK IS DEVOTED TO THE THEORY OF AUTONOMOUS INERTIAL SYSTEMS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A006 344 15/5
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF SYSTEMS AND LOGISTICS

COST-ESTIMATING RELATIONSHIPS FOR PREDICTING LIFE-CYCLE COSTS OF INERTIAL MEASUREMENT UNIT MAINTENANCE. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
JAN 75 92P LYNCH,LYNN M. ;RAYMOND, NEIL V. ;
REPT. NO. SLSR-16-75A

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *MAINTAINABILITY, *COST ESTIMATES, *INERTIAL MEASUREMENT UNITS, LIFE CYCLES, MATHEMATICAL MODELS, MAINTENANCE, THESES (U)

A MAJOR PROBLEM TO LIFE CYCLE COST PLANNERS IS THE SCARCITY OF TOOLS AVAILABLE FOR USE IN THE CONCEPTUAL PHASE OF SYSTEM DESIGN AND ACQUISITION THAT ACCURATELY PREDICT OPERATIONAL AND SUPPORT COSTS. THIS THESIS DEVELOPED A COST-ESTIMATING RELATIONSHIP (CER) THAT PREDICTS MAINTENANCE COSTS OF INERTIAL MEASUREMENT UNITS (IMUS) USING ONLY DESIGN AND POLICY DATA THAT WOULD BE AVAILABLE TO PLANNERS IN THE CONCEPTUAL PHASE OF WEAPON SYSTEM ACQUISITION. THE COST ESTIMATED IS THE AVERAGE QUARTERLY MAINTENANCE COST PER AIRCRAFT. THE ESTIMATING VARIABLES ARE SELECTED BASED ON TWO CRITERIA: (A) IS THE VARIABLE ONE THAT, VIEWED LOGICALLY, WOULD AFFECT MAINTENANCE COSTS, (B) IS THE VARIABLE ONE THAT WOULD BE KNOWN TO PLANNERS IN THE CONCEPTUAL PHASE OF WEAPON SYSTEM ACQUISITION. THE CER WAS DEVELOPED BY THE ORDINARY LEAST SQUARES METHOD OF MULTIPLE REGRESSION ANALYSIS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A006 439 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

SOME INDICATORS FOR INERTIAL NAVIGATION SYSTEMS RELIABILITY. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
AUG 74 18P ROGGE,RICHARD W. ;
REPT. NO. AGMC-74-044, AGMC-SNR-115-74-1

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, RELIABILITY, REPAIR (U)

THE PAPER ATTEMPTS TO CLARIFY SOME OF THE MEASUREMENTS OF INERTIAL NAVIGATION RELIABILITY (INS) AS APPLIED TO EVALUATION OF DEPOT OR TRC REPAIR. IT POINTS OUT THE EFFECT OF FLYING HOURS PROGRAMS ON MTBF AND SHOWS THAT TIME BETWEEN OVERHAUL (TBO) IS THE BEST MEASUREMENT OF INS RELIABILITY FOR THE TRC. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A007 300 17/7
NAVAL SURFACE WEAPONS CENTER DAHLGREN LAB VA

ERROR PROPAGATION IN THE SHIP'S INERTIAL NAVIGATOR: LINEAR VS NON-LINEAR THEORY, AND THE EFFECTS OF SHIPS VELOCITY AND EARTH'S OBLATENESS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 75 45P ELSAESSER,W. R. ;
REPT. NO. NSWC/DL-TR-3285
MONITOR: GIDEP 347.45.00.00-W4-01

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, ERRORS, PROPAGATION, SHIPS, LINEAR DIFFERENTIAL EQUATIONS, NONLINEAR ALGEBRAIC EQUATIONS (U)

THE EFFECTS OF THE LINEARIZATION APPROXIMATION, NEGLECT OF SHIP'S SPEED, AND THE SPHERICAL EARTH APPROXIMATION ON ERROR PROPAGATION IN THE SHIP'S INERTIAL NAVIGATION SYSTEM (SINS) IS ESTIMATED. THIS IS DONE BY CONSIDERING AN INERTIAL NAVIGATOR THAT IS PERFECT IN ALL RESPECTS. IT IS, HOWEVER, PUT INTO OPERATION WITH INCORRECT INITIAL CONDITIONS. THE RESULTING ERRORS ARE PROPAGATED FOR ONE HOUR USING ANALYTICAL PROCEDURES THAT CONTAIN EITHER NONE, OR ONE OR MORE OF THE ABOVE SIMPLIFICATIONS. COMPARISONS OF THE RESULTS THEN PROVIDE ESTIMATES OF THE EFFECTS OF EACH OF THESE APPROXIMATIONS ON ERROR PROPAGATION. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A008 472 17/7 9/2
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

EVALUATION OF A PROPOSED INS KALMAN FILTER IN A DYNAMIC FLIGHT ENVIRONMENT. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
DEC 74 187P HAMMETT, JERRY E. ;
REPT. NO. GE/EE/74-45

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *KALMAN FILTERING, *CENTRAL PROCESSING UNITS, MATHEMATICAL MODELS, DOPPLER RADAR, MATRICES(MATHEMATICS), COORDINATES, POSITION FINDING, COMPUTATIONS, THESES (U)
IDENTIFIERS: CDC 6600 COMPUTERS (U)

THIS REPORT IS AN EVALUATION OF A PROPOSED KALMAN FILTER FOR AN ADVANCED MANNED AIRCRAFT. THE EVALUATION IS PERFORMED UNDER SIMULATED FLIGHT PROFILES WHICH INCLUDE STRAIGHT AND LEVEL AND MANEUVERING FLIGHT. THE AIDED INERTIAL NAVIGATION SYSTEM IS REPRESENTED BY A 54-STATE LINEAR SYSTEM ERROR MODEL AND THE FILTER BY A 17-STATE ERROR MODEL WITH DECOUPLED HORIZONTAL AND VERTICAL CHANNEL MECHANIZATION. THE SIMULATED FLIGHT PROFILES INCLUDE TWO HOURS OF STRAIGHT AND LEVEL FLIGHT AND ONE ADDITIONAL HOUR OF EITHER STRAIGHT AND LEVEL OR MANEUVERING FLIGHT. A COMPARISON OF FILTER EFFECTIVENESS WITH THE OPTIMAL FILTER IS MADE FOR THE TWO HOUR STRAIGHT AND LEVEL FLIGHT. THE DECOUPLED 17-STATE FILTER EFFECTIVENESS IS EVALUATED DURING ONE ADDITIONAL HOUR OF MANUEUVERING FLIGHT BASED ON THE FILTER PERFORMANCE IN STRAIGHT AND LEVEL FLIGHT FOR THE SAME TIME PERIOD. IN ADDITION, AN ERROR BUDGET IS DETERMINED FOR BOTH FLIGHT PROFILES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A012 359 17/7
INTERMETRICS INC CAMBRIDGE MASS

ERROR SOURCE RECOVERY FROM INS TEST FLIGHT DATA. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
JUL 75 228P GRUNDY,PETER A. ;
REPT. NO. IR-122-1
CONTRACT: F29601-75-C-0016
MONITOR: ADTC,AFSWC TR-75-80,TR-75-49

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *FLIGHT TESTING, NAVIGATIONAL AIDS, ERRORS, KALMAN FILTERING, REGRESSION ANALYSIS, DATA PROCESSING, COMPUTER PROGRAMMING (U)

THE CIRIS SYSTEM AT HOLLOMAN AIR FORCE BASE PROVIDES A HIGHLY PRECISE REFERENCE FOR THE FLIGHT TESTING OF NAVIGATION SYSTEMS. THIS REPORT EXPLORES THE RECOVERY OF THE SIGNIFICANT SOURCES OF ERROR OF AN INERTIAL NAVIGATION SYSTEM UNDER TEST THROUGH OPTIMAL FILTER TECHNIQUES, USING CIRIS DATA AS REFERENCE INFORMATION. A KALMAN FILTER MODELLING ALL THE SIGNIFICANT SOURCES OF ERROR FOR THE TEST INS AND THE CIRIS INS AND PRECISION RANGING SYSTEM, IS EXECUTED OVER A SET OF SELECTED FLIGHT TEST PROFILES. THE ESTIMATION OF INDIVIDUAL SOURCES OF ERROR IS SHOWN TO BE INHIBITED BY CORRELATION OF THE CONTRIBUTIONS OF ERROR SOURCES TO THE MEASURED QUANTITIES. HIGHLY CORRELATED ERROR SOURCES ARE THEN LUMPED INTO LINEAR COMBINATIONS, AND THE REDUCED ERROR MODEL KALMAN FILTER IS EXECUTED OVER THE TEST PROFILES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A013 274 17/7
ANALYTIC SCIENCES CORP READING MASS

