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A COMPENDIUM OF NAS ENROUTE SYSTEM PERFORMANCE, ANALYSIS, AND M--ETC(U)
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A COMPENDIUM OF NAS ENROUTE SYSTEM PERFORMANCE, ANALYSIS, AND MODELING DOCUMENTATION RELATIVE TO THE MODEL A3D2 ENROUTE OPERATIONAL SYSTEM

FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D. C.

SEPTEMBER 1976

A COMPENDIUM OF NAS ENROUTE SYSTEM PERFORMANCE, ANALYSIS, AND MODELING DOCUMENTATION RELATIVE TO THE MODEL A3d2 ENROUTE OPERATIONAL SYSTEM

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Robert F. Irwin

September 1976

Final Report

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20590

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-76-175		

4. Title and Subtitle	5. Report Date
A Compendium of NAS EnRoute System Performance, Analysis, and Modeling Documentation Relative to the Model A3d2 EnRoute Operational System	September 1976
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s)	
Mae Ohman and Robert F. Irwin	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Federal Aviation Administration Systems Research & Development Service, ATC Systems Division, Document Programming Branch (ARD-140) NAFEC, Atlantic City New Jersey 08405	11. Contract or Grant No. 122-109-08A
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, D.C. 20590	Final Report Jan 1969 to June 1976
	14. Sponsoring Agency Code ARD-140 (NAFEC)

15. Supplementary Notes

16. Abstract

The documents identified in this compendium may be in the form of Design Concepts, Design Specifications, Performance Memorandums or Reports, or the response to FAA requested studies that may, or may not have been implemented into the EnRoute Model A3d2 Operational Software Program.

17. Key Words	18. Distribution Statement
EnRoute, Software, Operational Program Special Documentation, IBM Contract FA65WA-1395.	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	44	$4.00 - 3.00

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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METRIC CONVERSION FACTORS

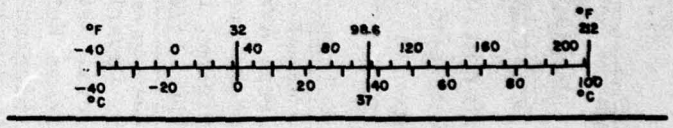
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, ⊕ Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



A COMPENDIUM OF NAS ENROUTE SYSTEM PERFORMANCE-ANALYSIS-MODELING DOCUMENTATION

PRODUCED

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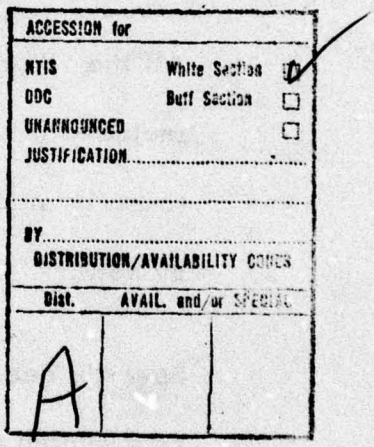
IBM/NAFEC

UNDER CONTRACT

FA65-WA-1395



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DEVELOPMENT PROGRAMMING BRANCH

ARD-140, NAFEC, BLDG. 7

ATLANTIC CITY, N.J. 08405

INTRODUCTION

This report covers the work performed in support of the Design, Development and Implementation of the Automated National Airspace System EnRoute Operational Program under Contract FA 65-WA-1395. A function of the contractor's "System Performance Analysis Department" was to prepare "Working Papers" for review and evaluation, relative to system design improvements, in addition to the performance measurements and analysis of newly developed systems.

The documents included in this compendium may be in the form of Design concepts, Design Specifications, Performance Memorandums or Reports, or responses to FAA requested studies, that may, or may not have been implemented into the Model A3d2 Operational Program.

All the "Working Papers" that were produced under the contract are not included in this compendium since they reflected studies that were pertinent to early model deliveries that are no longer relevant to the present operational system.

Specific questions relative to the contents or status of these documents may be directed to personnel of the Central Programming Branch, ARD-140, NAFEC, Atlantic City, New Jersey 08405.

Copies of these studies are available from the NAS DOCUMENTATION FACILITY, Bldg. 53, FAA/NAFEC, Atlantic City, N.J. 08405.

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DEFINITIONS

of

DOCUMENT NAMES

APUD.....ANALYSIS PROGRAM USERS DOCUMENT

SAAM.....SYSTEM ARCHITECTURE ANALYSIS MEMORANDUM

SAAR.....SYSTEM ARCHITECTURE ANALYSIS REPORT

SPAM.....SYSTEM PERFORMANCE ANALYSIS MEMORANDUM

SPAR.....SYSTEM PERFORMANCE ANALYSIS REPORT

SPAS.....SYSTEM PERFORMANCE ANALYSIS SPECIFICATION

ANALYSIS PROGRAM USER'S DOCUMENT

Document #	APUD 01.01 APUD 01.02
Date	April 29, June 12, Aug. 29, 1974
Title	Central Processor Utilization/Response Time CPU/RT Program

Abstract

The Central Processor Utilization/Response Time (CPU/RT) Program is a FORTRAN program which calculates and reports Compute Element (CE) utilization, Input-Output Control Element (IOCE) utilization (for the processor only), and response times for messages of priorities 2 through 6.

