ORDER

7430.3

DYNAMIC OCEAN TRACK SYSTEM

10/11/91

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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FOREWORD

This order directs affected Federal Aviation Administration (FAA) organizations to take the action(s) necessary to implement the Dynamic Ocean Track System (DOTS) and related hardware and software. It identifies associated activities, schedules, and funding, and describes required activities and assigns responsibilities to ensure that DOTS is properly introduced into the oceanic air traffic environment. Management responsibility for this project has been assigned to the Research and Development Division (ARD-100). Support and coordination with other agency organizations is essential for the successful implementation of the DOTS.

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TABLE OF CONTENTS

CHAPTER 1. GENERAL

1. PURPOSE. This Program Implementation Plan identifies the activities, schedules, and available/required funding for implementing the Dynamic Ocean Track System with it's associated hardware and software. It also provides Federal Aviation Administration (FAA) management direction and guidance for implementing DOTS into the National Airspace System (NAS).

2 DISTRIBUTION. This order is distributed to branch level in the Research and Development Service, NAS Transition & Implementation Service, the Systems Maintenance Service and Air Traffic Plans and Requirements Service, branch level in the regional Airway Facilities (AF) and Air Traffic divisions, division level at the Mike Monroney Aeronautical Center and the FAA Technical Center and to all Airway Facilities General NAS (GNAS) Sectors.

3. AUTHORITY TO CHANGE THIS ORDER. The Program Manager, DOTS, ARD-100, may approve changes to this order.

4. GLOSSARY. Appendix 1, Glossary of acronyms, contains acronyms and abbreviation used in this order.

5. RESERVED.

CHAPTER 2. PROJECT OVERVIEW

20. SYNOPSIS. Implementation of the FAA's Dynamic Ocean Track System (DOTS) will provide expanded capabilities to generate flexible tracks, track advisories and to display aircraft projections through the oceanic airspace. The DOTS will satisfy the following oceanic air traffic planning and management objectives:

a. Generate track systems which will provide the best airspace utilization consistent with user operating requirements. Generated tracks will be optimized using the latest available weather forecasts and the separation requirements for a given oceanic area.

b Provide traffic and track advisories to maximize airspace utilization by providing users with the best possible altitude/ route availability that can be achieved with monitored and predicted airspace competition.

c. Provide an oceanic traffic planning and monitoring display for supervisors and traffic management specialists using flight plans and periodic aircraft progress reports transmitted over the Aeronautical Radio, Inc., (ARINC) network.

(1) This Project Implementation Plan (PIP) covers the nation-wide (oceanic ARTCCs) implementation of DOTS to provide immediate user access to the DOTS generated and operator approved tracks and track advisories, but not to the track generation and traffic display system.

(2) DOTS will be implemented via an 8A set-aside contract.

21. PURPOSE. The Dynamic Ocean Track System (DOTS) is designed to provide capabilities to manage oceanic air traffic through the use of automated information gathering and route analysis and development tools. DOTS will provide the oceanic air traffic control system, in specific the oceanic Air Route Traffic Control Centers (ARTCC) and the Air Traffic Control System Command Center (ATCSCC), the methodology inherently necessary to provide quality traffic management in today's environment of rapidly expanding traffic growth.

22. HISTORY.

a. The groundwork for the DOTS program originated in 1983 in the Energy division of the FAA Office of Environment and Energy (AEE). Through a contract with Mitre Corporation capabilities were developed to.

(1) Provide a unique technique for accurate and fast computation of aircraft performance (fuel burn).

(2) Provide computer modeling capabilities for analyzing performance impacts of aircraft for different ATC procedures.

b. Upon being briefed on these capabilities, Air Traffic Service (AAT-1, R. J. Van Vuren), instructed AEE in June of 1983, to analyze the current oceanic operation in the Oakland Air Route Traffic Control Center (ARTCC), with respect to fuel efficient use of oceanic routes.

c. During the course of the next 12 months AEE developed a 4 dimensional aircraft performance optimization technique, and a wind and temperature processing capability. United Airlines agreed to participate- in a flight test that would be coordinated with Oakland, Los Angeles and the Honolulu air traffic control centers. Three scheduled UAL 747 flights from Los Angeles to Honolulu and back were used for the test. The first of the flights used UAL's standard flight planning system for its trip. The second flight flew the same ground track as the first aircraft, but with an altitude profile generated by the test system. The third flight flew a ground track and altitude profile generated by the test system.

d The results of the test yielded fuel savings of 3 to 5 percent when comparing the second flight to the first, and 8 percent when comparing the'third flight to the performance of the first aircraft. However, Air Traffic had to work well outside their normal procedures to be able to accommodate the flight tracks and profiles that the test system generated. The test was still considered a success, in that it showed that the test system could produce routes and profiles that an airline could fly with potential significant savings. It was determined that the system needed a way to capture these savings with a method that was conducive to operation within current ATC operating procedures.

e. By early 1985, the AEE team was working closely with Oakland Center to become acquainted with the oceanic operation. This was accomplished through many hours of observation of the control and planning operation and a great deal of interface with controllers, supervisors and managers. The major problem that emerged was that aircraft were flying random routes rather than flying on the established published oceanic route structure. These random routes were becoming increasingly more difficult to control as traffic volumes increased. The lack of lateral spacing in the desired random routes, (as opposed to the set lateral spacing which is associated with a structured track system), made it much more difficult for controllers to separate traffic. The result was often costly to the airlines in terms of excessive fuel consumption from flying low altitudes necessary to maintain required separation requirements. This problem spawned the beginning plans for the Dynamic Ocean Track System (DOTS).

f. A data collection process was begun to determine where aircraft were flying and how much fuel they were using. Once the data was compiled in a database, ideas for future improvements were compared against it for estimates on achievable fuel and time savings. Initial data collection techniques were very labor intensive. Flight strips were collected and data

was manually entered into computers for analysis. After a short while this process was automated by developing a communications link with the ARINC data source to automatically read the flight data. This provided data much faster and more accurate, resulting in a larger more comprehensive database for analysis work.

g. Requirements for other automation aids were soon realized. The capability was developed to display the collected oceanic traffic data over a map projection to verify the accuracy of collected data. The display aids in the identification and demonstration of current problem areas, and is also helpful in determining possible solutions to these problems.

h. After analyzing the data it became obvious that the fuel saving needs of the airlines and efficient air traffic control required the development of a flexible track system. A flexible track system that would supply the airlines with the fuel saving they were pursuing by flying random routes, and would supply the controller with a structure for easier and more efficient control of the airspace. To satisfy these requirements, the track system would have to have the capability to be flexed daily to accommodate changing winds and weather.

i. Once the flow of air traffic in the oceanic airspace could be viewed, another problem presented itself. In areas where existing tracks were being flown by the airlines (such as the routes between California and Hawaii), there was a tendency for all aircraft to fly the same route even though adjacent routes (50 miles lateral) were empty. This problem exists because all the airlines file their flight plans as though they were going to be the only aircraft in the sky. Given that they all know what the minimum fuel/time track is, and they all fly around the same time periods, they all file for and try to fly the same airspace at the same time. Therefore, supplying a track system only resolves half of the perceived problem in the oceanic area, There must be a means of distributing the aircraft over the available airspace in order to fully utilize capacity and provide for maximum efficiency.

j. In 1987 a test was conducted to determine the savings associated with generating a flexible track system. Given airspace availability on all routes, the latest wind and temperature information, and the performance characteristics of the aircraft flying in the system, the test explored the benefits of loading aircraft on tracks based on the most efficient alternatives. The objectives of the test were:

(1) To determine if DOTS could generate tracks and provide a track loading function on these routes in a timely manner for live operational use;

(2) Demonstrate how DOTS would interface with airlines;

(3) To collect data to determine potential benefits of implementing these capabilities.

k In spite of the system requiring some fine tuning in its method'of obtaining wind and temperature information and the need for a better way to distribute track information to the users, the test results showed a potential capability for a 5 to 7 percent fuel savings when compared to the way aircraft actually flew.

1 In 1988, the display capability was evaluated and changed from a'post processing tool to a real time tool. The task of performing this transformation was minimal and a 'real time' traffic display system (TDS) was left running at the oceanic supervisors position in Oakland. DOTS capabilities were also discussed with the Japan Civil Aviation Bureau (JCAB) in 1988. The result was the signing of an annex to an existing Memorandum of Understanding (MOU) between the United States FAA and Japan's JCAB to allow for joint testing of the DOTS functions.

m. In 1989, the FAA Air Traffic Service requested that the DOTS R&D effort be expanded to include the New York and Anchorage ARTCC's. This expansion was to include at a minimum the traffic display capability. The prototype was installed in Anchorage in May 1990 and in New York in August 1990.

n. In August of 1989, a track generation capability was installed in Oakland, and a simulated test with JCAB and international air carriers was conducted. DOTS generated tracks were compared with tracks generated by JCAB/Japan Airlines. The JCAB tracks were being used daily as the flexible track system. These tracks were generated using JAL's flight planning system. Comparisons showed less than a 0.2 percent difference in fuel, time, and distance. These results helped to calm airline concerns that DOTS would be capable of generating user preferred routes.

o. In the latter part of 1989, an annex similar to that signed with JCAB, was signed with the Australian Civil Aviation Authority (ACAA).

p In early 1990, the FAA Air Traffic Service requested that the DOTS capability be made available as an operational system in the Oakland, New York and Anchorage ARTCCs. This implementation was intended to be an interim system so that near term advantage could be attained from the DOTS capability. The long term goal was that all DOTS functions would be absorbed into the Enhanced Traffic Management System (ETMS) and the Oceanic Display and Planning System (ODAPS).

q A prototype system was developed and field tested at the Oakland Air Route Traffic Control Center (ARTCC). A contract was awarded to TAMSCO to produce an 'operational' DOTS system. The current two-year development program was initiated on February 8, 1990, to produce and document a production version of the DOTS. On September 13 1990, the basic contract was modified to include the field implementation of Demonstration Test and Evaluation software prior to the completion of production software.

By October 1990, Track Generation and Traffic Display systems running on Apollo workstations were delivered to the three facilities. The National Airspace Integrated Logistics Support (NAILS) and the Deployment Readiness Review (DRR) process were initiated, which entails the development and distribution for comment and review of a number of documents necessary for operational deployment.

r. The process of implementing an 'operational' system is continuing. The Track Generation and Traffic Display capabilities are scheduled to be implemented as 'operational' in 1991, and the Track Advisory capability is to be implemented in 1992. Integration requirements to ETMS and ODAPS will be determined by March 1992.

s. The DOTS is designed to be used in the **ARTCC's** Traffic Management Unit (TMU), which is responsible for providing strategic flow management planning. The TMU specialists plan and coordinate air traffic flows into and out of the areas controlled by the ARTCC to maximize utilization of the available airspace and to minimize congestion. The DOTS will also be used by Air Traffic Control Supervisors in the Oceanic Air Traffic Control Area to monitor oceanic air traffic being controlled by the Air Traffic Controllers under their supervision. ATC supervisors are responsible for monitoring the flow of air traffic through the oceanic areas of the **ARTCC's** airspace.