GRADIOMETER-AIDED INERTIAL NAVIGATION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 20 AUG 73-20 AUG 74,
APR 75 100P HELLER,WARREN G. ;
REPT. NO. TASC-TR-312-5
CONTRACT: DMA700-74-C-0075

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, GRADIOMETERS,
ERRORS, ACCURACY, GRAVITY (U)

THE PURPOSE OF THE STUDY IS TO DEVELOP A TECHNIQUE FOR COMBINING GRADIOMETER AND INERTIAL NAVIGATION SYSTEM (INS) OUTPUTS THAT MINIMIZES THE NAVIGATION AND GRAVITY RMS ERRORS, AND TO DETERMINE THE GRADIOMETER ACCURACY NEEDED FOR TYPICAL AIRCRAFT AND MARINE NAVIGATION AND GRAVITY-MAPPING APPLICATIONS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A013 916 17/7
AIR FORCE SPECIAL WEAPONS CENTER KIRTLAND AFB N MEX

PROCEEDINGS OF THE BIENNIAL GUIDANCE TEST SYMPOSIUM (7TH) HELD AT HEADQUARTERS 6585TH TEST GROUP, AIR FORCE SPECIAL WEAPONS CENTER, HOLLOMAN AIR FORCE BASE, NEW MEXICO ON 14 - 16 MAY 1975. VOLUME I. (U)

MAY 75 876P
REPT. NO. AFSWC-TR-75-26

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL GUIDANCE, *INERTIAL NAVIGATION, *MEETINGS, GYROSCOPES, ACCELEROMETERS, INERTIAL SYSTEMS, INERTIAL MEASUREMENT UNITS, TERMINAL GUIDANCE, NAVIGATIONAL AIDS (U)
IDENTIFIERS: *RING LASER GYROSCOPES, *RING LASERS (U)

THESE PROCEEDINGS CONTAIN PAPERS INCLUDED IN THE SEVENTH BIENNIAL GUIDANCE TEST SYMPOSIUM. THIS SYMPOSIUM, HOSTED BY THE CENTRAL INERTIAL GUIDANCE TEST FACILITY, IS DIRECTED TOWARD THE EXCHANGE OF INFORMATION, STIMULATION OF NEW IDEAS, AND DISCUSSION OF RECENT DEVELOPMENTS IN THE FIELD OF GUIDANCE TESTING. THE PAPERS PRESENTED IN THESE PROCEEDINGS INCLUDE SUCH TOPICS AS AIRCRAFT INERTIAL NAVIGATORS, STRAPPED-DOWN GUIDANCE SYSTEMS, COMPONENT EVALUATION, AND ANALYSIS TECHNIQUES. THE INCLUDED PAPERS WERE THOSE PRESENTED IN THE UNCLASSIFIED SESSION OF THE SYMPOSIUM. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A014 356 17/7
ANALYTIC SCIENCES CORP READING MASS

FREE-INERTIAL AND DAMPED-INERTIAL NAVIGATION MECHANIZATION AND ERROR EQUATIONS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 20 AUG 73-20 AUG 74,
APR 75 57P HELLER,WARREN G. ;
REPT. NO. TASC-TR-312-1-1
CONTRACT: DMA700-74-C-0075

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, NUMERICAL ANALYSIS, ERRORS, KALMAN FILTERING, ANOMALIES, INERTIAL SYSTEMS, ANGULAR MOMENTUM, EQUATIONS OF MOTION (U)
IDENTIFIERS: ERROR ANALYSIS, ERROR EQUATIONS (U)

THE EQUATIONS THAT DESCRIBE BOTH THE NAVIGATION MECHANIZATION AND THE PROPAGATION OF ERRORS IN AN UNAIDED INERTIAL SYSTEM ARE DETAILED. EXTENSIONS OF THESE EQUATIONS WHICH APPLY TO CONTINUOUS SPEED AND ALTITUDE DAMPING ARE ALSO GIVEN. A GENERAL VECTOR-MATRIX NOTATION IS EMPLOYED, THEREBY ELIMINATING THE NEED TO SPECIFY A PARTICULAR NAVIGATION MECHANIZATION BEFORE SETTING DOWN THE ERROR EQUATIONS. SPECIFIC APPLICATION OF THE GENERAL EQUATIONS TO THE LOCAL-LEVEL, WANDER-AZIMUTH MECHANIZATION IS OUTLINED. THE DETAILED FORM OF THE ERROR EQUATIONS IS GIVEN FOR BOTH THE FREE-INERTIAL CASE AND VARIOUS CHOICES OF CONTINOUS DAMPING. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A016 099 17/7
WHITE SANDS MISSILE RANGE N MEX INSTRUMENTATION DIRECTORATE

INERTIAL-RANGE INSTRUMENTED HYBRID NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
AUG 75 67P GREEN,R. E. ;PURI,N. N.
;
REPT. NO. STEWS-ID-75-1
PROJ: DA-1-U-865804-DE-93
TASK: 1-U-865804-DE-9303

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, HYBRID SYSTEMS, GUIDED MISSILE RANGES, KALMAN FILTERING, NAVIGATION COMPUTERS, INSTRUMENTATION, CALIBRATION (U)

THE REPORT DISCUSSES A HYBRID NAVIGATIONAL SYSTEM FOR LOW ALTITUDE AIRBORNE TRACKING AND FOR ACCURATE CALIBRATION OF RANGE INSTRUMENTATION EQUIPMENT. SYSTEM CONSISTS OF AN AIRBORNE INERTIAL PLATFORM, TRANSPONDER FOR DISTANCE MEASURING EQUIPMENT (DME) INTERROGATION (PROVIDING RANGE AND RANGE MEASUREMENTS), BAROMETER TYPE ALTIMETER OR A PHASE ARRAY RADAR, AN AIRBORNE NAVIGATIONAL AND FILTERING COMPUTER, AND GROUND BASED DME. INERTIAL PLATFORM MAY OR MAY NOT BE TORQUED. THE HEART OF THE SYSTEM IS THE NAVIGATIONAL COMPUTER AND THE KALMAN FILTER. A REFERENCE TRAJECTORY IS GENERATED BY THE CUBIC SPLINE METHOD AND ALONG WITH PROPER COORDINATE CONVERSION, THE DOPPLER DATA, RANGE MEASUREMENTS DATA, BAROMETER DATA, AND THE INERTIAL MEASUREMENT UNIT (IMU) ACCELEROMETER MEASUREMENTS CORRUPTED WITH NOISE ARE SIMULATED. NAVIGATIONAL EQUATIONS, ERROR EQUATIONS, AND THE KALMAN FILTER ALGORITHM ARE MECHANIZED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A016 478 1/3 5/1 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

AVIONICS PROLIFERATION: A LIFE CYCLE COST PERSPECTIVE. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUL 75 30P GENET ,RUSSELL M. ;MEITZLER, THOMAS D. ;
REPT. NO. AGMC-75-002

UNCLASSIFIED REPORT
AVAILABILITY: AVAILABLE IN MICROFICHE ONLY.

DESCRIPTORS: *AVIONICS, *LIFE CYCLE COSTS, *INERTIAL NAVIGATION, ECONOMIC ANALYSIS, COST EFFECTIVENESS, MILITARY AIRCRAFT (U)

THE PAPER DISCUSSES PROLIFERATION AND WHEN IT CAN OCCUR. IT SPECIFICALLY LOOKS AT THE ECONOMIC QUESTION OF WHEN CAN IT BE COST EFFECTIVE TO USE AN EXISTING MILITARY INERTIAL NAVIGATION SYSTEM FOR NEW AIRCRAFT RATHER THAN DEVELOPING AND USING A NEW SYSTEM. THE DISCUSSION IS FROM A LIFE CYCLE COST VIEWPOINT WITH PARTICULAR ATTENTION TO THE 'START-UP' COSTS. ATTACHED WITH THE PAPER IS A COMPLETE REPRODUCTION OF THE INPUT DATA AND COMPUTER RESULTS USED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A016 626 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

AGMC LCC MODEL FOR INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
OCT 75 72P MEITZLER,THOMAS D. ;
REPT. NO. AGMC-75-001

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *LIFE CYCLE COSTS, COST ANALYSIS, COMPUTER PROGRAMS, MATHEMATICAL MODELS, VARIABLES, CONSTANTS, PARAMETERS, LOGISTICS (U)
IDENTIFIERS: COST OF OWNERSHIP, *LIFE CYCLE COSTING (U)

THE PURPOSE OF THIS REPORT IS TO DOCUMENT A MATHEMATICAL MODEL CURRENTLY BEING USED TO EVALUATE THE POTENTIAL LIFE CYCLE COSTS OF INERTIAL NAVIGATION SYSTEMS. THIS MODEL HAS THE CAPABILITY OF ISOLATING AND ANALYZING LOGISTICS START-UP COSTS. IT ALSO ALLOWS FOR INERTIAL SYSTEM SUBASSEMBLY ANALYSIS. THE REPORT INCLUDES DEFINITIONS OF ALL INPUT AND OUTPUT PARAMETERS, EXPLANATION OF THE EQUATIONS, PROGRAM LISTING WITH DATA DECK DESCRIPTION, AND A SAMPLE RUN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A021 480 17/7
AIR FORCE AVIONICS LAB WRIGHT-PATTERSON AFB OHIO