SYSTEMS ARCHITECTURE ANALYSIS MEMORANDUM

Document #	SAAM-01
Date	April 21, 1972
Title	Documentation/Purpose & Procedure
Abstract	The document establishes the procedures for preparation and distribution of NAS Systems Analysis documentation.

Document #	SAAM-02
Date	April 21, 1972
Title	Model 3 Storage Utilization
Abstract	The CEST program is used to estimate the SE (Storage Element) requirements for the ARTCC sites. The CEST program uses a set of input parameters to determine the estimated core requirement and then computes the number of 32K SEs needed to meet that requirement.

Document #	SAAM-03
Date	March 1, 1972
Title	Gross Design/Priority of FDEP Outputs
Abstract	This memo presents an architectural review of CR0087 entitled "Priority of FDEP Outputs". Contents include a background of the CR, conclusions and recommendations concerning implementation.....

Document #	SAAM-04
Date	March 1, 1972
Title	Utility/CDC Driver Program
Abstract	Considerations involved in development of a program to drive the CDC in a NOSS environment.....

Document #	SAAM-05
Date	March 2, 1972
Title	Performance/Lock Suspension Problem
Abstract	This memo explains a lock suspension problem caused by cyclic programs requesting mutual resources in NAS 3d1.0 In addition, a recommendation is suggested which will alleviate this problem.....

SYSTEMS ARCHITECTURE ANALYSIS MEMORANDUM

Document # SAAM-07
Date April 6, 1972
Title Performance/Recovery Recording for Model A3c0.0

Abstract This memo presents an architectural review of Recovery Recording order for Model A3c0.0. The contents includes Recovery Recording order considerations and recommendations for system performance improvement.....

Document # SAAM-09
Date April 14, 1972
Title Performance/Potential Storage Interference Problems

Abstract This memo outlines reasons for potential storage interference problems for NAS 3c0.0 and recommends a new storage mapping scheme.....

Document # SAAM-10
Date May 5, 1972
Title Performance/Recovery Recording for Model A3d1.0

Abstract This memo presents an architectural review of Recovery Recording order for Model A3d1.0. The contents includes Recovery Recording order constraints and recommendations for system performance improvements.....

Document # SAAM-11
Date May 5, 1972
Title Performance/Recovery Recording for Model A3c0.0

Abstract This memo presents an architectural review of recovery recording order for Model A3c0.0. The contents includes recovery recording order constraints and recommendations for system performance improvement.....

Document # SAAM-12
Date June 1, 1972
Title Documentation/Radar Data Processing & Automatic Tracking

Abstract Functional review of Radar Data Processing and Automatic Tracking in Model 3d Version 2.....

SYSTEMS ARCHITECTURE ANALYSIS MEMORANDUM

Document #	SAAM-14
Date	September 5, 1972
Title	Methodology/Simplified FDP Guidelines
Abstract	Guidelines are presented for a study entitled: "A Reduced or Simplified FDP with the 3d2 RDP.....

Document #	SAAM-15
Date	November 17, 1972
Title	Disk Storage
Abstract	This memorandum, via a Disk Storage Chart, describes the disk storage estimates for A3d1 (maximum of 148 cylinders and 19 tracks) and for A3d2 (187 cylinders and 8 tracks).

Document #	SAAM-17
Date	November 9, 1972
Title	Gross Design
Abstract	The intent of this memorandum is to identify specific functional areas of study for a reduced or simplified FDP system to operate in conjunction with 3d2 RDP.

Document #	SAAM-20
Date	May 18, 1973
Title	Minimum Configuration Fail-Soft Sizing Results
Abstract	SAAM-20 represents the results of the IBM sizing activity in support of MITRE Minimum Configuration Fail-Soft Study.

SYSTEM ARCHITECTURE ANALYSIS REPORTS

Document # SAAR-01
Date February 8, 1972
Title Shared Storage Using Fixed Buffering.

Abstract This report presents in detail, a shared storage method of main storage reduction using fixed buffering.

Document # SAAR-02
Date February 1972
Title Dynamic Buffering Overhead

This report presents an analysis of dynamic buffering modification that were used as a basis for estimating the resultant core savings and response time degradations.

Document # SAAR-03
Date July 24, 1972
Title Utility

Abstract The purpose of this document is to place NOSS Support and Utility programs in prospective. It presents the attributes, desirable functions, and design changes for the NOSS and Utility programs, and where applicable, proposals for future design of the program.

Document # SAAR-04
Date March 13, 1972
Title Dynamic Buffering

Abstract Recommended programs for Dynamic Buffering.