23-29. RESERVED.

CHAPTER 3. PROJECT DESCRIPTION

30. FUNCTIONAL DESCRIPTION. DOTS is a collection of Oceanic Air Traffic planning and management enhancements functions- technologies that have been developed and combined to stand alone or to enhance other systems. From an overall system viewpoint, DOTS assists ATC Traffic Management Unit (TMU) specialists to perform the following three functions:

a. A Track Generation (TG) capability uses forecast aviation weather, wind and temperature, and site specific ATC flow requirements to compute a structured system of routes that allow the most efficient use of oceanic airspace. The resulting tracks take into consideration the varying separation requirements found in oceanic airspace. TMU specialists may interact with the track generation capability to provide specialized route requirements.

b. A Traffic Display (TDS) function accepts data from various aircraft flight data sources as it monitors and projects aircraft progress entering and progressing through oceanic airspace. A key element is the validation and verification of aircraft position data. The system updates wind and temperature forecasts automatically by including current Pilot Reports. These are then used in combination with flight plan data to project aircraft positions. All positions calculated from these data are compared with reported estimates to identify and automatically report differences.

c. A Track Advisory (TA) function defines flight path alternatives in order of projected travel time and fuel performance. TMU specialists compare requested tracks with possible track alternatives as recommended by DOTS. Generally, tracks that offer best time and fuel performance offer users efficient step-climb capabilities. TMU specialists offer rank ordered track plans to aircraft dispatch offices for flight plan revisions. The optimized plans are dynamically updated to account for changing traffic and weather.

d. Some of the key elements necessary to support these three basic functions are:

(1) Aircraft performance modelling.

(2) Communication processing.

(3) Dynamic weather database processing.

e. Highly accurate aircraft performance models have been developed from flight-test verified drag polar plots and engine specific fuel consumption data. With initial input of take-off weight,- an energy balance is derived which provides an accurate prediction of fuel burned as the aircraft proceeds along its chosen track. With inputs established for each model aircraft in the **world's** commercial fleets, and with performance degradation factors introduced as experience dictates, four-D dynamic programming with a high degree of accuracy can be achieved.

f The DOTS system receives ARINC position reports, confirms such receipt and verifies message content. The system also receives the Bracknel wind and temperature forecasts relayed by ARINC as well as the ARINC pilot reports. Through the National Airspace Data Interchange Network (NADIN) and the Aeronautical Fixed Telecommunications Network (AFTN), DOTS accesses flight plans and departure messages. In- addition, DOTS provides inter- facility information exchange. DOTS also processes aircraft position reports from Tokyo Radio for aircraft flying in Japanese controlled airspace, as well as Gander, Shanwick and Santa Maria traffic in the Atlantic. DOTS can function equally well with data **provided** from any **number of** sources,

g Using the Bracknel forecast developed in Great Britain as the primary input, the DOTS dynamic weather system refines this information with aircraft position and wind and temperature reports transmitted by pilots. Each aircraft is in fact a very useful weather probe., **Today's** highly accurate inertial navigation systems carried by most airliners making ocean crossings provide excellent **data** on winds aloft. As wind **and** temperature information is updated, the more current information is automatically,fed into the dynamic wind model. The introduction of Automatic Dependent Surveillance (ADS) position/wind and temperature reports will provide an even greater degree of precision in these pilot reports.

31. PHYSICAL DESCRIPTION DOTS will consist basically of Commercial Off-The-Shelf (COTS) hardware in a network configuration (Figure 3.1). The following is a list of the hardware items at each site:

Figure 3.1 System Hardware

ITEM	QTY	DESCRIPTION
1	4	Apollo DN3500 or DN3550 Workstation with 348 Mbyte Hard Disk Drive, 8 Mbyte Main Memory, Ethernet Network Controller, and Keyboard: (2 with Cartridge Tape Drive)

		(2 with Floppy Disk Drive)
2	3	Apollo 1280x1024 8-Plane Color Graphics Controller
3	1	Apollo 1024x800 4-Plane Color Graphics Controller
4	3	Apollo 19" 1280x1024 RGB Color Monitor
5	1	Apollo 19" 1024x800 RGB Color Monitor
6	4	Apollo/Itac 3-button Trackball
7	1	Dot Matrix Printer with Serial Interface
8	1	HP 7570A Wide-Bed pen Plotter
9	1	RS-232C Serial Cable for Printer (25-Pin Male-Male "Null-Modem")
10	1	RS-232C Serial Cable for Plotter (25-Pin Male-Male "Null-Modem")
11	1	RS-232C Serial Cable for ARINC Data (25-Pin Male-Male)
12	3	IEEE 802.3 "ThinNet" Coaxial Cable with BNC Connectors
13	2	BNC Coaxial Cable Terminators for ThinNet Cable.
14	4	Topaz (micro/ups) Powermaker (one for each workstation cluster)
		An OCS cable will be supplied by Anchorage.

Un-interruptable Power Supply System (UPS). This will consist of a TOPAZ model 1.8kVA UPS that will protect both itself and the DOTS against surges as defined by ANSI/IEEE Standard C62.41-1980 (6,000V peak, 500 nanosecond rise time). It will operate on standard commercial power with 2% maximum harmonic distortion from power lines and 5% maximum harmonic distortion from batteries.

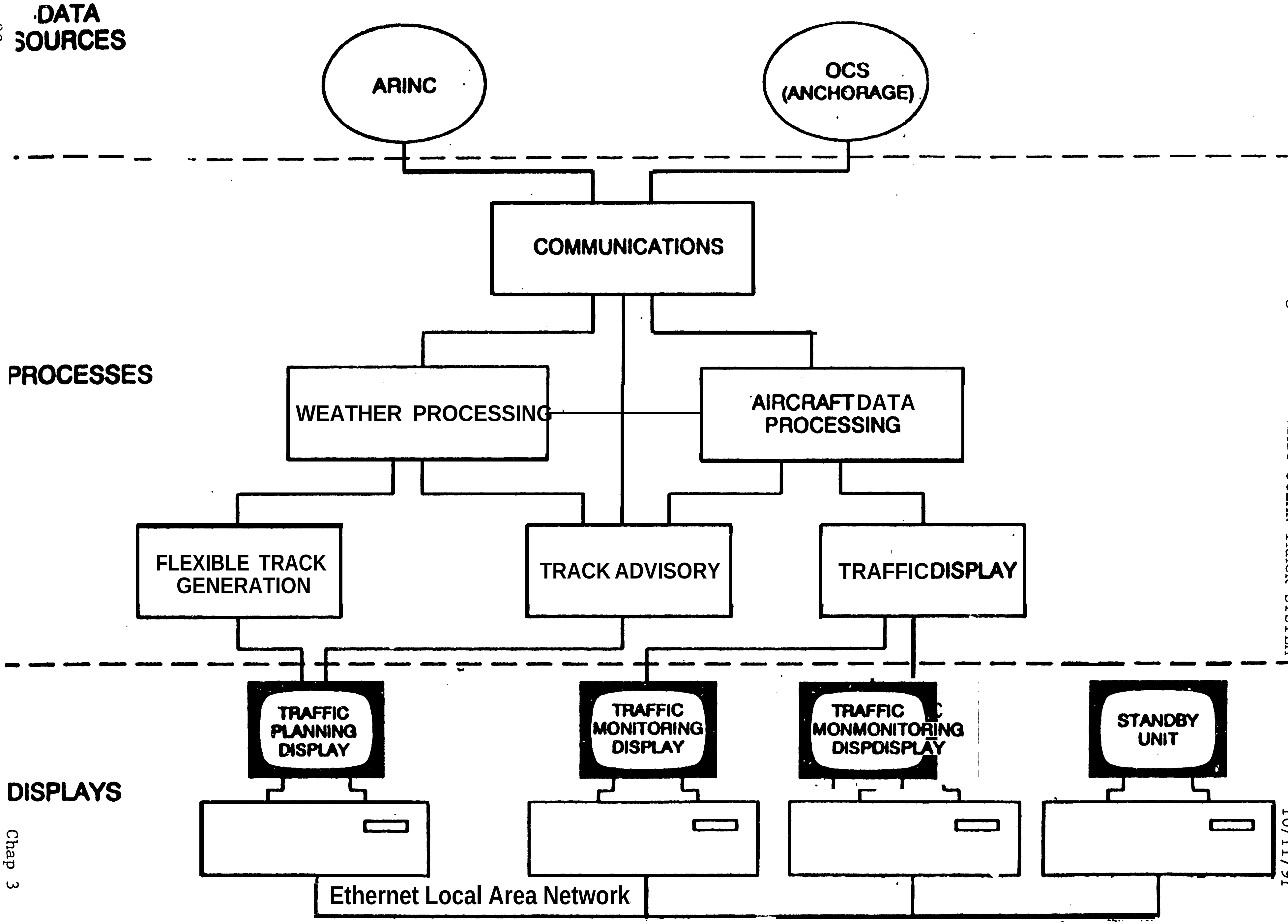


Figure 3.1 DYNAMIC OCEAN TRACK SYSTEM

32. SYSTEM REQUIREMENTS. In June of 1990, a Systems Requirement Team chaired by ATR-330 and made up of representatives from ARD- 100, ATR-210, ZOA-590, ZOA-505, ZAN-560, ZNY-GE, ATM-110, AAP- 200, ATM-200, AFS-430,NY ARTCC, and ATCSCC, met to define the system requirements for DOTS. A draft order for the DOTS system requirements is listed below. The requirements listed were derived from the minutes of the aforementioned June SRT meeting. The Air Traffic Plans and Requirements Service will be responsible for any modifications to the requirements listed below.

a. PURPOSE. This order establishes air traffic oerational requirements for the Dynamic Ocean Track System (DOTS). These requirements extend from the original baselined DOTS through the Advanced Automation System (AAS) period, and include integration into the Enhanced Traffic Management System (ETMS). The DOTS% requirements include installation in the Air Traffic Control System Command Center (ATCSCC) and Traffic Management Units (TMU) at the three FAA Air Route Traffic Control Centers (ARTCC) that have responsibility for controlling traffic in international airspace. These facilities are located in Oakland, Anchorage, and New York.

b. DISTRIBUTION. This order is distributed to the branch level in the Air Traffic, Program Engineering and Systems Engineering Services, Airport Capacity Program Office and Automation Service in Washington, Technical Center, Mike Monroney Aeronautical Center, Alaskan, Eastern, and Western Pacific regional air traffic and airway facilities offices,

c. SYSTEM DESCRIPTION. DOTS is designed for use in the management of oceanic air traffic. In coordination with other countries that are responsible for control of airspace that border U.S. controlled airspace, DOTS will produce flexible routes that account for user requirements in the area of efficient time and fuel.

(1) The track advisory function will provide traffic managers with the ability to determine airspace availability and the relative time and fuel penalties associated with different plans for individual aircraft. This will be used as a traffic management tool for coordination between the FAA and the user to use more efficiently the available airspace.

(2) The Traffic Display System (TDS) will be located in the traffic management area and at the oceanic supervisor position. Capabilities associated with the TDS will provide managers'with the ability to plan based on actual and projected aircraft movement.