ANALYSIS OF A REFERENCE SYSTEM FOR A MOBILE LABORATORY. (U)

DESCRIPTIVE NOTE: FINAL REPT. JAN 74-MAR 75,
JAN 76 170P MUSICK,STANTON H. ;
REPT. NO. AFAL-TR-75-193
PROJ: AF-6095
TASK: 609505

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *TEST VEHICLES, GROUND SUPPORT EQUIPMENT, INERTIAL MEASUREMENT UNITS, NAVIGATION COMPUTERS, INFRARED EQUIPMENT, KALMAN FILTERING, COMPUTER PROGRAMS (U)
IDENTIFIERS: PDP-11 COMPUTERS, SKC-2000 COMPUTERS, KT-70 INERTIAL MEASURING UNITS (U)

AN INERTIAL REFERENCE SYSTEM HAS BEEN DESIGNED FOR THE MOBILE EVALUATION LABORATORY USING A KT-70 INERTIAL MEASUREMENT UNIT, A SPEED SENSOR, A DEVICE FOR PROVIDING POSITION DATA AND TWO DIGITAL COMPUTERS. THE ANALYSIS NEEDED TO OPTIMALLY COMBINE THE OUTPUTS OF THESE EQUIPMENTS IN THE COMPUTER(S) HAS BEEN ACCOMPLISHED. THIS ANALYSIS PRODUCED A TWELVE STATE RECURSIVE KALMAN FILTER BASED ON AN ERROR-STATE-SPACE PROBLEM FORMULATION. THE KALMAN ERROR ESTIMATES ARE FED BACK TO THE INS TO CORRECT IT. MEANS FOR HANDLING THE HIGH DATA RATE FROM THE SPEED SENSOR HAVE BEEN ANALYZED AND A COMPUTATIONALLY SIMPLE ONE HAS BEEN CHOSEN. THE ENTIRE PROBLEM HAS BEEN FORMULATED IN A COMPUTER SIMULATION THAT WAS USED IN DESIGNING THE SYSTEM AND PREDICTING ITS PERFORMANCE. THE FINAL DESIGN WILL PROVIDE STABLE AND ACCURATE PERFORMANCE OVER A WIDE RANGE OF MEASUREMENT CONDITIONS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A021 526 17/7
ROCKWELL INTERNATIONAL ANAHEIM CALIF AUTONETICS GROUP

MICRO NAVIGATOR (MICRON) PHASE 2A. VOLUME I. TECHNICAL REPORT. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 APR 74-1 AUG 75, FEB 76 530P MILLER,JOSEPH M. ;
REPT. NO. C74-455/201-VOL-1
CONTRACT: F33615-74-C-1099
PROJ: AF-ADP666A
TASK: 666A03
MONITOR: AFAL TR-75-210-VOL-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 2, AD-A021 527.

DESCRIPTORS: *INERTIAL NAVIGATION, *INERTIAL MEASUREMENT UNITS, GYRO STABILIZERS, STRAPPED DOWN SYSTEMS, ELECTROSTATIC FIELDS, REACTION KINETICS, METAL OXIDE SEMICONDUCTORS, NAVIGATIONAL AIDS, COST ANALYSIS (U)
IDENTIFIERS: MICRO NAVIGATORS (U)

THE MICRO NAVIGATOR (MICRON) IS A LOW-COST HIGHLY RELIABLE, AND MODERATELY ACCURATE STRAPDOWN INERTIAL NAVIGATOR. THE HEART OF THE MICRON SYSTEM IS THE MICROELECTROSTATIC GYRO (MESG), AN INSTRUMENT WHICH INCORPORATES AN ALL-ATTITUDE, WHOLE-ANGLE READOUT FROM AN ELECTROSTATICALLY SUSPENDED ROTOR. UNDER PREVIOUS AIR FORCE CONTRACTS TWO DEVELOPMENTAL NAVIGATION SYSTEMS (N57A-1 AND N57A-2) WERE DEVELOPED. THE OBJECTIVE OF THE MICRON PHASE 2A CONTRACT WAS TO TEST N57A-1 AND N57A-2; TO DESIGN, FABRICATE AND INTEGRATE TWO GYRO SUBASSEMBLIES AND ONE GYRO TEST STATION; TO TEST GYROS AND GYRO SUBASSEMBLIES; AND TO PERFORM ANALYSES, STUDIES AND TRADE-OFFS FOR USE IN DEFINING THE MICRON SYSTEM. BOTH N57A SYSTEMS WERE FLIGHT TESTED AND THE CAPABILITY OF THE SYSTEM TO MEET THE POSITION ACCURACY REQUIREMENT WAS DEMONSTRATED. N57A-1 WAS USED TO DEMONSTRATE IN-MOTION POLHODE DAMPING. SYSTEM RELIABILITY SCREEN, SCORSBY AND HEADING SENSITIVITY TESTS WERE SUCCESSFULLY CONDUCTED ON N57A-2. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A021 527 17/7
ROCKWELL INTERNATIONAL ANAHEIM CALIF AUTONETICS GROUP

MICRO NAVIGATOR (MICRON) PHASE 2A.
VOLUME II. APPENDICES. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 APR 74-1 AUG 75,
FEB 76 232P MILLER,JOSEPH M. ;
REPT. NO. C74-455/201-VOL-2
CONTRACT: F33615-74-C-1099
PROJ: AF-ADP666A
TASK: 666A03
MONITOR: AFAL TR-75-210-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 1, AD-A021 526.

DESCRIPTORS: *INERTIAL NAVIGATION, *INERTIAL MEASUREMENT UNITS, GYRO STABILIZERS, STRAPPED DOWN SYSTEMS, ELECTROSTATIC FIELDS, REACTION KINETICS, METAL OXIDE SEMICONDUCTORS, NAVIGATIONAL AIDS, COST ANALYSIS (U)
IDENTIFIERS: MICRO NAVIGATORS (U)

THE OBJECTIVE OF THE MICRON PHASE 2A CONTRACT WAS TO TEST N57A-1 AND N57A-2; TO DESIGN, FABRICATE AND INTEGRATE TWO GYRO SUBASSEMBLIES AND ONE GYRO TEST STATION; TO TEST GYRO AND GYRO SUBASSEMBLIES; AND TO PERFORM ANALYSES, STUDIES AND TRADE-OFFS FOR USE IN DEFINING THE MICRON SYSTEM. BOTH N57A SYSTEMS WERE FLIGHT TESTED AND THE CAPABILITY OF THE SYSTEM TO MEET THE POSITION ACCURACY REQUIREMENT WAS DEMONSTRATED. N57A-1 WAS USED TO DEMONSTRATE IN-MOTION POLHODE DAMPING. SYSTEM RELIABILITY SCREEN, SCORSBY AND HEADING SENSITIVITY TESTS WERE SUCCESSFULLY CONDUCTED ON N57A-2. TWO GYRO SUBASSEMBLIES AND ONE GYRO TEST STATION WERE DESIGNED, FABRICATED, AND INTEGRATED. ONE SUBASSEMBLY WAS USED FOR MESGA DEVELOPMENT TESTING AND ONE WAS USED FOR 4-PLATE GYRO AND ELECTRONICS DEVELOPMENT. GETTER GYROS WERE FABRICATED AND TESTED. A GYRO DESIGN EVOLVED WHICH MEETS THE FAST REACTION REQUIREMENT. A 'SMALL GAP' GYRO WAS DEVELOPED WHICH REDUCES THE COST OF GYRO SUSPENSION ELECTRONICS. SYSTEM ANALYSES, STUDIES, AND TRADE-OFFS WERE MADE WHICH RESULTED IN CIRCUIT SIMPLIFICATION, REDUCED COSTS, AND PARTITIONING TO MEET MAINTAINABILITY AND PRODUCIBILITY REQUIREMENTS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A023 833 15/5 17/7 1/3
AERONAUTICAL SYSTEMS DIV WRIGHT-PATTERSON AFB OHIO PRAM PROGRAM OFFICE

APPLICATION OF A RELIABILITY AND MAINTAINABILITY WARRANTY. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JAN 76 17P BROGREN,JAN ;CROSIER, THEODORE E. ;GENET,RUSSELL M. ;BODEM,EARL T. ;
REPT. NO. ASD/RAXA-76-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE DATA EXCHANGE FOR INERTIAL SYSTEMS (9TH), CLEARWATER, FLA., 18-19 NOV 75 AND AS SUPPLEMENTAL MATERIAL AT THE 1976 ANNUAL RELIABILITY AND MAINTAINABILITY SYMPOSIUM, LAS VEGAS, NEV., 22 JAN 76.