Document # SAAR-05
Date March 31, 1972
Title Gross Design

Abstract This report identifies two problems present in the current architecture pertaining to systems evaluation.

SYSTEM ARCHITECTURE ANALYSIS REPORT

Document #	SAAR-07
Date	May 25, 1972
Title	Performance/Redesign of Subprogram "DUZ"
Abstract	A redesign of subprogram DUZ to effect greater system throughput.

Document #	SAAR-08
Date	July 1, 1972
Title	Performance/TARP, REMONR & STATISTICS
Abstract	The inclusion of dynamic buffering in NAS, dictates that new capabilities be added to the System Performance programs. (TARP, REMONR, and STATISTICS). This paper describes the current plans for those programs and identified new data which will have to be supplied if the capabilities are to be installed.

Document #	SAAR-09
Date	September 20, 1972
Title	Gross Design-Bulk Storage File (DASD Resident)
Abstract	The Bulk Storage File (BSF) is used to support the maintenance of a large number of repetitive flight plans and to provide a source for entering the flight plans into the National Airspace System (NAS). The report also contains a general discussion of a DASD and Index Sequential Data Sets.

Document #	SAAR-10
Date	April 12, 1973
Title	Dynamic Data Buffering
Abstract	The methodology and feasibility of disk residency and buffering of proposed flight plan data is investigated in this paper.

SYSTEM ARCHITECTURE ANALYSIS REPORT

Document # SAAR-11
Date February 16, 1973
Title Storage Static Table Buffering

Abstract The methodology and feasibility of Static Table Buffering is investigated in this paper. Static Table Buffering will produce, if all items are adopted, a gross core storage savings of 8638 words or 0.26 Logical Storage Elements.

Document # SAAR-12
Date September 13, 1972
Title Conflict Prediction

Abstract The filtering efficiency of two different conflict prediction algorithms was determined for a given set of assumptions and data. The specific conclusion resulting from the analysis was, that for the assumptions and data used in this paper, the geographical filter is superior for look ahead times up to 2 or 2.5 minutes. After this look ahead value the altitude filter becomes superior.

Document # SAAR-14
Date October 5, 1973
Title Preliminary Design Resource Recovery via IOCE

Abstract This paper presents ideas and conclusions in several areas of CPU resource buy back. Several of these ideas can be considered final, others require additional study, therefore the analysis and conclusions presented should be considered preliminary.

Document # SAAR-14.1
Date November 24, 1974
Title Resource Recovery via the IOCE Analysis of Preliminary Conceptual Design

Abstract This document reports the processing, processing sensitivity, and I/O requirements of the NAS System's IOCE architecture as proposed by Resource Recovery via the IOCE (SAAR-14) The analysis as presented in this paper was instrumental in pointing out weaknesses both in the SAAR-14.0 conceptual design and the basic set of assumptions used in structuring that design. The new design being developed replaces in total, the design presented in SAAR-14.0.

SYSTEM ARCHITECTURE ANALYSIS REPORT

Document #	SAAR-14.2
Date	July 22, 1974
Title	CPU Recovery via the IOCE

Abstract

This document presents a method of reducing compute utilization by offloading additional functions to the IOCE. This proposal in conjunction with other ideas will extend the life of the 9020A Centers.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-04
Date	November 12, 1971
Title	Analysis of Radar Data Buffer Storage Interference in the Radar Processing Subsystem
Abstract	This analysis investigates the impact of SE Interference on the radar processing programs, both CE and IOCE resident, caused by the use of the Radar Data Table (RT). This analysis determines the interference to be expected when these functions vie for access to the single SE containing RT.

Document #	SPAR-08
Date	January 7, 1972
Title	Effects of the Collimation and Registration Analysis
Abstract	This study addresses the effects which the operation of the collimation and registration functions exert on the operation of the Radar Processing and Tracking (RPAT) subsystem. Effects are discussed in terms of IOCE processing time, CE processing time, and radar data age.

Document #	SPAM-21
Date	May 17, 1972
Title	Initial 3D2 Analysis
Abstract	This document presents the results of a series of CSS Model simulations of the 3D2 System Performance on a 9020D Duplex Configuration at a 100% load (444 tracks) (simulating the entire system in core storage, i.e., no dynamic buffering). The analysis describes the impact on system performance due to the addition of the flight plan aided tracking function and the automatic handoff initiation function to the 3D1 System.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAM-23.00.01
Date	July 26, 1972
Title	Rate of Change of Mode C Altitude Reports
Abstract	This document establishes a basis for determining the simulation loading factor for Mode C beacon modifications as a function of track load. The analysis is based on the specified distribution of tracks into classes, in particular, arrival, departure, over flight, and withins. The number of Mode C changes per subscan derived here is 21.

Document #	SPAM-29
Date	May 31, 1972
Title	Initial Analysis of the Current Purge Algorithm
Abstract	This document reports the results of continuing investigation and analysis of the dynamic buffering procesures in the NAS System.