Areas of congestion, severe weather, and restricted airspace will be displayed. Wind patterns and associated jet streams will be displayed over aircraft% positions. The TDS will provide oceanic planners with the ability to view ahead of schedule, traffic demands and rerouting requirements due to congestion and weather problems.

(3) The TDS will be at the ATCSCC to be used as a backup capability to the field facilities and for the coordination of domestic and international air traffic.

d. AUTHORITY. The' Air Traffic Plans and Requirements service, ATR-1, is authorized to issue changes to this order.

e. APPLICATION. This order applies to all air traffic personnel and is for the guidance of other organizational units.

f. MISSION NEEDS. The DOTS's mission is to manage oceanic air traffic with automated information gathering and route analysis and development tools. To the extent possible, DOTS shall identify optimum altitude and routes predicated on air traffic and user requirements. DOTS will provide the oceanic air traffic control system, in specific ARTCC's and the ATCSCC, the methodology inherently necessary to provide quality traffic management in today's environment of rapidly‘expanding growth.

g. BACKGROUND. Basic Air Traffic Control (ATC) service in today's oceanic environment is strategic, rather than tactical, as happens in the domestic environment. Oceanic air traffic controllers maintain a mental plan of the traffic by utilizing flight progress strips and by that extrapolating the aircraft's position. This task is extremely difficult when several flights in the oceanic airspace are operating on slightly different routes that are marginally--separated from one another.

h OPERATIONAL REQUIREMENTS. Explanation of General Requirements.

(1) All operational requirements contained in this order shall be developed, procured, and implemented as quickly as possible.

(2) The DOTS shall be a self-supported stand-alone system and will be in the same location as the TMU and the oceanic supervisor's position.

(3) The DOTS functions will eventually be integrated into the ETMS.

(4) All existing and planned DOTS capabilities shall be retained.

(5) The system shall provide to designated facilities the capability for phased implementation of DOTS requirements and provisions must be made for satisfying new operational and training requirements identified during this period.

(6) Both the Air Traffic Plans and Requirements Service and the Office of Air Traffic System Management must be explicitly involved in the system development, design, and resolution of technical and operational issues as they arise during the development, procurement, and implementation phases.

(7) The operational suitability of DOTS shall be evaluated by both the Air Traffic Plans and Requirements Service and the Office of Air Traffic System management. These efforts shall include operational testing and evaluation during the development phases.

(8) Alternative Selection/Strategy Evaluation - This shall provide the capability to rank alternative resolutions for each flight plan based on the optimum available airspace so that the most effective strategy can be selected. The rank order lists will be displayed to the specialist.

(9) The displays shall be of high resolution. The quality of the presentation shall be constant throughout the display area, clear of clutter, flicker free and of uniform brightness. The presentation shall provide sufficient contrast and brightness so that all displayed items can be easily read under all ambient light-conditions, and must be free of glare. The display background color shall be the most pleasing and optimum for use in ARTCC's. Reflectance and susceptibility of the display face to smudging shall be kept to the lowest level within the existing state-of-the-art.

i. <u>DATA BASE</u>. A flight plan data base is required to support the DOTS functions.

j <u>FUNCTIONS</u>. The following functions are required to support the safest and most efficient system operation of air traffic.

k. FLEXIBLE TRACK GENERATION FUNCTIONAL REQUIREMENTS.

(1) The Track Generation function shall have the following capabilities:

(a) Track shall be separated from active restricted and warning areas using variable, selectable vertical and lateral separation values. This shall also apply to Significant Meteorology (SIGMET).

(b) System shall have the capacity to use double the number of existing gateway points.

(c) System shall be capable of generating flexible tracks starting at arrival and departure point or gateway fixes.

(d) System shall be capable of generating routes:

1. With no gateway restrictions

2. Using only local facility gateways

3. Using multiple variations of available gateways

(e) If an existing fixed route is used in part or in total, the system will automatically display points relative to that route.

(f) The system shall have the ability to redefine individual segments of a generated track.

(g) System generated routes:

1. The system will select best routes and automatically plot them on the display.

2. Variable lateral separation for generating tracks will be available.

3. Tracks can be generated in balanced pairs, based on the computed index, plus next best.

4. Tracks (system generated or manual) will be checked against separation definitions.

(h) Input Data Verification:

1. All operator entered latitude/longitude or fix points will be verified against a data base of fixes and latitude/longitude coordinates with a warning given if not within the parameter (see system wide features for definition of parameter files). If entered, coordination is within a distance specified by an adjustable parameter to a known fix, operator will be queried to use latitude/longitude or fix name.

2. Format may be selected for printing and naming tracks from a set of formats defined by air traffic.

(i) Transmit and Coordinate Tracks at Required Times.

1. System transmits track coordinates to Notice to Airmen (NOTAM) Office or facility selected addresses.

(2) Track Generation Workstation-Display Characteristics. The Track Generation function will be accessed on the Traffic Planning (TP) Display. Log-on procedures will be required.

(a) Generated tracks will be plotted on the display with distinct colors for East/West bound tracks. Unseparated segments are displayed 'red', if they do not meet defined separation criteria.

(b) Individual grid points on a route may be selected to identify where lateral separation is not required.

(c) Pop down screen will show atitude/longitude, time, distance, and fuel burn for each generated route (manual, fixed, or system generated).

(d) Hard copy of tracks will be provided on a plotter by sector and total area.

(e) The operator acceptance of tracks will be accomplished through the use of passwords.

(f) The facility may specify the number and level of passwords required.

(3) Operational Requirements.

(c) Tracks will be available to the traffic management display only, until formal acceptance procedure is followed. Operator will initiate the transmission of tracks using 3 sequential key inputs and a password. The message format to be used for transmitting tracks will be displayed on the screen. A hard copy will be printed on dot -matrix printer.

(d) A plotting capability shall exist for plotting all charted and uncharted Special Use Airspace (SUA) and SIGMET areas with or without flexible tracks.

(e) When plotting is not available only a hard copy will be printed on the dot matrix printer.

(f) Document 7030 (ICAO Regional Supplement) shall be used to determine degree and time limitations of route segments to be used for track generation.

(g) Response time for generating tracks will not exceed 2 minutes/track.

(h) The system shall have the ability to abort a Process during run.

m. TRAFFIC DISPLAY SYSTEM (TDS).

(1) TDS Functional Requirements - The system shall:

(a) Display aircraft position.

(b) Show Flexible and Fixed Route Structure.

(c) Depict charted and uncharted SUA's, moving Altitude Reservation .(ALTRV) and SIGMET Areas.

(d) Displays Aviation Winds for selected altitudes from 5000 feet to highest altitude available.

(e) Detect when the difference between cleared and reported positions, altitudes and times exceed a defined amount. The amount exceeded prior to notification will be defined by facility.

(f) Identify and locate individual aircraft on the display by highlighting the data block. When a requested aircraft is not found an "Aircraft Unavailable" message will be displayed.

(g) Have the ability to highlight all aircraft that have a specific carrier, altitude, departure airport, arrival airport, or route number.

(h) Have the ability to display individual sectors, expand on any part of the map display and re-center map on new center point.

(i) Have the capability to accelerate aircraft projections based on current or proposed flight plan information. Variable speeds will be selectable.

(j) Shall display cursor position in latitude/longitude rounded to the nearest minute. This function shall have the capability of being toggled on or off.

(k) Shall display name of the fix closest to cursor position. This function shall have the capability of being toggled on or off.

(m) The system shall have the capability to receive, process, and display aircraft position data in standard ICAO/IATA format from the following sources when available:

2 Edmonton;
_ Reykjavik;
3 Tokyo Radio;
4
5 Gander; Santa
6 Maria; .
7 Piarco; Shanwick.

(2) TDS Characteristics

(a) The TDS map display will show: (all colors are parameter controlled)

1. Land masses

2. Ocean

3. Aircraft - Westbound and Eastbound will be colored different

4. Airway routes

5. Airway route designators

6. Sector boundaries

7. Latitude tick marks - 5 degree increments

8. Longitude tick marks - 5 degree increments

9. Latitude/Longitude numeric identifiers - toggle on or off with key input

10. Flexible Tracks

11. Winds

(b) TDS Data Manipulation

1 TDS will be capable of modifying, deleting, adding data in the &craft database.

2. Through selection of menu item, TDS will display a leader line by allowing operator to enter the number of minutes to project ahead a selected aircraft(s) distance along his route of flight. The number of minutes will be a global variable changeable from the display.

3. Aircraft Projection function:

(aa) Aircraft may be selected to display planned route(s) of flight from proposed flight plan information. Routes may be selected to display all aircraft on route and within 100 miles (parameter adjustable) of route.

(bb) Plus times may be entered to display aircraft at projected time at cleared altitude.

(cc) Aircraft planned altitude can be displayed in data blocks, in addition to actual altitudes (Default will be actual cleared altitudes).

(dd) System will be capable of calculating flight time (minutes) and distance (nautical miles) between two points. The second point may be a random point other than an aircraft position. Random points may be selected by latitude/longitude point or closest fix point based on toggled menu option.

(ee) Projection will display:

1. distance (nautical miles between points)

2. (+) time between each selected point

3. actual time at each point

4. latitude/longitude point at each point selected

4. Charted and uncharted **SUA's/SIGMET** Areas:

(aa) Warning area database with permanent areas will be displayed automatically giving date and time, block altitude, and block area. A warning message will be displayed at an **area's** scheduled deactivation time. The area must be deactivated by the operator (password required).

(3) TDS Display Manipulation

(a) System shall be equipped with a 3 button trackball for activating display functions,

(b) Keyboard entry available for **some** display options. Commands will be prefaced by a **"/".** If no command is given after a **"/"** with a specified time the system will exit input state.

(c) System will have the capability to activate and deactivate keyboard. A message will be displayedindicating the **status.**

(d) System shall have a **zoom** and re-position capability. The **zoomed** area can be adjusted in size or moved around **the screen** using trackball or keyboard arrow keys.

(e) System shall have the ability to adjust screen update rate on display of aircraft position. (Position movements in short timeframes are imperceptible in oceanic airspace so allowance **for** variable update adjustment will be in the interest of saving CPU **time if** and when necessary.) Rate value shall be an input parameter.

(f) The **system** shall have the capability to display all information available on specific aircraft. This information shall include:

1. Actual flight plan.

2. All Aeronautical Radio (ARINC) messages received on that **specific aircraft.**

3. All OCS messages received on that specific aircraft.

4. DOTS formatted aircraft data which includes Aircraft ID, Aircraft Type, Positions, Date and Times, Altitudes, and Speeds

(g) Aircraft data blocks shall consist of aircraft Identification (ID), altitude, and speed information. Data block characteristics include the ability to:

1. Display mach number and ground speed.

2. Toggle on and off aircraft ID line, altitude line and speed line the data block, or the total data block.

3. Select data block for rotation and extend leader to move.

4. ID character set in data block will be larger than other elements in Data Block.

5. Display Cleared and Reported Altitude.

6. Cleared and reported altitudes shall be displayed. Altitudes shall be coded as follows:

" " Climb
" " Descent
"C" Cleared
"+" Altitude higher than cleared
"-" Altitude lower than cleared
"P" Planned
"B" Block altitude

(h) The data block will be color coded (legend provided, colors are parameter selectable) to identify possible problems with aircraft information. Four different colors will indicate a possible problem with altitude, position, time, and an overdue aircraft. In the event of a detected problem, the color of the data block will indicate the nature of the problem therefore making timeshare with data block redundant and unnecessary for this feature.