DESCRIPTORS: *INERTIAL NAVIGATION, *GYROSCOPES, *MAINTENANCE, *RELIABILITY, *MEETINGS, COST ANALYSIS, DEPOTS, AIR FORCE FACILITIES, GOVERNMENT(FOREIGN), SWEDEN, FIGHTER AIRCRAFT (U)
IDENTIFIERS: WARRANTIES, LIFE CYCLE COSTS, PRAM(PRODUCTIVITY RELIABILITY AVAILABILITY MAINTAINABILITY), PRODUCTIVITY RELIABILITY AVAILABILITY MAINTAINABILITY (U)

APPROACHES TO DEPOT WARRANTIES IN THE ROYAL SWEDISH AIR FORCE AND U. S. AIR FORCE ARE DISCUSSED. THE DEVELOPMENT DETAILS OF A WARRANTY FOR AN INERTIAL GUIDANCE SYSTEM ARE GIVEN. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A024 377 12/1 17/7
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT
PARIS (FRANCE)

PRACTICAL ASPECTS OF KALMAN FILTERING IMPLEMENTATION. (U)

DESCRIPTIVE NOTE: LECTURE SERIES.
MAR 76 188P
REPT. NO. AGARD-LS-82, ISBN-92-835-0160-8

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT NORWAY (10-11 MAY 1976), THE NETHERLANDS (13-14 MAY 1976) AND ITALY (17-18 MAY 1976. NATO FURNISHED.

DESCRIPTORS: *KALMAN FILTERING, *CONTROL THEORY, *INERTIAL GUIDANCE, *INERTIAL NAVIGATION, MATHEMATICAL MODELS, OPTIMIZATION, NATO (U)

;CONTENTS: EXPERIENCES IN THE DEVELOPMENT OF AIDED INS FOR AIRCRAFT; PRACTICAL CONSIDERATIONS IN IMPLEMENTING KALMAN FILTERS; EXPERIENCES WITH THE B-1 NAVIGATION FILTER; EXPERIENCES IN FLIGHT TESTING HYBRID NAVIGATION SYSTEMS; ETUDE ET REALISATIONS DE FILTRES DE KALMAN POUR SYSTEMES DE NAVIGATION; A SHIP TRACKING SYSTEM USING A KALMAN-SCHMIDT FILTER; DESIGN AND ANALYSIS OF LOW-ORDER FILTERS APPLIED TO THE ALIGNMENT OF INERTIAL PLATFORMS; KALMAN FILTER BIBLIOGRAPHY. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A024 744 17/7 14/2
DARCOM INTERN TRAINING CENTER TEXARKANA TEX

FEASIBILITY STUDY OF PERFORMING SYSTEM CALIBRATION IN AN OPERATE MODE. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
APR 76 95P GORAK,ROBERT JOSEPH ;
REPT. NO. DARCOM-ITC-02-08-76-006

UNCLASSIFIED REPORT

DESCRIPTORS: *CALIBRATION, *GYROSCOPES, *INERTIAL NAVIGATION, DOWNTIME, REDUCTION, PERTURBATIONS, SYSTEMS ENGINEERING, FEASIBILITY STUDIES (U)

THE AVAILABILITY OF A SYSTEM CAN BE UPGRADED IF THE USUAL DOWNTIME ALLOCATED FOR PERFORMING CALIBRATION TASKS IS REDUCED OR ELIMINATED. THE OBJECTIVE OF THIS PAPER IS TO STUDY THE FEASIBILITY OF PERFORMING THE CALIBRATION OF SYSTEM PARAMETERS WHILE THE SYSTEM IS IN AN OPERATE MODE. TO THIS END, A CALIBRATION TECHNIQUE EXHIBITING THIS FEATURE WAS DEVELOPED AND STUDIED FOR A MARINE INERTIAL NAVIGATION SYSTEM. THE ERRORS INTRODUCED BY THE CALIBRATION TECHNIQUE WERE EXAMINED AND PROBLEMATIC AREAS WERE OUTLINED. ALTHOUGH THE REPORT IS DIRECTED SPECIFICALLY TOWARDS THE CALIBRATION OF CERTAIN PARAMETERS OF A PARTICULAR SYSTEM, THE IDEAS AND CONCEPTS PRESENTED IN THE DEVELOPMENT OF THE REPORT'S CALIBRATION TECHNIQUE SHOULD BE APPLICABLE TO OTHER SYSTEM FOR THE ELIMINATION OF ALL OR SOME OF THEIR CALIBRATION DOWNTIME. THE FORMULATION OF A SIMILAR TYPE OF CALIBRATION PROCEDURE IS ESPECIALLY DESIRABLE FOR SYSTEMS WHOSE UNAVAILABILITY AT A TIME OF CRITICAL NEED COULD RESULT IN A CATASTROPHIC LOSS OF MEN, MATERIAL AND TACTICAL ADVANTAGE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A027 433 17/7
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

A DIGITAL CONTROLLER FOR HORIZONTAL ANGULAR MOTION OF THE FJSRL SEISMIC ISOLATION PLATFORM. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
JUN 76 122P BURKHART,MARTIN J. ;
REPT. NO. GE/EE/76-6

UNCLASSIFIED REPORT

DESCRIPTORS: *STABILIZED PLATFORMS, *CONTROL SYSTEMS, *DIGITAL SYSTEMS, *INERTIAL NAVIGATION, *STOCHASTIC PROCESSES, DIGITAL COMPUTERS, PNEUMATIC DEVICES, HORIZONTAL STABILIZERS, KALMAN FILTERING, NAVIGATION COMPUTERS, NAVIGATIONAL AIDS (U)
IDENTIFIERS: *SEISMIC ISOLATION PLATFORM, HORIZONTAL ANGULAR MOTION, STOCHASTIC CONTROLLER, INERTIAL INSTRUMENT TESTING, DESIGN, DIGITAL CONTROL SYSTEMS (U)

THIS STUDY IS PART OF A CONTINUING EFFORT TO DEVELOP A STOCHASTIC CONTROLLER FOR THE ANGULAR MOTION ABOUT A HORIZONTAL AXIS OF THE SEISMIC ISOLATION PLATFORM AT THE FRANK J. SEILER RESEARCH LABORATORY. THE DESIGN OF A DIGITAL CONTROLLER IS INVESTIGATED BASED ON THE ASSUMPTION THAT A KALMAN FILTER WOULD PROVIDE SUFFICIENTLY ACCURATE ESTIMATIONS OF THE STATES OF THE SYSTEM. THE DESIGN SPECIFICATIONS ARE TO MAINTAIN ANGULAR POSITION WITHIN + OR - 0.001 ARCSECONDS AND ANGULAR VELOCITY WITHIN + OR - 1.6 X 0.00001 ARCSECONDS PER SECOND FOR A STEP FUNCTION OF 1.25 FT-LBS APPLIED TO THE PLATFORM. DISCRETE MODELS FOR THE PLATFORM AND TWO ACTUATORS ARE DEVELOPED. THE DISCRETE MODELS ARE USED TO DESIGN A CONTROLLER FOR EACH ACTUATOR. A CONTROLLER FOR THE PNEUMATIC ACTUATOR IS DESIGNED TO FORCE THE PLATFORM TO A ZERO STEADY-STATE POSITION. AN OPTIMAL CONTROLLER, WHICH REGULATES THE CLOSED PNEUMATIC LOOP, IS DESIGNED FOR THE SHAKER ACTUATOR. A THEORETICAL EVALUATION OF THE CONTROL SYSTEM SHOWS ANGULAR POSITION IS MAINTAINED WITHIN + OR - 2.81 X 0.0001 ARCSECONDS AND ANGULAR VELOCITY HAS A PEAK OVERSHOOT OF 2.24 X 0.01 ARCSECONDS PER SECOND BUT SETTLES TO WITHIN THE DESIGN SPECIFICATION IN 0.08 SECONDS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A028 788 5/9 15/5
STRATEGIC AIR COMMAND OFFUTT AFB NEBR

GIANT CHANGE, KC-135 DUAL INS TEST. (U)

DESCRIPTIVE NOTE: FINAL REPT. NOV 75-MAR 76,
JUL 76 86P BAJUK, TERENCE G. ;

UNCLASSIFIED REPORT

DESCRIPTORS: *CARGO AIRCRAFT, *FLIGHT CREWS, *INERTIAL NAVIGATION, FEASIBILITY STUDIES, REDUCTION, PERFORMANCE TESTS, MISSION PROFILES, SYSTEMS ENGINEERING, PERSONNEL MANAGEMENT, STRATEGIC AIR COMMAND (U)
IDENTIFIERS: KC-135 AIRCRAFT, GIANT CHANGE FLIGHT CREW TEST, DUAL NAVIGATION SYSTEMS, C-135 AIRCRAFT (U)

THE STRATEGIC AIR COMMAND CONDUCTED A TEST TO DETERMINE THE FEASIBILITY OF REDUCING THE SIZE OF THE KC-135 CREW COMPLEMENT WHILE MAINTAINING MISSION EFFECTIVENESS. THIS TEST INVESTIGATED THE POSSIBILITY OF USING A THREE MAN CREW (PILOT, COPILOT, AND BOOM OPERATOR) WITH THE COPILOT ASSUMING THE NAVIGATION DUTIES WITH THE AID OF A DUAL INERTIAL NAVIGATION SYSTEM (INS). THE EXERCISE TERM ASSIGNED THE TEST WAS GIANT CHANGE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A029 482 17/7 14/1 15/5 5/1
DEFENSE SYSTEMS MANAGEMENT SCHOOL FORT BELVOIR VA

COST EFFECTIVE ILS. A CASE STUDY AND EVALUATION. (U)

DESCRIPTIVE NOTE: STUDY PROJECT REPT.,
NOV 74 55P GRUBB, JAMES R. ;
PROJ: DSMS-PMC-74-2

UNCLASSIFIED REPORT
AVAILABILITY: MICROFICHE COPIES ONLY.