Document #	SPAR-29
Date	December 8, 1972
Title	Recommendations for Code Modules to be buffered on the Dynamic Buffered System
Abstract	This document presents specific recommendations as to which code modules should be buffered in the dynamic buffered system and also includes the assumptions and analysis used in obtaining the recommendations.

Document #	SPAR-38
Date	August 15, 1973
Title	A3d2.0 Utilization and Response Time Test Results
Abstract	This document presents tests results for test 62 and 63A on System 221, and tests 64 and 65 on System 021. The most significant aspect of the test results was in the startup/startover area.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-39
Date	January 15, 1974
Title	United Kingdom System Utilization and Response Time Test Results. Tests 64 and 65 on System UK 23Y.
Abstract	This document presents the initial United Kingdom CPU utilization and response time test results for System Test 64 and 65. The input message response times analyzed and startup timings for establish mode and re-establish mode were well within the guidelines specified in NAS-MD-318.

Document #	SPAR-40
Date	June 1974
Title	Utilization and Response Time Predictions for 3d2.0 Using the CPU/RT Algorithm
Abstract	This document was written to present NAS performance predictions for the A3d2.0 system. They are evaluated in terms of CE utilization, IOCE utilization and message response times. Insight into the Capacity of NAS, both 9020A and 9020D systems, can be obtained from these predictions.

Document #	SPAM-41
Date	August 3, 1972
Title	1982 CPU and Response Time Predictions for DCC (9020E) sites.
Abstract	This document presents the results of a series of Display Channel Complex simulation model runs based on traffic load projections for 1981 and 1982 at five centers. The purpose was to determine which centers would require triplex 9020E computers and which could use duplex configurations.

Document #	SPAR-41
Date	April 1974
Title	Validation/Calibration Modelling Effort
Abstract	This document presents the results of a validation and calibration effort for the 3d2.0 version of the CSS NAS model which took place in October, November and December 1973.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document # SPAR-42
Date July 12, 1974
Title A3d2.1 Utilization and Response Time Test Results

Abstract This report presents the A3d2.1 utilization and response time test results for Tests 62 and 62A on System 533, Test 64 on System 332 and Test 65 on System 335. Input message response times and startup/startover times remained within the guidelines specified in NAS-MD-318.

Document # SPAM-43
Date October 20, 1972
Title Simulation Tape Characterization

Abstract This document presents a statistical characterization of the input data used for capacity and response time testing of the Simulated 111, 222, 333 and 444 track loads for Model A3d1.0.

Document # SPAR-43
Date July 8, 1974
Title 9020A CPU Buy Back: NAS Monitor Investigation

Abstract The NAS Monitor program was investigated and analyzed for CPU savings. There were three objectives to the study and each is described fully in this document.

Document # SPAR-44
Date August 2, 1974
Title The Effects of SAR/TAR Activity on System Performance

Abstract A study was initiated to determine the effects of System Analysis Recording and Timing Analysis Recording activity on NAS system performance. The objective was to identify the CE utilization and response time impact of operating the NAS system at higher SAR/TAR selections, similar to those used operationally at the sites.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document # SPAR-45
Date June 20, 1974
Title Main-Memory Storage Requirements for Fail-Soft

Abstract This document is the first of a series of interim reports describing the results of a study of a Fail-Soft System for the NAS CCC as proposed by Mitre Technical Report, MTR 4239. It gives the estimated main-memory storage requirements for that system. A final report will be issued upon completion of the entire study.

Document # SPAR 46.1
Date May 13, 1975
Title Disk Storage Requirements and Basic Transition Methodology For Fail-Soft

Abstract This document is one of a series of reports describing the results of the system performance analysis of a proposed Fail-Soft system for the National Airspace System Central Computer Complex. The description of the system is contained in Mitre Technical Report, MTR-4239. The FailSoft System will enable continuing computer support of Air Traffic Control operations when insufficient equipment is available for the normal NAS operational program. A final report will be issued upon completion of the entire Fail-Soft study. This document replaces interim document, SPAR 46.

Document # SPAR 47
Date July 22, 1974
Title 9020A SAR/TAR CPU Accuracy Validation

Abstract This report presents the results of the 9020A SAR/TAR CPU Accuracy Validation Analysis Task as described in SPAS 10. It recommends that an investigation be initiated in the area of TAR recording in an attempt to identify NAS programming changes which would minimize the differences in the SMI and SAR/TAR reported results.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR 47.1
Date	September 4, 1974
Title	9020D SAR/TAR CPU Accuracy Validation
Abstract	This report presents the results of the 9020D SAR/TAR CPU Accuracy Validation Analysis Task as described in SPAS 10. It recommends that an investigation in the area of TAR recording in an attempt to identify NAS programming changes which would minimize the differences in the SMI and SAR/TAR reported results. It also recommends that changes be made to the SAR/TAR reduction program to account for the TAR CPU overhead and automatically made timing adjustments to take into account the pre-TAR and post-TAR generation time.