(i) Data blocks shall have automatic placement on the display to eliminate overlap. This feature can be toggled on and off. Off status will continue to prevent data block overlap for all aircraft newly entering system. Wakeup is status will be off.

(j) Reported travel times between reported waypoints will be calculated and cross checked with system generated time estimates utilizing the updated weather database.

(k) The system shall have an emergency aircraft function with the following features:

1. Aircraft and data block will turn 'red' when an aircraft is declared to be under an emergency. Emergency status and the reason for the emergency are entered using the aircraft data edit function. Emergency status reason code and reason text are recorded in the aircraft file. The reason for the emergency is coded.

2. Time share data block with reason code for emergency.

(1) The system shall have a Special Handling Aircraft function with the following features:

1. The aircraft symbol shall be displayed with a 'triangle' when an aircraft is declared 'special handling' using the aircraft dataedit function.

2. Special handling status is recorded in aircraft file.

3 No time share for Special Handling aircraft will be required:

(m) The system shall display charted and uncharted SUA's, moving ALTRV's, and SIGMET areas. For this purpose, charted SUA's are Special Use Areas taken from the NAS 56-day database. Uncharted SUA's are Special Use Areas defined by the facility and entered into the DOTS system (including stationary ALTRV's). Features shall include:

1. Charted and uncharted SUA's and SIGMET areas are shown with a red outline when inactive and with red cross-hatching when active.

2 Moving ALTRV's are shown by a rectangle instead of the usual air&aft symbol.

3. A data block will appear for all active uncharted SUA's and SIGMET areas. A menu item will allow data blocks for these active areas to turned on and off globally.

Individual data blocks maybe toggled on or off whether the area is active or not. A leader will connect the data block to the area if necessary. The data block will contain the name, altitude, date, and time for uncharted SUA's. The data block will contain a label (up to 16 alphanumeric characters) for SIGMET areas. Initial mode for uncharted SUA's and SIGMET data blocks will be on.

4 A data block will be available for all charted SUA's. The data-block will contain the name, altitude, date, and time. Individual data blocks may be toggled on or off whether the area is active or not. A leader will connect the data block to the area if necessary. Initial mode on data blocks will be off.

5. Activation start time for any special use area may be 'current system clock date and time.

6. SIGMET areas may be activated, moved, or deleted from the display.

7. Charted and uncharted SUA's and SIGMET areas may be deactivated-from the display with trackball or keyboard; a password will be required.

(n) Display winds

1. Selected flight levels can be displayed (Default 390).

2. Streamers with hollow circles at origin pointwill be used to display forecasted weather.

3. Streamers with filled circles at origin point will be used to display PIREP updated weather.

4. 5 degree by 2.5 degree grid will be used to display forecast.

5. 5 degree by 1 degree grid will be used to display updated winds.

n. TRACK ADVISORY.

(1) TA Functional Requirements

(a) The possible options for Track Advisory that can be evaluated are as follows:

1. Generate a baseline fuel/time performance index using the flight plan request without regard for ATC separation requirements.

2. Generate an index for the best altitude performance consistent with the flight plan requested altitude that can be achieved on the requested route, using separation requirements.

3. Define the delay, in one-minute increments, that would be required to allow the aircraft to cross the gateway at the altitude requested and with the requested subsequent altitude performance using separation requirements.

4. Generate index for the best altitude performance consistent with flight plan request when entering at one or both of the next two lower available altitudes.

5. Generate index for the best altitude performance consist&t with the flight plan request when entering at the next higher available altitude.

6. Repeat options 1.2 to 1.5 for all selected alternative routes.-

7. Compute efficiency factors based on ratio of calculated index for each option to the baseline index.

8. Transmit route altitude availability to airspace users from a list of options. Options shall be listed based on efficiency factor. Password will be required.

9. A separate DOTS ARINC address will be defined for TA messages only. (Defined in parameter data file.)

10. The slot buffer time interval used to insure separation at a gateway fix can be defined by the facility. The default is the standard ATC separation time for that area.

(b) When an aircraft flight profile passes through radar-controlled airspace, the applicable radar separation minima will be used for that portion of the route.

(1) TA Workstation/Display Characteristics

(a) TA Display Manipulation

1. Tabular display

2. As each flight plan is received, show the following:

(aa) Aircraft ID
(bb) Proposed departure time
(cc) Departure point
(dd) Flight Information Region (FIR) entry gateway
(ee) FIR exit gateway
(ff) Destination
(gg) TA option priorities
(hh) Indication that a Track Advisory message has been sent to the dispatcher.
(ii) Indication that message from the dispatcher regarding a track selection has been received.

3. Display the following for a selected aircraft ID:

(aa) Flight Plan
(bb) Current TA options and associated efficiency factors
(cc) Messages sent indication
(dd) Messages waiting indication.

4. Send flight plan options to user (password required) given the users ARINC address and format requirements.

5 Message waiting indication will turn on when a message has been'received and will stay on until turned off by operator.

(b) TA Data Manipulation

1. When a new Estimated Departure Time (EDT) for an aircraft is received, the system notifies the operator with a flashing indication. The operator then may initiate a recalculation index for track options.

2 When a departure message is received the EDT maintained by t&k advisory is replaced with the actual time of departure.

3. If the EDT passes, and aircraft has not yet departed, the procedure is as follows:

(aa) The facility will have defined two time intervals: a recalculation time A and a reservation cancellation time B.

(bb) When the EDT arrives without a departure message, the EDT on the track advisory display turns red to alert the operator.

(cc) At time A after EDT, the track options are automatically recalculated, and the red EDT on the display begins to flash.

(dd) At time B after EDT the aircraft's reservation is cancelled.

(ee) At any time between EDT+A and EDT+B the operator may abort the automatic reservation cancellation.

(ff) If the reservation is cancelled, other aircraft are evaluated for that slot. If changing to the vacated slot would be beneficial for another aircraft the operator will be notified.

4. A "Reservation List" based on ATC and user negotiated plans is maintained, including:

* Aircraft ID
* FIR entry gateway
* FIR exit gateway
* Time at entry gateway
* Altitude at entry gateway

5. A history file of departures will include:

* Aircraft ID
* Departure time
* Departure point
* Destination
* Route

p. BACKUP SYSTEM.

(1) Automatic tape backup each day will be available when tape is loaded in the machine. A manual backup option is available under password control. (complete data backup)

(2) All aircraft files can be downloaded to the Apollo floppy disk drive in personal computer (PC) format. Backup files are selectable to floppy disk.

(3) The system shall have a backup dialup line to ARINC in the event of a communication line failure.

(4) Backup files include:

(a) Actual AFTN/NADIN flight plan.

(b) System generated aircraft performance file.

(c) All ARINC reports on aircraft identifying all bad or unknown reports.

(d) Daily tracks generated.

(e) Weather database.

(5) Tape Playback:

(a) The backup system shall have the ability to re-display historical aircraft traffic movement saved by the DOTS system. This capability shall be:

1. Tape based only.

2. Activated by key input with date and time period information.

(6) Backup Apollo provides hardware system backup.

q. SYSTEM-WIDE FEATURES.

(1) Time blocks - continually rotating on display to identify operating condition of all major DOTS functions.

(2) Workstation Communications - Limited text messages can be defined and transmitted between workstations on the Apollo network. The receiving workstation will display the message across bottom portion of screen. Operator must select the message to remove it from the display. These messages will be included in the backup historical data files.

(3) Selective data - Specialist may select and highlight any Track Generation or Track Advisory data displayed on the screen, and write it to a file. The Specialist may then edit and print the data on a dot matrix printer, or address data information and send it to an external source.

(4) DOTS dialup capability from outside the facility. Facility is responsible for issuing passwords.

(5) Option to input SIGMET's with trackball or keyboard.

(6) DOTS shall 'contain a Parameter file that will be initiated at system startup at each facility. Each facility will define its own parameter data limitations from options available in the system. This will include things like prioritization and assignment of passwords and color selection for certain displays or functions from those made available by the system.

(7) Additional uncharted SUA's may be added to database using a full screen editor or by being manually entered.

(8) The system shall process aircraft position data as it becomes available.

(9) System shall have the capability to route OCS messages from ZAN DOTS to the ZOA DOTS.

33. INTERFACES. DOTS interfaces will include:

a. Primary and backup line interface to ARINC; Data interface to NOTAM office or facility selected addresses through ARINC.

b. Data interface to Anchorage ARTCC's OCS.

c. The DOTS external power interface will provide 120 Volts Alternating Current (Vac) at 20 amperes to the Uninterruptable Power Supply (UPS).

d The DOTS remote power interface will provide 120 Vac at 20 amperes to the remote UPS.

34-39. RESERVED.

CHAPTER 4. PROJECT SCHEDULE AND STATUS

40. PROJECT SCHEDULES AND GENERAL STATUS. Summary milestone schedules encompassing program and project milestone activities are developed and maintained by the Program Manager for DOTS in ARD-100. Project milestones are reflected in terms of scheduled completion date. The summary schedule associated with the DOTS project forms the basis for deriving the milestone schedule presented in the GANTT charts in section 46 of this chapter (Figure 4.3).

41. MILESTONE SCHEDULE SUMMARY. The schedule summarizing DOTS implementation milestones is expressed in terms of Builds and delivery dates. If necessary, the schedule will be changed to reflect the latest DOTS implementation milestones, based on the actual rather than planned dates. Changes to the schedule will be implemented by ARD-100.

42. IMPLEMENTATION PLAN. The approach that will be taken to implement the DOTS at the ARTCCs impacts the software development planning. Therefore, this section addresses the implementation plan first, while the following section discusses the software development plan. Figure 4.1 shows the relationship of the Tasks to seven Builds discussed in the following subsections and includes projected installation dates for each site. Section 47, Deliverable Schedule, contains additional scheduling information.