DESCRIPTORS: *LOGISTICS SUPPORT, *COST EFFECTIVENESS, *INERTIAL NAVIGATION, *SYSTEMS MANAGEMENT, NAVAL PROCUREMENT, INTEGRATED SYSTEMS, COST ESTIMATES, LIFE CYCLE COSTS, DISPLAY SYSTEMS, STABILIZED PLATFORMS, AVIONICS, DOPPLER RADAR (U)
IDENTIFIERS: *INTEGRATED LOGISTIC SUPPORT (U)

THE PURPOSE OF THIS CASE STUDY IS TO DETERMINE, THROUGH THE ANALYSES OF THE ACQUISITION OF A SYSTEM, THE AREAS WHICH IMPACT ACHIEVING ILS IN A COST EFFECTIVE MANNER. THE PROBLEM AREAS ARE IDENTIFIED IN THE CASE AND RECOMMENDATIONS ARE MADE TO CORRECT SITUATIONS WHICH IMPAIR ACHIEVING COST EFFECTIVE ILS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A030 069 17/7 14/1
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO INDUSTRIAL ENGINEERING SUPPORT DIV

AGMC LIFE CYCLE COST MODEL, AN ACCOUNTING MODEL FOR INERTIAL NAVIGATION SYSTEMS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
AUG 76 70P ROGGE,RICHARD W. ;
REPT. NO. AGMC-XRX-76-3

UNCLASSIFIED REPORT
AVAILABILITY: MICROFICHE COPIES ONLY.

DESCRIPTORS: *INERTIAL NAVIGATION, *LIFE CYCLE COSTS, COST MODELS, COST ANALYSIS, ACCOUNTING (U)

THIS REPORT DESCRIBED THE ACCOUNTING MODEL DEVELOPED BY AGMC TO EVALUATE THE LIFE CYCLE COSTS OF INERTIAL NAVIGATION SYSTEMS. HOWEVER, IT IS A GENERAL PURPOSE MODEL AND MAY BE TAILORED FOR OTHER THAN INERTIAL NAVIGATION SYSTEMS BY SIMPLY RE-NAMING PARAMETERS AS APPLICABLE. THE PURPOSE OF THE MODEL IS TO PROVIDE A METHOD TO COMPARE TWO OR MORE TYPES OF SYSTEMS, OR MAINTENANCE OPTIONS ON THE SAME SYSTEM. IT PROVIDES A SIMPLIFIED APPROACH TO MODELING COSTS, AS THE NUMBER OF DIFFERENT TYPES OF INPUT DATA REQUIRED IS RELATIVELY SMALL. THIS MODEL HAS THE CAPABILITY OF ISOLATING AND IDENTIFYING START-UP COSTS AND RECURRING COSTS. IT ALLOWS ANALYSIS THROUGH THREE INDENTURE LEVELS: LINE REPLACEABLE UNITS (LRU), SHOP REPLACEABLE UNITS (SRU), AND DEPOT REPLACEABLE UNITS (DRU). INCLUDED IN THIS REPORT ARE A DESCRIPTION OF PARAMETERS, MODEL EQUATIONS, A SAMPLE RUN PRINT OUT AND A PROGRAM LISTING OF THE MODEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A030 337 17/7
FEDERAL AVIATION ADMINISTRATION WASHINGTON D C SYSTEMS RESEARCH AND DEVELOPMENT SERVICE

A COMPARISON OF AIR RADIONAVIGATION SYSTEMS (FOR HELICOPTERS IN OFF-SHORE AREAS). (U)

DESCRIPTIVE NOTE: FINAL REPT.,
AUG 76 20P QUINN,GEORGE H. ;
REPT. NO. FAA-RD-76-146

UNCLASSIFIED REPORT

DESCRIPTORS: *RADIO NAVIGATION, *DOPPLER NAVIGATION, *INERTIAL NAVIGATION, *NAVIGATIONAL AIDS, HELICOPTERS, OFFSHORE, FLIGHT PATHS, OMEGA NAVIGATION, VERY LOW FREQUENCY, LORAN, OMNIDIRECTIONAL, TACAN, DISTANCE MEASURING EQUIPMENT, GLOBAL POSITIONING SYSTEM, NAVIGATION SATELLITES, RADIO BEACONS (U)
IDENTIFIERS: LORAN C (U)

THIS PAPER EXAMINES THE TECHNICAL POTENTIAL OF TEN NAVIGATION SYSTEMS THAT MAY MEET SPECIFIC IFR EN ROUTE NAVIGATION REQUIREMENTS FOR HELICOPTERS OPERATING IN OFF-SHORE AREAS. TECHNICAL FACTORS CONSIDERED ESSENTIAL FOR NAVIGATION ARE: (1) OPERATIONAL RANGE, (2) OPERATIONAL ALTITUDE, (3) ACCURACY, AND (4) RELIABILITY. NOT ADDRESSED IN THIS PAPER ARE SUCH OPERATIONAL FACTORS AS PILOT WORKLOAD, NUMBER OF WAY POINTS, TYPE OF DISPLAY, ETC. ESTIMATED USER EQUIPMENT COST WILL BE INCLUDED BECAUSE OF ITS IMPORTANCE IN SYSTEM SELECTION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A031 770 17/7
AEROSPACE GUIDANCE AND METROLOGY CENTER NEWARK AIR FORCE STATION OHIO

PROCEEDINGS OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS QUARTERLY MEETING (6TH) HELD AT ST. PETERSBURG, FLORIDA, ON 25-27 FEBRUARY 1975. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
FEB 75 222P STAUFFER,RUSSELL B. ;
REPT. NO. AGMC-76-007

UNCLASSIFIED REPORT

DESCRIPTORS: *LIFE CYCLES, *COST ANALYSIS, *INERTIAL SYSTEMS, *MEETINGS, *INERTIAL NAVIGATION, COSTS, BUDGETS, LOGISTICS, DESIGN TO COST, JOINT MILITARY ACTIVITIES, MAINTENANCE, SPARE PARTS, MANAGEMENT PLANNING AND CONTROL, ACQUISITION, ECONOMICS, RELIABILITY(ELECTRONICS) (U)

THESE PROCEEDINGS DESCRIBE THE ACTIVITIES OF THE SIXTH QUARTERLY MEETING OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS HELD 25 - 27 FEBRUARY 1975 IN ST. PETERSBURG, FLORIDA. THE PROCEEDINGS CONTAIN THE TEXTS AND SLIDES (WHERE AVAILABLE) OF THE INVITED PAPERS AND THE RESULTS OF SUB-GROUP MEETINGS ON CREATION OF AN LCC TASK GROUP DESCRIPTIVE PAPER AND PREPARATION OF INPUT/OUTPUT SPECIFICATIONS AND FINALIZATION OF VARIABLE NAMES FOR THE LCC MODEL UNDER DEVELOPMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A032 033 12/1 17/7
TECHNION - ISRAEL INST OF TECH HAIFA DEPT OF AERONAUTICAL ENGINEERING

ITERATIVE ORTHOGONALIZATION OF THE DIRECTION COSINE MATRIX. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUN 74-31 MAY 76,
JUL 76 105P MEYER,J. ;BAR-ITZHACK,I.
Y. ;
REPT. NO. TAE-286
CONTRACT: AF-AFOSR-2743-74
PROJ: AF-6095
MONITOR: AFAL TR-76-212

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION,
*MATRICES(MATHEMATICS), DIFFERENTIAL EQUATIONS,
ITERATIONS, ALGORITHMS, NUMERICAL INTEGRATION,
COMPUTATIONS, COMPUTER APPLICATIONS, ISRAEL (U)
IDENTIFIERS: *DIRECTION COSINE MATRIX (U)