Document #	SPAR 48
Date	August 15, 1974
Title	9020A CPU Buy Back Application Programs Investigation
Abstract	The Application Programs were investigated and analyzed for CPU savings. The study has three objectives, all of which are described in this document.

Document #	SPAR 49
Date	August 5, 1974
Title	Preliminary General Description of the A3d2.1 System
Abstract	A general description of the A3d2.1 system.

Document #	SPAR 49.1
Date	August 30, 1974
Title	A General Description of the A3d2.1 System
Abstract	A general description of the A3d2.1 System.

Document #	SPAR 50
Date	September 6, 1974
Title	Summary of the 9020A CPU Buy Back Study
Abstract	The NAS Program was investigated and analyzed for CPU savings. There were three objectives to this study: document in detail the CPU usage of the NAS Program; investigate for CPU savings those areas requiring substantial CPU resources; and recommend design changes to the NAS Program wherever substantial CPU savings can be achieved.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-51
Date	January 16, 1975
Title	A3d2.1 System Utilization and Response Time Test Results
Abstract	This document contains the A3d2.1 System CPU utilization and response time test results: Tests 62 and 602 on System 545y and Tests 64 and 604 on System 345y.

Document #	SPAR-52
Date	February 24, 1975
Title	System Performance Measurements of a Quadruplex 9020A
Abstract	The A3d2.1 System was measured using two different levels of NAS on-line data recording. The first level was SAR Category 1 and no TARS, while the second level was SAR category 4 and all TARS. The results are presented in this document.

Document #	SPAR-53
Date	March 3, 1975
Title	A3d2.1L (UK) System Utilization and Response Time Test Results
Abstract	This report contains the A3d2.1L System CPU utilization and response time test results conducted on system UK49Y 9020D Duplex and the 9020D Simplex.

Document #	SPAR-54
Date	January 28, 1975
Title	Jacksonville Measurement Results
Abstract	The document contains data measurement results obtained at Jacksonville.

Document #	SPAR-55
Date	March 19, 1975
Title	IOCE Utilization Measurement Study
Abstract	This document presents the results obtained in measuring IOCE utilization for the A3d2.1 system using the IBM SMI (system measurement instrument.)

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-56
Date	May 27, 1975
Title	3d2.2 (RBB) Storage Estimates
Abstract	This document contains the initial 3d2.2 RBB core storage estimates for the Chicago, Cleveland, New York and Houston Air Traffic Control Centers. Fixed Tables, Core Resident Programs, Site Adapted Tables and the Buffer Areas are the four basic system sizing factors the estimates are composed of.

Document #	SPAR-57
Date	May 9, 1975
Title	9020A Storage Interference Measurement Results
Abstract	This document presents the results of a 9020A storage interference study. It also presents the method used to obtain the measurements and the data collected.

Document #	SPAR-58
Date	April 28, 1975
Title	MOD 08A Storage Interference Impact Analysis
Abstract	This document presents the approach and analysis results of the task to evaluate the impact to the performance of the 9020A upon introduction of a storage element with twice the capacity of the current MOD 08 storage element. The analysis presented deals primarily with the performance impact of the 9020A system as it relates to the CPU loss attributable to storage interference.

Document #	SPAM-59.3
Date	May 31, 1973
Title	Summary of A3d2 Model Results with Input Message Loading Defined by CR3147A changes to SPO-MD-318
Abstract	This document reports CPU utilization and response time results from two runs made with the A3d2 CCC Model.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-59
Date	April 30, 1975
Title	Houston ARTCC Measurement and Evaluation
Abstract	This report is on the performance measurements made at the Houston ARTCC on January 30, 1975, with the A3d2.1 First Update System.

Document #	SPAR-59.1
Date	June 12, 1975
Title	Memphis Air Route Traffic Control Center Computer Measurement and Evaluation
Abstract	This report consists of a quantitative evaluation of computer performance at the Memphis ARTCC. The measurements taken there on March 20, 1975, served as a primary data base.

Document #	SPAR-59.2
Date	July 15, 1975
Title	Chicago ARTCC Measurement and Evaluation
Abstract	This report is on the performance measurements made at the Chicago ARTCC on April 24, 1975 with the A3d2.1 System.

Document #	SPAR-59.3
Date	August 20, 1975
Title	Oakland Air Route Traffic Control Center Computer Measurement and Evaluation
Abstract	This report consists of a quantitative evaluation of computer performance at the Oakland ARTCC. The measurements that were taken on May 8, 1975, served as a primary data base.