43. OPERATION TEST AND EVALUATION SOFTWARE (OTE). The DOTS OTE software will be developed and installed at the sites through a phased implementation approach. Rather than implement the entire DOTS at one time, the Tasks described in Section 32 will be allocated to one of four distinct OTE Builds. A Build is defined as a software system that is being delivered to the FAA for operational test and evaluation. It represents a subset of the product's final capabilities. Each OTE Build will be separately developed, installed, tested, and accepted at the three sites. As each Build is installed at a site, the site will recognize a significant increase in functionality until, finally, the complete DOT System is operational at that site. The four OTE Builds are listed below:

a. Build 3 - Track Generation
b. Build 4 - Traffic Display
c. Build 6 - Flight Plan & Dynamic Wind Processing
d. Build 7 - Track Advisory

44 DEVELOPMET TEST AND EVALUATION (DTE). Development Test and Evaluation (DTE) Builds will be developed and installed prior to completing development of three of the four OTE Builds. The DTE Builds serve two purposes. First, they allow the software designers to test the algorithms, methods, and hardware utilization proposed for the production system in a field operational environment. Second, they allow the FAA field personnel who will be using the production system to evaluate the user interfaces and confirm that the functions meet their requirements. The DTE efforts will not require formal life cycle documentation.

a. Users will provide written comments after the DTE software has been in use in the field for 30 consecutive calendar days. The comments, along with internal observations and performance data, will then be incorporated into the detailed design of the production software. Any functional changes to the Track

b Generation or Track Advisory resulting from the DTE will be incorporated into the DOTS Functional Description and System/Subsystem Specification in accordance with the configuration management procedures described in the DOTS Software Configuration Management Plan.

c. The three DTE Builds are listed below:

(1) Build 1 - Traffic Display DTE
(2) Build 2 - Track Generation DTE
(3) Build 5 - Track Advisory DTE

Figure 4.1
IMPLEMENTATION PLAN

Build 1 - Traffic Display (DTE)
- o New York — April 1990
- o Anchorage' — May 1990
- o Oakland — September 1990

Build 2 - Track Generation (DTE)
- o Oakland — September 1990
- o New York — September 1990

Build 3 - Track Generation (OTE System)
- Weather Forecast Database
- Track Generation Function
  - o Oakland — April 1991
  - o New York — May 1991
  - o Anchorage — May 1991

Build 4 - Traffic Display (OTE System) .
- ARINC Position/Clearance/PIREP & Forecast Data
- ARINC Message Validation.
- Traffic Display/Communication System
  - o Oakland — April 1991
  - 0 New York — May 1991
  - o Anchorage — May 1991

Build 5 - Track Advisory (DTE)
- o Oakland — January 1992
- o Anchorage — January 1992
- o New York — February 1992

Build 6 - Flight Plan & Dynamic Wind Processing (OTE)
- ARINC Message Validation
- NADIN/AFTN Communication Flight Plan Processor
- Weather Database Update
  - o Oakland — January 1992
  - o Anchorage — January 1992
  - o New York — February 1992

Build 7 - Track Advisory (OTE System)
- Track Advisory Function
  - o Oakland — March 1992
  - o Anchorage — April 1992
  - o New York — 'May 1992

45. BUILD DESCRIPTIONS. The scope of each Build is described below.

a. Build 1 consists of DTE installations of the Traffic Display at New York, Oakland and Anchorage ARTCCs. The system is implemented on two Apollo workstations at each site. The system processes ARINC messages and extracts aircraft data. No flight plan processing or OCS data processing is performed. The ARINC software and display software were provided by FAA. This Build was initially installed under the Operational Development effort.

b Build 2 is the DTE version of Track Generation. Since Track Generation is performed as a batch process and is essentially independent of the aircraft data processing and display functions, it can be installed as a separate Build. Implementation of the DTE Track Generation functions required modifying the ARINC communications software and adding weather forecast processing functions to provide wind and temperature data for generating tracks. The DTE Track Generation does not include the system management functions that allow operators to select and change parameters. Also, the DTE Track Generation display is limited to those features available as part of Build 1 and any additional features necessary to evaluate Track Generation. Automatic retransmission of the weather forecast will not be included in the DTE Track Generation.

c. Build 3 is the OTE version of Track Generation and Weather Forecast processing. It will be installed and tested at all three sites at the same time as Build 4.

d. Build 4 is the OTE version of the Traffic Display and the aircraft data processing functions which support the display. The ARINC message handling and initial 'system monitoring functions will be included, but flight plans will not be processed in this Build. Additional system monitoring software will be included with each subsequent Build. OCS data processing will be included in the Anchorage installation.

e. Build 5 is the DTE version of Track Advisory. This Build will interface with the communications and aircraft data functions of Build 4. It will use flight plan data and weather updates processed by Build 6 software, which will be installed at the same time.

f Build 6 is installed during the same site visit as Build 5 and consists of OTE flight plan processing and dynamic weather database update software. With this Build, the aircraft data processing software and the Traffic Display will be complete.

g **Build 7** is the OTE version of Track Advisory. It will also include the final version of system management software. Some of the system management functions may be included in earlier Builds as necessary to provide an operable system. Installation of this Build completes the DOTS OTE system.

46. SOFTWARE DEVELOPMENT PLAN. The structured methodology for developing the DOTS software is depicted in Figures 4.3, 4.4 and 4.5, The DOTS Life Cycle. Appendix 1 of this document defines the acronyms used in the figure, and provides definitions for these terms.

a. As shown in the figure, the activities and documentation associated with the development will address three different scopes, based on the approach taken in the contractor% software development plan.

b. First, all the requirements analysis and preliminary design will be done a single time for the entire DOT System. A functional baseline and allocated baseline will be established against which the detailed design and operational system can be verified. The preliminary design will be taken to the level at which the four Builds can be identified as independent subsystems and all the interfaces, between the Builds are defined. At this point in time, DTE Builds will be developed and installed for field testing and evaluation.

c. Second, a detailed design will be prepared for each of the four OTE Builds. The detailed designs will be taken to the level at which code can be written.

d Third, code will be written for each of the four OTE Builds. The code written for the first site installation will be adapted, as necessary, for the remaining two sites in order to capture any requirements unique to an ARTCC. Thus, a maximum of twelve (12) sets of code will be written and tested, one for each of the'four OTE Builds at each of the three sites.

47 DELIVERABLE SCHEDULES. Formal DOTS deliverables will be forwarded for FAA review. In accordance with modification 0002 of the contract, the FAA will review and (1) approve, or (2) provide comments on the deliverables for revision or additions by the Contractor, within ten calendar days after receipt of the deliverable. Figures 4.6 and 4.7, Deliverable Schedule (sorted by item and date, respectively), list the date that each deliverable is due to the FAA. These deliverables are divided into two categories:

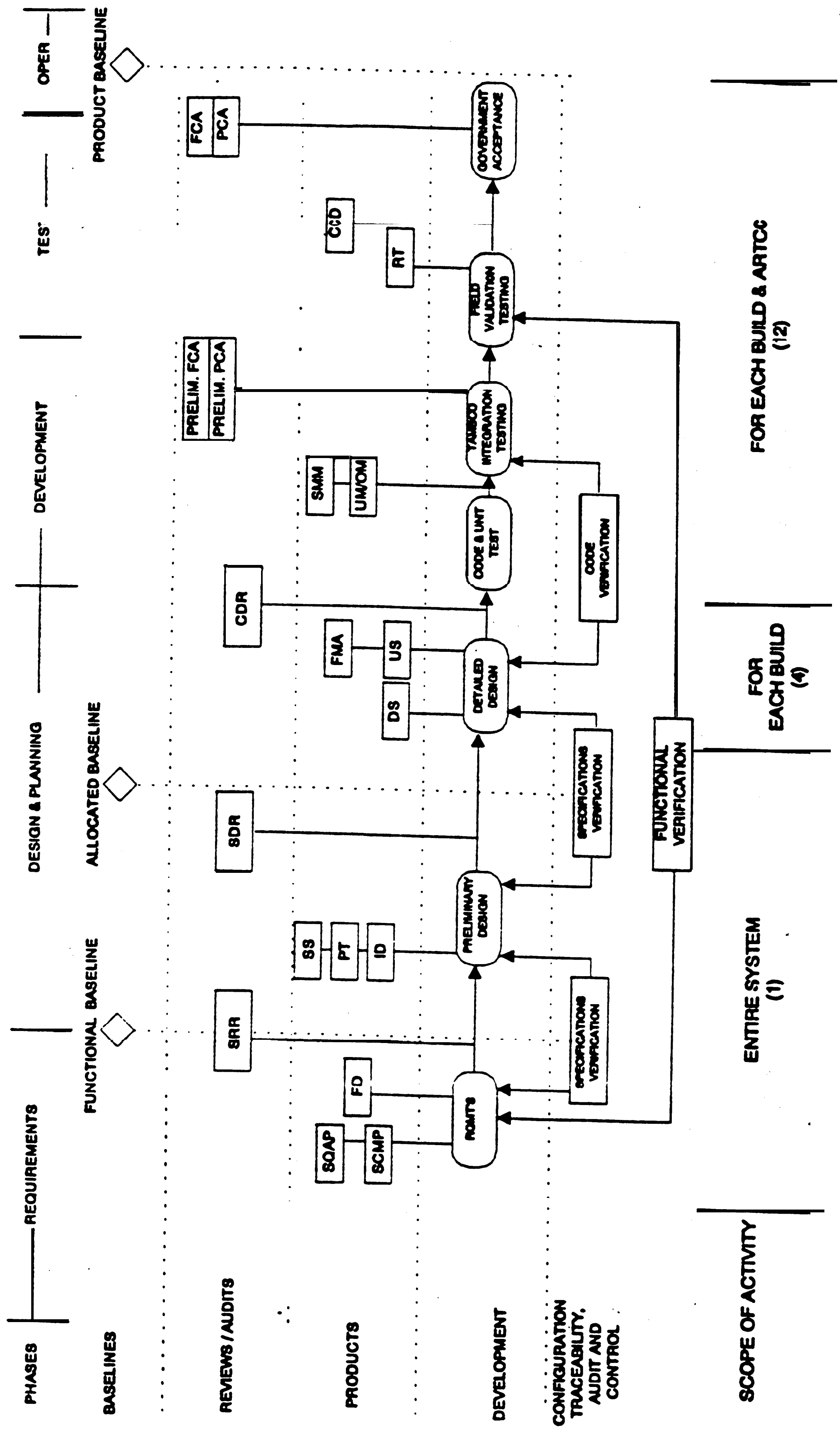
a. Documentation written for the entire DOTS. These documents are delivered one time and address all Builds, Tasks, and ARTCCs that are part of the DOTS. This documentation is represented by the following:

(1) Functional Description
(2) System Development Plan
(3) Software Quality Assurance Plan
(4) Software Configuration Management Plan
(5) System Specification
(6) Test Plan
(7) Interface Document
(8) Configuration Control Document
(9) System Integration Documentation
(10) Final Report