WHEN THE DIRECTION COSINE MATRIX (DCM) IS USED IN STRAPDOWN INERTIAL NAVIGATION OR OTHER AEROSPACE SYSTEMS TO DESCRIBE VEHICULAR ATTITUDE, IT IS COMPUTED INACCURATELY DUE TO THE USE OF FAST BUT IMPRECISE ALGORITHMS, AND THE RESULTING MATRIX IS OFTEN NOT ORTHOGONAL. BY PERIODICALLY RESTORING THE ORTHOGONALITY OF THE ERRONEOUS DCM, THE ERRORS CAN BE REDUCED. A NATURAL WAY OF RESTORING THE ORTHOGONALITY IS TO REPLACE THE DCM WITH AN ORTHOGONAL MATRIX WHICH IS CLOSEST IN THE EUCLIDEAN SENSE TO THE COMPUTED DCM. THE EXPRESSION FOR THIS MATRIX, WHICH IS OF COURSE A FUNCTION OF THE COMPUTED DCM, IS DIFFICULT TO EVALUATE EXPLICITLY, SO THAT ITERATIVE TECHNIQUES HAVE BEEN SUGGESTED IN THIS WORK AND ELSEWHERE. THE USE OF ITERATIVE TECHNIQUES RAISES THE QUESTION OF CONVERGENCE CRITERIA AND PROPERTIES WHICH HAD NOT BEEN THOROUGHLY INVESTIGATED. THIS WORK DEALS WITH THE INVESTIGATION OF THE CONVERGENCE OF FIVE SUCH ITERATIVE TECHNIQUES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A032 538 15/5 17/4 1/3
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF SYSTEMS AND LOGISTICS

AN ANALYSIS OF USAF DEPOT LEVEL MAINTENANCE CAPABILITY TO MEET SURGE REQUIREMENTS FOR A RIW ITEM: THE C/KC-135, C-141 INERTIAL NAVIGATION SYSTEM. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
SEP 76 147P SHARP,GARY W. ;TOSHACH, JOHN C. ;
REPT. NO. SLSR-15-76B

UNCLASSIFIED REPORT

DESCRIPTORS: *MAINTENANCE MANAGEMENT, *INERTIAL NAVIGATION, MAINTENANCE, REPAIR, LIFE CYCLE COSTS, REQUIREMENTS, THESES, AIRCRAFT EQUIPMENT, JET TRANSPORT PLANES (U)
IDENTIFIERS: RELIABILITY IMPROVEMENT WARRANTY, C-135 AIRCRAFT, KC-135 AIRCRAFT, C-141 AIRCRAFT (U)

THE STUDY PRESENTS AN ANALYSIS OF THE IMPACT OF AN RIW CONTRACT ON THE MAINTENANCE SUPPORT OF THE C/KC-135, C-141 INERTIAL NAVIGATION SYSTEM IN THE EVENT OF A NATIONAL EMERGENCY. THE STUDY REVEALED THAT ADEQUATE SUPPORT COULD BE MAINTAINED THROUGH A COMBINATION OF THE INS CONTRACTOR'S MAINTENANCE SUPPORT AND THE REPAIR CAPABILITY THAT COULD BE DEVELOPED BY IN-HOUSE REPAIR FACILITIES, IF THE CONTRACTOR MEETS THE GUARANTEED MTBF. FAILURE TO MEET THE GUARANTEED MTBF WOULD RESULT IN DISRUPTIONS OF SUPPORT. THE STUDY RECOMMENDS AN ANALYSIS OF SUPPORT CAPABILITIES TO MEET NATIONAL EMERGENCY SURGES PRIOR TO COMMITMENT TO RELIABILITY IMPROVEMENT WARRANTIES FOR SOLE MAINTENANCE SUPPORT. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A033 418 17/7 14/1 5/1
FAIRCHILD CAMERA AND INSTRUMENT CORP MOUNTAIN VIEW CALIF
SEMICONDUCTOR COMPONENTS DIV

PROCEEDINGS OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS, QUARTERLY MEETING, 29-31 JULY 1975 AT FAIRBORN, OHIO. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUL 75 195P STAUFFER,RUSSELL B. ;
REPT. NO. AGMC-76-006

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL SYSTEMS, *LIFE CYCLE COSTS, *INERTIAL NAVIGATION, MEETINGS, JOINT MILITARY ACTIVITIES, DESIGN TO COST, MODELS, GUARANTEES, FAILURE, RELIABILITY, AVIONICS, JET FIGHTERS, SYMPOSIA (U)
IDENTIFIERS: F-16 AIRCRAFT, WARRANTIES (U)

THESE PROCEEDINGS DESCRIBE THE SEVENTH QUARTERLY MEETING OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS HELD 29-31 JULY 1975 IN FAIRBORN, OHIO. THE CONFERENCE PROCEEDINGS INCLUDE THE SLIDES AND TEXTS OF THE INVITED PAPERS WHICH WERE AVAILABLE, THE MINUTES OF THE EXECUTIVE BOARD MEETING, A LIST OF TERMS AND ACRONYMS USED IN LIFE CYCLE COSTING, AND REPORTS OF PROGRESS IN SPECIAL WORKING GROUPS AND ON THE TASK GROUPS LIFE CYCLE COST MODEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A034 278 17/7
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

COVARIANCE ANALYSIS OF KALMAN FILTERS PROPOSED FOR A RADIOMETRIC AREA CORRELATOR/ INERTIAL NAVIGATION GUIDANCE SYSTEM. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
DEC 76 156P FITSCHEN,CHARLES KENNETH ;
REPT. NO. GE/EE/76D-23

UNCLASSIFIED REPORT

DESCRIPTORS: *KALMAN FILTERING, *INERTIAL NAVIGATION, *RADIOMETRY, *WEAPON DELIVERY, COVARIANCE, STRAPPED DOWN SYSTEMS, RADIOMETERS, STANDOFF (U)
IDENTIFIERS: *AREA CORRELATORS (U)

IN THIS REPORT, A COVARIANCE ANALYSIS IS PERFORMED ON TWO KALMAN FILTERS PROPOSED FOR USE IN A WEAPON SYSTEM UTILIZING A STRAPDOWN INERTIAL NAVIGATION SYSTEM (INS), UPDATED BY POSITION DATA FROM A RADIOMETRIC AREA CORRELATOR (RAC), FOR GUIDANCE. FILTER PERFORMANCE IS ANALYZED WHEN PRIMARY NAVIGATION INFORMATION IS PROVIDED BY A SPERRY INS, WHICH USES LASER GYROSCOPES, AND WHEN AN INS EMPLOYING CONVENTIONAL DRY-TUNED GYROSCOPES, MANUFACTURED BY HAMILTON-STANDARD, IS INCORPORATED INTO THE WEAPON SYSTEM. FOR THE COVARIANCE ANALYSIS, TRUTH MODELS IN THE FORM OF LINEAR STATE EQUATIONS ARE PRESENTED WHICH REFLECT THE BEST DESCRIPTION OF THE WEAPON SYSTEM WHEN EITHER THE SPERRY OR HAMILTON-STANDARD INS IS USED. THE SPERRY SYSTEM MODEL IS COMPOSED OF 46 STATES AND THE HAMILTON-STANDARD SYSTEM MODEL 61 STATES. PRIMARY EMPHASIS IN THIS INVESTIGATION IS PLACED ON MINIMIZING SYSTEM TERMINAL NAVIGATION ERROR. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A034 921 17/7
AIR FORCE FLIGHT TEST CENTER EDWARDS AFB CALIF

INERTIAL NAVIGATION SYSTEMS TESTING HANDBOOKS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUL 76 186P PLEWS,LARRY D. ;BRINKLEY,
CHARLES W. ;REESER,KENNETH E. ;
REPT. NO. AFFTC-TIH-76-1

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *HANDBOOKS, *FLIGHT TESTING, TEST METHODS, COMPUTER PROGRAM DOCUMENTATION, COMPUTER PROGRAMS, SYSTEMS ENGINEERING, DATA REDUCTION (U)

THIS HANDBOOK DESCRIBES THE METHODS BEING USED IN TESTING AN INERTIAL NAVIGATION SYSTEM AT THE AIR FORCE FLIGHT TEST CENTER (AFFTC). FUTURE TECHNOLOGICAL ADVANCES, DEVIATIONS FOR PECULIAR CHARACTERISTICS OF INDIVIDUAL TEST PROGRAMS, AND COST CONSTRAINTS MAY NECESSITATE OTHER METHODS BEING USED IN SOME CASES. A BACKGROUND ON INERTIAL NAVIGATION SYSTEMS, FLIGHT TESTING, AND DOCUMENTATION OF COMPUTER SOFTWARE DEVELOPED FOR POST-FLIGHT REDUCTION OF DATA IS PRESENTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A035 028 17/7
ARMAMENT DEVELOPMENT AND TEST CENTER EGLIN AFB FLA