Document #	SPAR-59.4
Date	August 15, 1975
Title	Composite Site Analysis Report of the JAX, HOU, MEM, CHI and OAK ARTCC's Computer Measurement and Evaluation
Abstract	This report contains a summary of all the data measured at each of the five sites, namely, Jacksonville, Houston, Memphis, Chicago and Oakland. Jacksonville was measured on the A3d2.0 system while the others were measured on the A3d2.1 system.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document # SPAR-60
Date May 9, 1975
Title System Model Test Report

Abstract This report documents the tests conducted to validate the System Model of the National Airspace System. The modeled components include radar, central computer complex (9020A or 9020D), Display Channel (CDC or DCC) and ARTS (single or dual IOP)

Document # SPAM-61
Date June 12, 1973
Title CE Utilization Cost of SAR/TAR Activity

Abstract This document addresses the question of the impact on CE Utilization, of the increase in SAR/TAR activity.

Document # SPAR-61
Date May 15, 1975
Title TESDATA 1155 Storage Interference Measurement Procedure for the 9020A

Abstract This report presents a technical approach and the analysis techniques required to accurately determine the amount of 9020A CPU processing power that is lost due to storage contention delays inherent to the system design. Operating techniques and procedures for the TESDATA 1155 Computer Measurement System (Hardware Monitor) and technical interfacing data to the 9020A units are included.

Document # SPAM-62
Date September 1, 1973
Title Phase II Storage Interference in NAS, The Effects of Planned Mapping

Abstract This document presents the results of Phase II of a two phase study of storage interference in the NAS System. The purpose was to present the results of a remapped system and to recommend permanent changes to the NAS Core Map.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document # SPAR-62
Date May 13, 1975
Title Final Report-Fail-Soft Study

Abstract This document is the final report of an analysis of a proposed Fail-Soft System design for the National Airspace System (NAS) Central Computer Complex (CCC). The proposed Fail-Soft System described by Mitre Technical Report 4239, accommodates failure of two like CCC elements. The foremost factors of the Fail-Soft System evaluated were storage and CPU requirements and a method of transitioning between normal NAS and the Fail-Soft System.

Document # SPAR-63
Date June 3, 1975
Title Fail-Soft Modeling Results

Abstract This study was undertaken to substantiate the practicability (with respect to CPU Utilization and Response Time Performance) of a Fail-Soft Version of NAS. Mitre Technical Report 4239 and IBM System Performance Analysis Report 45 were used as guides.

Document # SPAM-64.1
Date December 7, 1973
Title Increased Load Measurements on the 9020D using the CSS Model

Abstract This document presents the results of a study on the NAS System behavior using NAS-MD-318 loads greater than 100% (444 tracks) on a duplex 9020D configuration.

Document # SPAM-64.2
Date December 19, 1973
Title Increased Load Measurements on the 9020A for System A3d2.0

Abstract This document presents the results of a study on the NAS system behavior using NAS-MD-318 loads greater than 50% (222 tracks) on a 9020A triplex configuration.

SYSTEM PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document # SPAR-64
Date June 9, 1975
Title Module Frequency/Execution Time Determination

Abstract This document contains the results of a task that was initiated for the purpose of determining the performance characteristics, in terms of frequency of execution, execution time, and CPU utilization, for the various application subroutines in the A3d2.1 NAS System.

Document # SPAM-65
Date October 25, 1973
Title 3d2.0 Pool Storage Algorithm

Abstract The purpose of this document is to provide the individual ARTCCs with an updated pool storage algorithm for 3d2.0. It also provides estimates, based on mathematical calculations of pool requirements based upon IFR count.

Document # SPAR-65
Date July 15, 1975
Title A3d2.2 System Utilization and Response Time Test Results

Abstract This document contains the results of the A3d2.2 CPU utilization and response time tests conducted on the 9020A Triplex, Test 602, and on the 9020D Duplex, Test 604. All requirements were met as specified in NAS-MD-318.

Document # SPAM-66
Date November 9, 1973
Title UK System Performance Predictions

Abstract This document presents the results of a study of the United Kingdom System that was initiated for the purpose of predicting the performance of the system in terms of CPU utilization and message response times, estimating the core storage requirements, and identifying the Test Area 6 load that is most representative of the anticipated peak load situation.

SYSTEMS PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document # SPAR-66
Date August 1, 1975
Title A3d2.2 RBB Instruction Sequence Scan Report

Abstract This report presents the objectives, approach and results of the task to scan the instruction code of the NAS A3d2.2 (RBB) system to obtain counts and sequence of instructions.

Document # SPAM-67
Date December 3, 1973
Title System Parameters Affecting Core Storage

Abstract This document presents the results of an evaluation of system parameters believed to have an impact on core storage as discussed in Mitre document TOS#121-37A.

Document # SPAM-67.1
Date June 15, 1974
Title System Parameters Affecting Core Storage

Abstract This document presents the results of an evaluation of system parameters believed to have an impact on core storage as discussed in Mitre document TOS#121-37A. It discusses those parameters which do and do not have a significant impact and affect on core storage.

Document # SPAR-67
Date August 18, 1975
Title Validation of the TESDATA 1155 in Supporting Test Area 6 Capacity Measurements

Abstract This document describes the method used and the test results obtained in validating the TESDATA 1155 Compute Performance Measurement System (Hardware Monitor) with respect to measuring CPU utilization. An accurate performance measure of the NAS System was provided in this report.