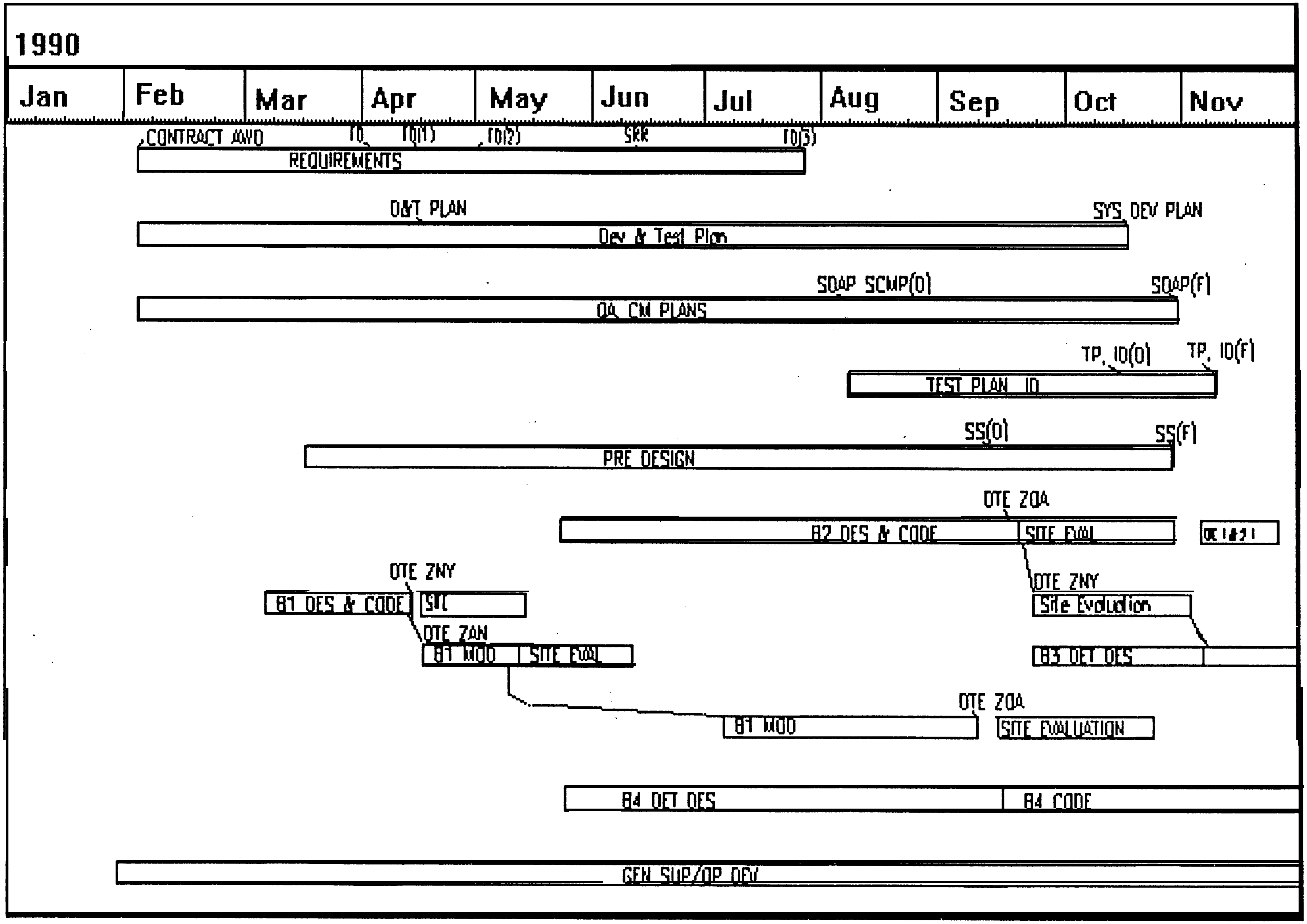
Note: The SQAP and SCMP will be delivered as a combined document.

b. Documentation specific to each site and each Build. These documents and OTE versions of software are delivered to each, site whenever a Build is installed for site test and acceptance. Since there are three sites and four Builds, Contractor will deliver twelve sets of the following items:

(1) Unit Software Specification
(2) Users Manual/Operators Manual
(3) Software Maintenance Manual
(4) Failure Mode Analysis
(5) Data Element Dictionary
(6) Operational Software
(7) Report on Test & Evaluation of Operational Software



PHASES
REQUIREMENTS
DESIGN & PLANNING
DEVELOPMENT
TEST
OPER
BASELINES
FUNCTIONAL BASELINE
ALLOCATED BASELINE
PRODUCT BASELINE
REVIEWS / AUDITS
SRR
SDR
CDR
PRELIM. FCA
PRELIM. PCA
FCA
PCA
PRODUCTS
SQAP
SCMP
FD
SS
PT
ID
DS
FMA
US
SMM
UM/OM
CCD
RT
DEVELOPMENT
RQMTS
PRELIMINARY DESIGN
DETAILED DESIGN
CODE & UNIT TEST
YAMSCO INTEGRATION TESTING
FIELD VALIDATION TESTING
GOVERNMENT ACCEPTANCE
CONFIGURATION TRACEABILITY, AUDIT AND CONTROL
SPECIFICATIONS VERIFICATION
CODE VERIFICATION
FUNCTIONAL VERIFICATION
SCOPE OF ACTIVITY
ENTIRE SYSTEM (1)
FOR EACH BUILD (4)
FOR EACH BUILD & ARTCC (12)


1990
Jan
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Mar
Apr
May
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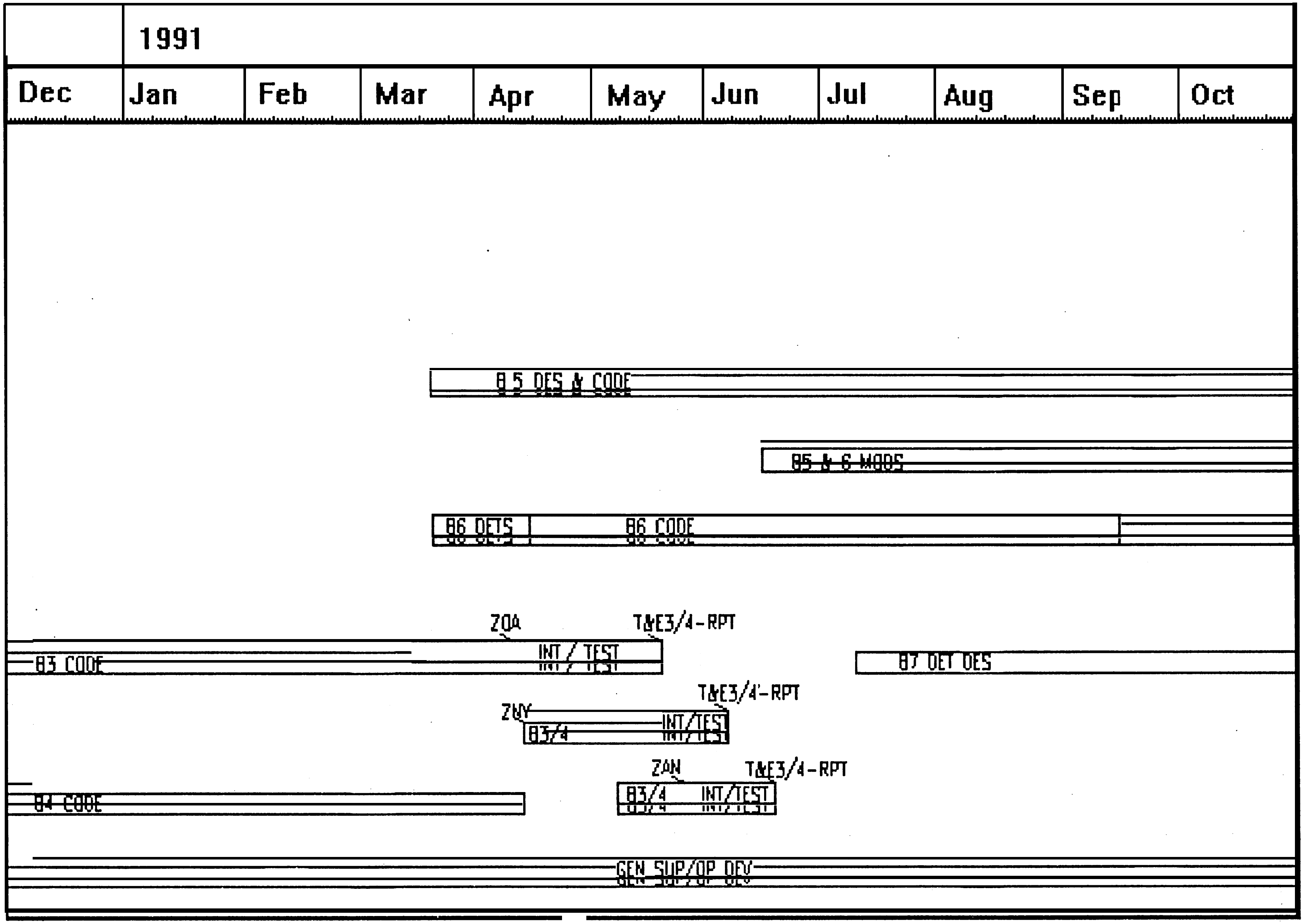
Sep
Oct
Nov
CONTRACT AWD
IO
IO(1)
IO(2)
SRR
IO(3)
REQUIREMENTS
D&T PLAN
SYS DEV PLAN
Dev & Test Plan
SQAP SCMP(0)
SQAP(F)
QA CM PLANS
TP, ID(0)
TP, ID(F)
TEST PLAN ID
SS(0)
SS(F)
PRE DESIGN
OTE ZOA
B2 DES & CODE
SITE EVAL
OTE ZNY
B1 DES & CODE
SIT
OTE ZAN
B1 MOD
SITE EVAL
OTE ZNY
Site Evolution
B3 DET DES
OTE ZOA
B1 MOD
SITE EVALUATION
B4 DET DES
B4 CODE
GEN SUP/OP DEV