TEST PLANNING INFORMATION AND PROCEDURES FOR TESTING AIRCRAFT NAVIGATION SYSTEMS, (U)

OCT 75 115P KING,ALTON B. ;SANDLIN, LARRY F. ;
REPT. NO. ADTC-TR-75-70

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, NAVIGATORS, AIRBORNE, TEST METHODS, DATA REDUCTION, HELICOPTERS, JET FIGHTERS, CIRCULAR ERROR PROBABLE, PALLETS, MISSION PROFILES, PLANNING, TEST FACILITIES (U)
IDENTIFIERS: UH-1H AIRCRAFT, RF-4C AIRCRAFT (U)

THE DESIGNATION OF THE CENTRAL INERTIAL GUIDANCE TEST FACILITY (CIGTF) AS THE DOD FOCAL POINT FOR AIRCRAFT INERTIAL NAVIGATOR TEST AND EVALUATION REQUIRED THAT A GENERALIZED TEST PLAN BE WRITTEN TO GOVERN ALL FUTURE TESTS. THIS DOCUMENT OUT LINES SUCH A STANDARDIZED TEST, INCLUDING TEST PHILOSOPHY AND OBJECTIVES, THE TEST APPROACH AND AN OUTLINE OF THE TEST PROCEDURE. IT PROVIDES THE READER WITH AN UNDERSTANDING OF THE 6585TH TEST GROUP'S AIRCRAFT NAVIGATOR TEST CAPABILITIES, THE TYPES OF TEST PROGRAMS CURRENTLY AVAILABLE, AND THE REQUIREMENTS NECESSARY FOR AN AGENCY TO ENTER SYSTEMS IN THESE PROGRAMS. TEN APPENDICES WHICH COVER AREAS SUCH AS ANALYSIS METHODS, LABORATORY TESTING, AND INSTRUMENTATION, ARE INCLUDED TO PROVIDE THE CUSTOMER WITH ADDITIONAL DETAILED INFORMATION.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A041 677 17/7 9/2 9/5
AIR FORCE AVIONICS LAB WRIGHT-PATTERSON AFB OHIO

CONVERSION OF COMPUTER SOFTWARE FOR THE GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM. VOLUME II. SKC-2000 COMPUTER LISTING. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 73-DEC 75,
FEB 77 213P MIKULSKI,WILLIAM ;SHEPHARD,
WILLIAM E. ;
REPT. NO. AFAL-TR-77-8-VOL-2
PROJ: 1927
TASK: 02

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 1, AD-A041 711.

DESCRIPTORS: *NAVIGATION COMPUTERS, *INERTIAL NAVIGATION, *GYROSCOPES, *ELECTROSTATIC FIELDS, *COMPUTER PROGRAMS, ELECTRICAL EQUIPMENT, DIGITAL COMPUTERS, INERTIAL MEASUREMENT UNITS, ALIGNMENT (U)
IDENTIFIERS: SKC-2000 COMPUTERS, HDC-601 COMPUTERS, ELECTROSTATIC GYROSCOPES, GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM, GEANS(GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM), WUAFAL19270202, PE64609F (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A041 711 17/7 9/5 9/2
AIR FORCE AVIONICS LAB WRIGHT-PATTERSON AFB OHIO

CONVERSION OF COMPUTER SOFTWARE FOR THE GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM. VOLUME I. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 73-DEC 75, FEB 77 127P MIKULSKI,WILLIAM ;SHEPHARD, WILLIAM E. ;
REPT. NO. AFAL-TR-77-8-VOL-1
PROJ: 1927
TASK: 02

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO VOLUME 2, AD-A041 677.

DESCRIPTORS: *NAVIGATION COMPUTERS, *GYROSCOPES, *ELECTROSTATIC FIELDS, *INERTIAL NAVIGATION, *COMPUTER PROGRAMS, ELECTRICAL EQUIPMENT, DIGITAL COMPUTERS, INERTIAL MEASUREMENT UNITS, ALIGNMENT (U)
IDENTIFIERS: GEANS(GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM), GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM, ELECTROSTATIC GYROSCOPES, SKC-2000 COMPUTERS, HDC-601 COMPUTERS, WUAFAL19270202, PE64609F (U)

THE GIMBALLED ELECTROSTATIC GYRO NAVIGATION SYSTEM (GEANS) CONVERSION EFFORT CONSISTED OF THE CONVERSION OF AN ASSEMBLY LANGUAGE PROGRAM FOR THE HONEYWELL HDC-601 COMPUTER TO ANOTHER ASSEMBLY LANGUAGE PROGRAM FOR THE SINGER/KEARFOTT SKC-2000 COMPUTER. THE HDC-601 AND SKC-2000 WERE RUN IN REAL TIME SIMULTANEOUSLY. THE SKC-2000 REAL TIME EXECUTIVE AUTOMATICALLY SYNCHRONIZED WITH THE HDC-601 SO BOTH PROGRAMS RAN IN PARALLEL, USING THE SAME INPUT DATA FROM THE INERTIAL MEASUREMENT UNIT (IUM). ALIGNMENT AND NAVIGATION OUTPUT OF BOTH PROGRAMS COULD THEN BE COMPARED AND THE SKC-2000 OUTPUT VERIFIED. THE CONVERSION WAS COMPLETED SUCCESSFULLY, THE HDC-601 AND SKC-2000 OUTPUTS AGREEING TO ABOUT 0.015 NAUTICAL MILES PER HOUR. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A042 419 17/7
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHOOL OF ENGINEERING

GRAVITY MODELING FOR PRECISE TERRESTRIAL INERTIAL NAVIGATION, (U)

JUN 77 157P EDWARDS, ROBERT M. ;

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, SURFACE NAVIGATION, GRAVITY, GEOPOTENTIAL, GRAVITY ANOMALIES, GEODESY, FAST FOURIER TRANSFORMS, NAVIGATION, MODELS, CRUISE MISSILES, GRADIOMETERS, PRECISION (U)
IDENTIFIERS: TERRESTRIAL NAVIGATION (U)

A HISTORICAL PERSPECTIVE OF GRAVITY MODELING FOR TERRESTRIAL NAVIGATION IS PRESENTED. THE TRADITIONAL ELLIPSOIDAL MODEL IS EXPLAINED, AND THE CONSEQUENT ERRORS ARE DISCUSSED. THE PROPAGATION OF THESE ERRORS INTO NAVIGATION ESTIMATION ERRORS IS PRESENTED. A BRIEF SURVEY OF ADVANCED MODELING METHODS AND THE PERTINENT THEORY IS PRESENTED. THE SYSTEM DESIGN PROBLEM OF SELECTING AN ADVANCED GRAVITY MODEL IS PRESENTED AS A SCENARIO TO MOTIVATE THE PROPOSED RESEARCH. TO ADDRESS THIS PROBLEM, A NEW THEORETICAL ANALYSIS TECHNIQUE IS DEVELOPED. THIS TECHNIQUE INCLUDES THE EFFECTS OF NAVIGATION ERROR PROPAGATION, THE STATISTICS OF THE ANOMALOUS FIELD (THE RESIDUAL AFTER ELLIPSOIDAL OR OTHER REFERENCE FIELD MODELING), THE STATISTICS OF GRAVITY SURVEY ERRORS, AND THE ADVANCED GRAVITY MODELING. THESE EFFECTS ARE COMBINED TO YIELD A MEASURE OF SYSTEM PERFORMANCE COST AS REFLECTED IN THE NAVIGATION ERROR STATE COVARIANCE DUE TO GRAVITY MODELING ERRORS ACTING ALONE. THIS REPORT CONTAINS REFERENCES TO 82 ITEMS IN THE OPEN LITERATURE PERTINENT TO THIS SUBJECT AREA. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A042 987 17/7 14/4
MARTIN MARIETTA AEROSPACE DENVER COLO DENVER DIV

MICRON RELIABILITY ANALYSES. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. APR 74-APR 77, JUN 77 167P BURROWS,RICHARD W. ;HOLTZ, RAY A. ;
REPT. NO. MCR-74-164
CONTRACT: F33615-74-C-1107
PROJ: 666A
TASK: 03
MONITOR: AFAL TR-77-62

UNCLASSIFIED REPORT

DESCRIPTORS: *INERTIAL NAVIGATION, *MICROMINIATURIZATION, *RELIABILITY(ELECTRONICS), JET FIGHTERS, BEAM LEADS, TANTALUM CAPACITORS, THERMAL STABILITY, FLY BY WIRE CONTROL, INTEGRATED CIRCUITS, MATHEMATICAL MODELS, TEST METHODS, COSTS, JET FIGHTERS (U)
IDENTIFIERS: F-16 AIRCRAFT, WUAFAL666A0323, PE63203F (U)