SYSTEMS PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-68
Date	September 2, 1975
Title	On-Line CPU Monitoring
Abstract	This document presents an accurate method of measuring CPU in the operational environment. The CPU results are reported in real time as the data is collected, therefore it is called the On-Line CPU Monitor.

Document #	SPAR-69
Date	August 15, 1975
Title	Calibration/Validation Report for the CCC EnRoute Model
Abstract	The purpose of this report is to document the status of the CCC Model.

Document #	SPAM-70
Date	October 4, 1974
Title	Houston Site Measurement Results
Abstract	The primary purpose of this study was to evaluate and characterize the current traffic load imposed upon the Houston site on August 14, 1974, to determine the current CPU utilization of the site in the FDP operational mode, and to estimate its CPU in the full FDP/RDP Mode.

Document #	SPAM-70.2
Date	October 14, 1974
Title	Houston Site Measurement Results
Abstract	This paper presents the system performance measurement results for the Houston ARTCC on August 14, 1974. The major conclusions obtained from the analysis of this site are listed in this document.

SYSTEMS PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR-70
Date	October 10, 1975
Title	Systems Model and EnRoute CCC Model Evaluation Using the Houston Site Measured Data
Abstract	This study represents the first time that the NAS System Model and EnRoute CCC Model were used to predict site performance statistics.

Document #	SPAM-71
Date	December 16, 1974
Title	NAS System Measurements of the High Altitude Conflict Alert Function
Abstract	This document presents the results obtained in measuring the performance of the NAS system with conflict alert as defined in NCP 3047A. Analysis was also done concerning the impact of modifying conflict alert system parameters.

Document #	SPAM-72
Date	November 15, 1974
Title	System Performance Analysis of the RBB Dynamic Buffering System
Abstract	This document presents the results of a study undertaken to evaluate NAS system performance using the modified dynamic buffering algorithm which was recommended in the RBB study.

Document #	SPAR-72
Date	January 8, 1976
Title	A3d2.1 Response Time Recording Tool Investigation (RTRT)
Abstract	This document presents a method for measuring the software portion of response times in a site environment, i.e., with all hardware devices on-line.

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Document #	SPAM-73
Date	January 28, 1975
Title	Mini-SPAM Results-73 Test 604 (1/14/75) RDP and Test 604 (1/14/75) FDP for the UK System
Abstract	This document presents the results for FDP/RDP Systems Test for the United Kingdom System (Tape UK 49Y)

Document #	SPAR-73
Date	December 19, 1975
	Optimization
Abstract	This document presents the results of a study to reduce core storage and improve CPU utilization of the 9020 system through the implementation of new instructions and the enhancement of the JOVIAL compiler.

Document #	SPAM-74
Date	November 26, 1975
Title	Mode C Intruder Logic CPU Estimate
Abstract	This document contains the CPU requirements for integrating Mode C intruder logic into the Conflict Alert function.

Document #	SPAR 74
Date	February 2, 1976
Title	Applications for Model 08A Storage Elements at the 9020A ARTCC's
Abstract	This report discusses software and system techniques utilizing 08A storage elements which could be applied to reduce system storage risks and to provide significant storage growth options.

Document #	SPAR 75
Date	April 9, 1976
Title	An Analysis of the Impact of the "Store and Forward" Flow Control Design on the CCC System
	This document contains the modeling results of the proposed Central Flow Control design. The results are presented in six major areas to assess the overall impact of the proposed design on system performance.

SYSTEMS PERFORMANCE ANALYSIS MEMORANDUMS AND REPORTS

Document #	SPAR 76
Date	May 24, 1976
Title	CCC Simulation Model/Calibration Report of the Model A3d2.2 System
Abstract	The purpose of this report is to document the results of a task to assess the accuracy of the CCC Model in presenting the performance characteristics of the NAS A3d2.2. The NAS A3d2.2 CCC Model is a simulation program that provides a means for analyzing the performance of the NAS program. The model represents the NAS hardware, NAS program modules, message types and logic paths that are the primary contributors to hardware and software resource usage in terms of CE utilization and response times. The NAS CCC Simulation Model is written in ECSS and SIMSCRIPT, and runs under the System/360 Operating System (OS/MVT). The model has approximately 33,000 source statements and requires approximately 1014-1272K Bytes of core storage to execute depending upon the load.

Document #	SPAR 77
Date	June 23, 1976
Title	Analysis of an Operational EnRoute System to Execute in 10 Storage Elements (SE's)
Abstract	This study presents a technique to develop a Simplex 10 SE Operational EnRoute System capable of supporting 100 Flight Plans and 50 tracks.

SYSTEM PERFORMANCE ANALYSIS SPECIFICATIONS

Document # SPAS-2
Date October 17, 1972
Title CCC, DCC and On-Line Lab

Abstract This document explains the objectives, methodology and analysis techniques of the CCC, DCC and on-line lab measurement and evaluation task.