Figure 4.3


1991
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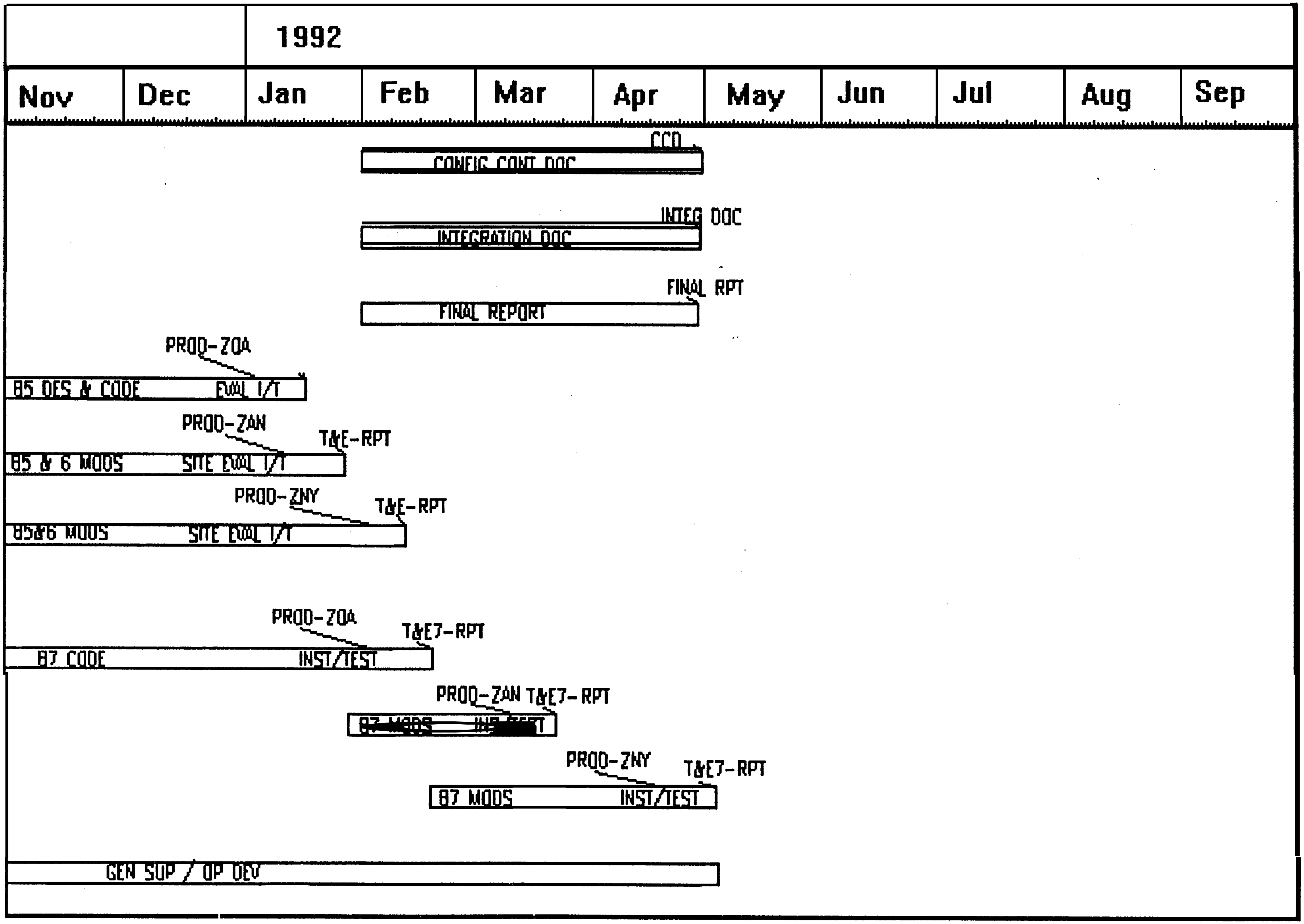
Sep
Oct
B 5 DES & CODE
B5 & 6 MODS
B6 DETS
B6 CODE
ZOA
T&E3/4-RPT
B3 CODE
INT / TEST
B7 DET DES
T&E3/4-RPT
ZNY
B3/4
INT/TEST
ZAN
T&E3/4-RPT
B4 CODE
B3/4
INT/TEST
GEN SUP/OP DEV

Figure 4.4


1992
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May
Jun
Jul
Aug
Sep
CCD
CONFIG CONT DOC
INTEG DOC
INTEGRATION DOC
FINAL RPT
FINAL REPORT
PROD-ZOA
85 DES & CODE
EVAL I/T
PROD-ZAN
T&E-RPT
85 & 6 MODS
SITE EVAL I/T
PROD-ZNY
T&E-RPT
85&6 MODS
SITE EVAL I/T
PROD-ZOA
T&E7-RPT
87 CODE
INST/TEST
PROD-ZAN
T&E7-RPT
PROD-ZNY
T&E7-RPT
87 MODS
INST/TEST
GEN SUP / OP DEV

Figure 4.5

Figure 4.6: DELIVERABLES SCHEDULE, SORTED BY ITEM
(Page 1 of 2)

Item	Description	Quantity	Delivery Date
2.1	System Documentation Deliverables		
2.1.1	Functional Description	3	3-Apr-90
2.1.2a	System Development Plan	3	19-Apr-90
2.1.2b	System Development Plan (Revised)	3	15-Oct-90
2.1.3	Software Quality Assurance Plan	3	25-Oct-90
2.1.4	Software Configuration Management Plan	3	25-Oct-90
2.1.5	System Specification	3	19-Oct-90
2.1.6	Test Plan	3	8-Nov-90
2.1.7	Interface Document	3	8-Nov-90
2.1.8	Configuration Control Documentation	3	30-Apr-92
2.1.9	System Integration Documentation	3	30-Apr-92
2.1.10	Draft Final Report	1	16-Apr-92
2.1.11	Final Report	3	7-May-92
2.2	Facility/Build Documentation		
2.2.1	Build 3 (Track Generation)		
2.2.1a	Facility/Build Documentation-Anchorage	3	20-May-91
2.2.1b	Facility/Build Documentation-Oakland	3	15-Apr-91
2.2.1c	Facility/Build Documentation-New York	3	6-May-91
2.2.2	Build 4 (Traffic Display)		
2.2.2a	Facility/Build Documentation-Anchorage	3	20-May-91
2.2.2b	Facility/Build Documentation-Oakland	3	15-Apr-91
2.2.2c	Facility/Build Documentation-New York	3	6-May-91
2.2.3	Build 6 (Flight Plan & Dynamic Wind Processing)		
2.2.3a	Facility/Build Documentation-Anchorage	3	27-Jan-92
2.2.3b	Facility/Build Documentation-Oakland	3	13-Jan-92
2.2.3c	Facility/Build Documentation-New York	3	10-Feb-92
2.2.4	Build 7 (Track Advisory)		
2.2.4a	Facility/Build Documentation-Anchorage	3	3-Apr-92
2.2.4b	Facility/Build Documentation-Oakland	3	20-Mar-92
2.2.4c	Facility/Build Documentation-New York	3	l-May-92
2.2.5	Final Configuration		
2.2.5a	Facility/Build Documentation-Anchorage	3	3-Apr-92
2.2.5b	Facility/Build Documentation-Oakland	3	20-Mar-92
2.2.5c	Facility/Build Documentation-New York	3	l-May-92
2.3	Report on Site Test and Evaluation of Operational Software		
2.3.1	Build 3 (Track Generation)		
2.3.1a	Report on ST&E of Oper. SW - Anchorage	3	17-Jun-91
2.3.1b	Report on ST&E of Oper. SW - Oakland	3	13-May-91

Figure 4.6 (cont.):DELIVERABLE SCHEDULE, SORTED BY ITEM
(Page 2 of 2)

Item	Description	Quantity	Delivery Date
2.3.1c	Report on ST&E of Oper. SW - New York	3	3-Jun-91
2.3.2	Build 4 (Traffic Display)		
2.3.2a	Report on ST&E of Oper. SW - Anchorage	3	17-Jun-91
2.3.2b	Report on ST&E of Oper. SW - Oakland	3	13-May-91
2.3.2c	Report on ST&E of Oper. SW - New York	3	3-Jun-91
2.3.3	Build 6 (Flight Plan & Dynamic Wind Processing)		
2.3.3a	Report on ST&E of Oper. SW - Anchorage	3	3-Apr-92
2.3.3b	Report on ST&E of Oper. SW - Oakland	3	20-Mar-92
2.3.3c	Report on ST&E of Oper. SW - New York	3	l-May-92
2.3.4	Build '7 (Track Advisory)		
2.3.4a	Report on ST&E of Oper. SW - Anchorage	3	3-Apr-92
2.3.4b	Report on ST&E of Oper. SW - Oakland	3	20-Mar-92
2.3.4c	Report on ST&E of Oper. SW - New York	3	l-May-92
2.3.5	Final Build		
2.3.5a	Report on ST&E of Oper. SW - Anchorage	3	l-May-92
2.3.5b	Report on ST&E of Oper. SW - Oakland	3	l-May-92
2.3.5c	Report on ST&E of Oper. SW - New York	3	l-May-92
2.4	Development Test & Evaluation, Build 1 (Traffic Display)		
2.4.1	DT&E Traffic Display System-Anchorage	1	8-May-90
2.4.2	DT&E Traffic Display System-Oakland	1	14-Sep-90
2.4.3	DT&E Traffic Display System-New York	1	10-Apr-90
2.5	Fully Tested, Fully Compliant DOT System		
2.5.1	Fully Tested & Compliant DOTS-Anchorage	1	19-Mar-92
2.5.2	Fully Tested & Compliant DOTS-Oakland	1	20-Feb-92
2.5.3	Fully Tested & Compliant DOTS-New York	1	16-Apr-92
2.6	Quarterly Financial Reports		Quarterly
2.7	Development Test & Evaluation, Build 2 (Track Generation)		
2.7.1	DT&E Track Generation System-New York	1	21-Sep-90
2.7.2	DT&E Track Generation System-Oakland	1	14-Sep-90
2.8	Development Test & Evaluation, Build 5 (Track Advisory)		
2.8.1	DT&E Track Advisory System-Anchorage	1	27-Jan-92
2.8.2	DT&E Track Advisory System-New York	1	10-Feb-92
2.8.3	DT&E Track Advisory System-Oakland	1	18-Jan-92

Figure 4.7: DELIVERABLES SCHEDULE, SORTED BY DATE
(Page 1 of 2)

Item	Description	Quantity	Delivery Date
2.1.1	Functional Description	3	3-Apr-90
2.4.3	DT&E Traffic Display System-New York	3	10-Apr-90
2.1.2a	System Development Plan	3	19-Apr-90
2.4.1	DT&E Traffic Display System-Anchorage	1	8-May-90
2.4.2	DT&E Traffic Display System-Oakland	1	14-Sep-90
2.7.2	DT&E Track Generation System-Oakland	1	14-Sep-90
2.7.1	DT&E Track Generation System-New York	1	21-Sep-90
2.1.2b	System Development Plan (Revised)	3	15-Oct-90
2.1.5	System Specification	3	19-Oct-90
2.1.3	Software Quality Assurance Plan	3	25-Oct-90
2.1.4	Software Configuration Management Plan	3	25-Oct-90
2.1.6	Test Plan	3	8-Nov-90
2.1.7	Interface Document	3	8-Nov-90
2.2.1b	Facility/Build Documentation-Oakland	3	15-Apr-91
2.2.2b	Facility/Build Documentation-Oakland	3	15-Apr-91
2.2.1c	Facility/Build Documentation-New York	3	6-May-91
2.2.2c	Facility/Build Documentation-New York	3	6-Apr-91
2.3.1b	Report on ST&E of Oper.SW - Oakland	3	13-May-91
2.3.2b	Report on ST&E of Oper.SW - Oakland	3	13-May-91
2.2.1a	Facility/Build Documentation-Anchor.	3	20-May-91
2.2.2a	Facility/Build Documentation-Anchor.	3	20-May-91
2.3.1c	Report on ST&E of Oper. SW - New York	3	3-Jun-91
2.3.2c	Report on ST&E of Oper. SW - New York	3	3-Jun-91
2.3.1a	Report on ST&E of Oper. SW - Anchor.	3	17-Jun-91
2.3.2a	Report on ST&E of Oper. SW - Anchor.	3	17-Jun-91
2.2.3b	Facility/Build Documentation-Oakland	3	13-Jan-92
2.8.3	DT&E Track Advisory System-Oakland	1	18-Jan-92
2.2.3a	Facility/Build Documentation-Anchor.	3	27-Jan-92
2.8.1	OT&E Track Advisory System-Anchorage	1	27-Jan-92
2.8.2	OT&E Track Advisory System-New York	1	10-Feb-92
2.2.3c	Facility/Build Documentation-New York	3	10-Feb-92
2.5.2	Fully Tested & Compliant DOTS-Oakland	1	20-Feb-92
2.5.1	Fully Tested & Compliant DOTS-Anchorag	1	19-Mar-92
2.2.5b	Facility/Build Documentation-Oakland	3	20-Mar-92
2.3.4b	Report on ST&E of Oper. SW - Oakland	3	20-Mar-92
2.3.3b	Report on ST&E of Oper. SW - Oakland	3	20-Mar-92
2.2.4b	Facility/Build Documentation-Oakland	3	20-Mar-92