THE PURPOSE OF THE MICRON RELIABILITY ANALYSIS PROGRAM WAS FOR MARTIN MARIETTA CORPORATION (MMC) TO ASSIST THE AIR FORCE AVIONICS LABORATORY TO ACHIEVE A MICRON INERTIAL NAVIGATION SYSTEM THAT WOULD EXHIBIT A HIGH RELIABILITY AND PROVIDE A SIGNIFICANTLY REDUCED COST-OF-OWNERSHIP. THE APPROACH USED BY MMC TO HELP ATTAIN THE SPECIFIED PROGRAM GOALS INCLUDED, BUT WAS NOT LIMITED TO, PREPARING A RELIABILITY PROGRAM PLAN AND RELIABILITY TEST PLAN, PERFORMING INDEPENDENT RELIABILITY ANALYSES AND ASSESSMENTS, PREPARING DESIGN GUIDELINES, PERFORMING TRADE OFF STUDIES, DEVELOPING RELIABILITY MODELS, SUPPLYING DATA, AND MONITORING TESTING. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A043 335 17/7 17/3 14/2
ANALYTIC SCIENCES CORP READING MASS

GRADIOMETER-AIDED RAPID GRAVITY SURVEY SYSTEM. (U)

DESCRIPTIVE NOTE: CONTRACT REPT.
APR 77 33P
REPT. NO. TASC-SP-957-1-1
CONTRACT: DAAG53-76-M-5899
MONITOR: ETL 0112

UNCLASSIFIED REPORT

DESCRIPTORS: *GRADIOMETERS, *INERTIAL NAVIGATION, *POSITION FINDING, ERRORS, KALMAN FILTERING, GRAVITY, REAL TIME, ACCELEROMETERS, GYROSCOPES, DATA PROCESSING, DEFLECTION, COMPUTERIZED SIMULATION (U)
IDENTIFIERS: *RAPID GRAVITY SURVEY SYSTEM, *INERTIAL POSITIONING SYSTEM, RGSS(RAPID GRAVITY SURVEY SYSTEM), ZERO VELOCITY, VERTICAL DEFLECTION END CALIBRATION (U)

THIS REPORT CONSIDERS A MOBILE VEHICLE EQUIPPED WITH BOTH AN INERTIAL POSITIONING SYSTEM (IPS) AND A GRADIOMETER. FOR SUITABLE GRADIOMETER-AIDING CONFIGURATIONS, THE FOLLOWING VARIABLES ARE DETERMINED: (1) REAL-TIME VS POST-MISSION DATA PROCESSING, (2) PRESENCE OR ABSENCE OF TERMINAL CALIBRATION DATA, (3) CONTINUOUS TIME VS HALTED VEHICLE GRADIOMETER OPERATION, (4) GRADIOMETER ERRORS, (5) ZERO VELOCITY AND GRADIOMETER CALIBRATION STOPS, AND (6) GYRO AND ACCELEROMETER ERRORS. THIS REPORT CONCLUDED THAT ONE SEC OR BETTER GRADIOMETER-AIDED RGSS PERFORMANCE IN OPEN TRAVERSE IS UNLIKELY WITHOUT VERTICAL DEFLECTION END CALIBRATION. IN ADDITION, THE KEYNOTE OF SUCCESSFUL RGSS/GRADIOMETER INTEGRATION WILL BE CONTROL AND COMPENSATION OF SYSTEM BIAS AND LOW FREQUENCY ERROR SOURCES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A043 610 17/7
INCOSYM INC CALABASAS CA

INCOFLEX TWO AXES ACCELEROMETER PROGRAM. (U)

DESCRIPTIVE NOTE: FINAL REPT. 22 JUN 76-26 JUL 77,
AUG 77 43P RUSSELL,J. ;CRAIG,R. J. ;
CONTRACT: DAAK40-76-C-1025

UNCLASSIFIED REPORT

DESCRIPTORS: *ACCELEROMETERS, *INERTIAL NAVIGATION, *PENDULUMS, SUSPENSION DEVICES, MULTIPLE OPERATION, THERMAL STABILITY, TEMPERATURE COEFFICIENTS, ACCURACY, DRIFT, BIAS, TORQUE, TEST METHODS, FLEXING, FEEDBACK (U)

THE PURPOSE OF THE CONTRACT WAS TO BUILD 2 TWO-AXES ACCELEROMETERS, TEST THEM AND DELIVER TO THE U.S. ARMY MISSILE COMMAND. THESE ACCELEROMETERS WERE TO BE ACCURATE ENOUGH FOR THE INERTIAL NAVIGATION BUT WERE TO REQUIRE NO HEATING OR THERMAL CONTROL. THIS REPORT DOCUMENTS THE EFFORT AND THE TEST RESULTS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 763 718 17/7
AEROSPACE CORP EL SEGUNDO CALIF ENGINEERING SCIENCE OPERATIONS

APPLICATION OF EXTENDED KALMAN FILTERING TO A DYNAMIC LABORATORY CALIBRATION OF AN INERTIAL NAVIGATION SYSTEM, (U)

MAR 73 250P HELLINGS,FRAZIER J. ;
REPT. NO. TR-0073(3115)-3
CONTRACT: F04701-72-C-0073
MONITOR: SAMSO TR-73-219

UNCLASSIFIED REPORT

DESCRIPTORS: (*INERTIAL NAVIGATION, DATA PROCESSING), GYRO COMPASSES, ACCELEROMETERS, DETECTORS, ALIGNMENT, ERRORS, MATHEMATICAL MODELS, REGRESSION ANALYSIS (U)
IDENTIFIERS: COMPUTER AIDED ANALYSIS, KALMAN FILTERS (U)

THE REPORT DESCRIBES A DATA REDUCTION TECHNIQUE THAT OBTAINS ESTIMATES OF INERTIAL SENSOR ERROR MODEL COEFFICIENTS FROM A DYNAMIC LABORATORY CALIBRATION OF A TYPICAL INERTIAL NAVIGATION SYSTEM. THE ERROR MODEL COEFFICIENTS ARE THOSE ASSOCIATED WITH GYROS, ACCELEROMETERS, AND THEIR MISALIGNMENT ERRORS THAT HAVE BEEN FOUND BY TEST AND ANALYSIS TO BE THE PREDOMINANT SOURCES OF ERROR AFFECTING SYSTEM ACCURACY. ALL THE ERROR TERMS CONSIDERED ARE CATEGORIZED AS EITHER FIXED (INDEPENDENT OF APPLIED ACCELERATION), FIRST-ORDER (PROPORTIONAL TO THE FIRST POWER OF ACCELERATION), OR HIGHER-ORDER TERMS, WHICH ARE PROPORTIONAL TO THE SQUARE OR CUBE OF ACCELERATION. IN THE CASE OF THE HIGHER-ORDER TERMS, THE ERROR MODEL COEFFICIENTS OF INERTIAL GRADE SENSORS ARE FROM ONE TO FOUR ORDERS OF MAGNITUDE SMALLER THAN THE FIXED AND FIRST-ORDER TERMS. (MODIFIED AUTHOR ABSTRACT) (U)

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•ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT PARIS (FRANCE)

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•AERONAUTICAL SYSTEMS DIV WRIGHT-PATTERSON AFB OHIO PRAM PROGRAM OFFICE

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•AEROSPACE SYSTEMS INC BURLINGTON MASS

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NORTH ATLANTIC (NAT) AIDED INERTIAL NAVIGATION SYSTEM SIMULATION. VOLUME I. TECHNICAL RESULTS.

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•AIR FORCE AVIONICS LAB HOLLOMAN AFB N MEX DETACHMENT 1

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AD- 902 092

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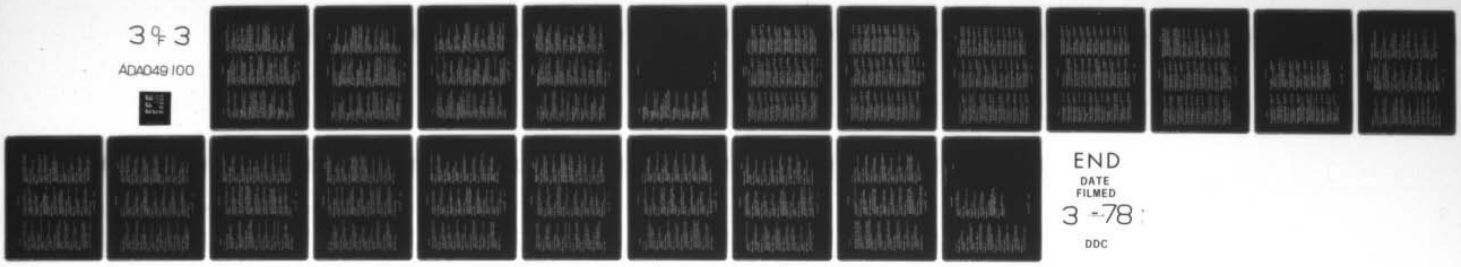

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