Document # SPAS-6
Date February 15, 1974
Title CPU Recovery

Abstract This document describes a task effort directed toward recovering CPU resources in NAS. The major area to be investigated for CPU recovery are: offloading additional radar functions to the IOCE, selective redesign of the Application Programs Area and Monitor Area, operational and procedural changes, storage mapping optimization, and hardware investigations to augment or upgrade existing CPU resources.

Document # SPAS-07
Date June 19, 1974
Title Operational ARTCC Performance Measurement and Evaluation

Abstract The purpose of this paper is to outline two approaches which can be used for making the set of measurements necessary to gather information on the current CPU processing requirements, message response times, message input rates and recording impacts.

Document # SPAS 07.00.01
Date September 10, 1974
Title Changes to SPAS-07

Abstract These pages replace the corresponding pages in SPAS-07, Operational ARTCC Performance Measurement and Evaluation. These changes include a sample measurement scenario to be added to the description of the SAR/TAR measurement technique and other minor changes.

SYSTEM PERFORMANCE ANALYSIS SPECIFICATIONS

Document #	SPAS-07.01
Date	December 5, 1974
Title	Operational ARTCC Performance Measurement and Evaluation (Data Collection)
Abstract	This document replaces the System Performance Analysis Specification SPAS-07, dated June 19, 1974 and SPAS 07.00.01 dated September 10, 1974.

Document #	SPAS-07.01.01
Date	April 16, 1975
Title	Operational ARTCC Performance Measurement and Evaluation (Data Collection)
Abstract	The purpose of this paper is to outline the approach to be used for making the set of measurements necessary to gather information on the current CPU processing requirements, message response times, message input rates and recording impacts. This paper also describes the data to be collected, and the methods to be used to accomplish this collection. This SPAS supersedes SPAS 07, SPAS 07.00.01, SPAS 07.01 and SPAS 07.01.01.

Document #	SPAS-07.02
Date	February 11, 1975
Title	Operational ARTCC Performance Measurement and Evaluation (Data Reduction)
Abstract	This document explains how the data obtained from a site measurement is to be reduced, analyzed and reported. It also concerns itself with the data reduction programs, the information to be reported on, and the reports that are to be generated.

Document #	SPAS-07.02.01
Date	July 1, 1975
Title	Operational ARTCC Performance Measurement and Evaluation (Data Reduction)
Abstract	This document explains how the data collected in SPAS-07.01.01 is to be reduced, analyzed and reported. This document supplements SPAS-07.02.

SYSTEM PERFORMANCE ANALYSIS SPECIFICATIONS

Document # SPAS-09
Date June 25, 1974
Title National Airspace System Central Computer Complex (CCC) ECSS/Simscript Model

Abstract This paper describes a task effort directed toward rewriting the National Airspace System (NAS) Central Computer Complex (CCC) model in the ECSS/Simscript simulation languages. The intent, is to present the principal guidelines and the direction to be used in rewriting the model for management, and to those engaged in the rewrite.

Document # SPAS-10
Date June 19, 1974
Title SAR/TAR CPU Accuracy Validation

Abstract The purpose of this task is to validate the technique of using SAR recording data (specifically TAR recording) to obtain CPU utilization measurements. It will determine what degree of accuracy will be experienced in the CPU utilization measurements using the SAR recording technique.

Document # SPAS-12
Date June 16, 1974
Title Mod 08A Storage Interference Impact Analysis

Abstract This document intends to describe several analysis approaches available to assess the magnitude of the 9020A degradation and to make a recommendation as to the approach which should be used.

Document # SPAS-13
Date February 20, 1975
Title Site Core Requirements for the RBB System

Abstract This document is a specification to build a Model A3d2.2 Core Requirements Model for use by the sites.

SYSTEM PERFORMANCE ANALYSIS SPECIFICATIONS

Document #	SPAS-14
Date	December 12, 1974
Title	Validation of the TESDATA 1155 in Supporting Test Area 6 Capacity Measurements
Abstract	The purpose of this task is to validate the use of the TESDATA 1155 Computer Performance Measurement System (Hardware Monitor) to collect and report on NAS CE utilization in the following categories: SVC processing, external interrupt processing, I/O interrupt processing, PE execution, and dispatcher idle time (Dispatcher active time is included in external interrupt time).

Document #	SPAS-14.1
Date	September 18, 1975
Title	Validation of the TESDATA 1155 in Supporting Test Area 6 Capacity Measurements
Abstract	The TESDATA 1155 and the modified procedures specified in this SPAS to collect and reduce the NAS performance data provide an accurate CPU utilization measurement technique for current and future NAS system measurement activity.

Document #	SPAS-15
Date	February 2, 1975
Title	Module/Frequency/Execution Time Determination
Abstract	The purpose of this task is to determine the frequency of execution and execution time for each measurable program module in A3d2.1 NAS.

GPO 910-928