Figure 4.7 (cont): DELIVERABLE SCHEDULE, SORTED BY DATE
(Page 2 of 2)

Item	Description	Quantity	Delivery Date
2.3.3a	Report on ST&E of Oper. SW - Anchorage	3	3-Apr-92
2.2.4a	Facility/Build Documentation-Anchorage	3	3-Apr-92
2.2.5a	Facility/Build Documentation-Anchorage	3	3-Apr-92
2.3.4a	Report on ST&E of Oper. SW - Anchorage	3	3-Apr-92
2.5.3	Fully Tested & Compliant DOTS-New York	1	16-Apr-92
2.1.10	Draft Final Report	1	16-Apr-92
2.1.8	Configuration Control Documentation	3	10-Apr-92
2.1.9	System Integration Documentation	3	10-Apr-92
2.3.3c	Report on ST&E of Oper. SW - New York	3	l-May-92
2.3.5b	Report on ST&E of Oper. SW - Oakland	3	l-May-92
2.2.4c	Facility/Build Documentation-New York	3	l-May-92
2.2.5c	Facility/Build Documentation-New York	3	l-May-92
2.3.5a	Report on ST&E of Oper. SW - Anchorage	3	l-May-92
2.3.4c	Report on ST&E of Oper. SW - New York	3	l-May-92
2.3.5c	Report on ST&E of Oper. SW - New York	3	l-May-92
2.1.11	Final Report	3	7-May-92

Facility/Build Documentation will be delivered initially in the form of draft documents so that site testing can be accomplished. These documents are the Users Manual/Operators Manual (UM/OM) and the Software Maintenance Manual (SMM). Following Government acceptance of the software, either change pages to the drafts or replacement copies will be provided, as necessary; so that each site has a final, complete set of documentation.

c. In addition, Contractor will deliver Quarterly Financial Reports within ten (10) calendar days after the end of the contract quarter being reported. These reports will be delivered on the following dates:

	To Cover the Period From:		
May 10, 1990	2/8/90	To	4/30/90
August 10, 1990	5/1/90	To	7/31/90
November 10, 1990	8/1/90	To	10/31/90
February 10, 1991	11/1/90	To	1/31/91
May 10, 1991	2/1/91	To	4/30/91
August 10, 1991	5/1/91	To	7/31/91
November 10, 1991	8/1/91	To	10/31/91
February 10, 1992	11/1/91	To	1/31/92
May 17, 1992	2/1/92	To	5/7/92

48. ASSUMPTIONS. The following paragraphs contain assumptions that are necessary for the timely development and implementation of the DOTS,

a. Access to Government Furnished Data - The deliverable products and schedule are predicated on **access to** all necessary ATC policies, regulations, and directives that pertain to the implementation of this system.

b ARINC Data Source **-** Access to ARINC data is necessary in order to properly code **and** test the DOTS software. The Government will provide a connection at the Contractor facility, that consists of a dedicated telephone line, the necessary hardware to interface with the ARINC network, and approval from the necessary agencies so that the Contractor receives the data in time to do meaningful testing.

c. Government Furnished Interfaces - The scheduled installation and testing of the software at the three sites is predicated on the availability of Government supplied interface hardware and data sources when needed.

d Government Furnished Equipment - The performance of the DOTS development in a timely and cost effective manner is predicated on the availability of Government Furnished Equipment.

e. System Performance - The DOTS software will be implemented on Government supplied and selected Apollo workstations. Every effort will be made to optimize the system performance on the specified hardware. However, no warranty **is** made concerning system performance or capacity.

f Access to Government **Facilities -** The Government will provide access'to the appropriate ATC facilities, as required. This access will be subject to prior coordination with the designated Government representative.

g Government Site Responsibilities **-** The DOTS **software will be** installed at Government supplied **and equipped work areas in Oakland** Anchorage, and New York **ARTCCs.** Contractor site installation shall'be limited to the shipping and unpacking of hardware and the connecting of the hardware **to signal and** power sources within five feet of the location. The Government will supply power, signal wiring, furniture, and other items of this nature at each site.

49. INTERDEPENDENCIES AND SEQUENCE. Implementation of DOTS is not critically dependent on the implementation of other automation programs. DOTS is intended to provide automation **to the oceanic** traffic management process. Implementation of DOTS will automate the present manual process.

CHAPTER 5. PROJECT MANAGEMENT

50 PROJECT MANAGEMENT, GENERAL. Overall project management responsibility for implementation of DOTS rests with ARD-100. Project management functions and responsibilities are administrated by the FAA. Management functions relative to DOTS implementation encompass technical, financial, program office, and schedule management planning responsibilities. Allocation of DOTS requirements, development, procurement, implementation, and logistics support responsibilities, are as follows:

a. ARD-100. Program management; hardware and software procurement; and hardware configuration management. DOTS project management, encompassing DOTS procurementent and implementation; funding for initial DOTS training, and maintenance; configuration management; and final hardware and software DOTS configuration.

b AHT-400. Responsible for identifying, analyzing and refining resource requirements for Airway Facilities (AF) training needs determined by the service or other FAA entity. This office also ensures agency standards are applied in meeting new equipment technical training requirements, ensures the use of task analysis as a , basis for technical training development, coordinates the service technical content review, administers the course approval process, and ensures that programs meet field requirements as defined by the service.

c. AHT-500. Responsible for developing and/or obtaining training to meet the requirements established by ATZ-100.

d ASM-120. Responsible for planning and monitoring the execution of FAA maintenance policy and ensuring that required maintenance resources have been identified. Responsible for contract maintenance support and the procurement of support equipment not currently in the FAA Inventory.

e. ASM-200. Responsible for issuance of policies, standards and guidelines relating to Airway Facilities maintenance coverage and response. Position classification, career development, technical training requirements, certification of technical field personnel, field organization, the performance of studies the analysis of issues associated with field staffing requirements, sector staffing standards for new NAS systems and forecasting trends affecting future service policy.

f. ASM-400. The National Automation Engineering Field Support Division is the principal element of the Service assigned responsibilities encompassing direct engineering support to field facilities; directive publication and issuance; and in-service improvement and modification development, evaluation, and implementation for NAS systems as assigned by the latest version of **1320.48**, Engineering Field Support Division. ASM-400 provides input to the NAILS process and will participate in the DOTS shakedown testing.

g. ATZ-100. Responsible for establishing all air traffic training requirements and development of associated training proposals to meet those requirements.

h. ALG-200. Responsible for developing supply support and provisioning policy.

i. ANS-400. The principle element within the Agency responsible for assuring that all applicable NAILS element requirements are planned, acquired, managed, and integrated into all new NAS subsystems, equipments and facilities in a manner that provides for total life-cycle support. Also responsible for determining life-cycle costing and funding constraints.

j. FAA Regions. Responsible for supervising the assigned (AF) work force. Each region is responsible for assigning sufficient personnel to the AF sectors within the region to ensure adequate oversight of the contractor's maintenance of the DOTS.

k. AF SECTOR. Responsible for assigning DOTS Maintenance Contractor oversight responsibilities for all DOTS facilities within the sector based on geographic disposition and skill capabilities.

l. FAA Logistics Center. Responsible for provisioning, supply support, and the management of depot level maintenance, performed by the contractor. DOTS equipment is all COTS and is installed at only three locations so it will not be necessary for the Logistics Center to stock DOTS spares. If there is a need for the Logistics Center to stock spares in the future, it will be determined by the DOTS Program Office who will provide all the coordination and documentation and funding.

m. FAA Academy. Responsible for technical evaluation of contractor training and for development and conduct of FAA training as required.

n. ALG-300. Responsible for initiating, managing, administering and modifying the DOTS contract as required.

o. ACN-110. Development of hardware and software evaluation master test plan and integration test plans and procedures; DOTS performance evaluation testing; FAA integration testing; and DOTS implementation planning support.

q ATR-300. Associate program management support and planning, including development and coordination of DOTS requirements. Provide coordination to DOTS project management, encompassing DOTS procurement and implementation; funding for initial DOTS training, and maintenance; configuration management; and final hardware and software DOTS configuration.

r. ASE-600. Responsible for conducting Physical and Functional Configuration Audits (PCA, FCA), and developing baseline case file for inclusion of operational systems into NAS inventory.

s. Contractor. Provision of hardware and software, initial training, and maintenance, as required by the DOTS contract.

51. PROJECT CONTACTS. The following personnel are involved in the management and planning of DOTS implementation efforts, and are the project contacts for -DOTS implementation:

Position	Name	Organization	Telephone
Program Manager	Dave Ford	ARD-100	(202)267-353
Contracting Officer	Sarah Scott	ALG-360	(202) 267-7395
Requirements	Elbert Henry	ATR-330	(202)267-7241
Project Manager	Diane Brigida	TAMSCO	(703)271-0411
Technical Lead	Bela Collins	AvTec	(703)271-0411
Test Lead	Pat Lewis	ACN-110	(FTS)482-6202
OT&E Shakedown Testing	Larry Williams	ASM-410	(FTS)482-5737

Configuration Management	Dick Ziebart	ASM-440	(FTS)482-6274
Logistic Support	CMLS Contractor	TAMSCO	(703)271-0411
Training Support	TBD		
Scheduling Support	Program Office	ARD-100	
Test Monitor	Calvin Alexander	ACN-110	(609) 484-4398
Assessment & Document Review	Kyle Graybeal	ASE-600	(202)646-2331

52 PROJECT COORDINATION. The project management office (ARD-100), coordinates DOTS development, procurement, implementation, and logistic support requirements through the following organizations:

a. ASM-100 Maintenance Engineering Division

b. ASM-200 Maintenance Operations Division

c. ASM-400 National Automation Engineering Field

d. AHT-400 Airway Facilities Training Program

e. AHT-500 Air Traffic Training Program Division

f. ALG-300 Contracts Division

g. ALG-200 NAS Support Division

h. ATZ-100 Field Development Program

i. ANS-400 NAILS Program Division

j. AK-400 FAA Logistics Center

k. AAC-900 FAA Academy, Mike Monroney Aeronautical

1. Regional Offices (Coordination of site equipment deliveries, and system configuration management)

m. ATR-300 Air Traffic Plans & Requirements Service

53. PROJECT RESPONSIBILITY/COORDINATION MATRIX. Figure 5.1 illustrates the internal and external organizational elements responsible for major project functions.

FIGURE 5.1
Project Responsibility/Coordination Matrix

Organ.	Cnfg. Mgt.	Training	Maint.	Testing	Acquit	Deploy
ARD-100	X	X	X	X	X	X
ATR-300	X	X	X	X	X	X
AHT-400		X			X	
AHT-500		X			X	
ASM-120			X		X	
ASM-200		X	X			
ASM-400	X		X			X
ATZ-100		X			X	
ANS-420	X	X	X		X	X
ALG-300					X	
ACN-110	X	X	X	X		X
ASE-600	X			X		
Regions	X	X	X	X	X	X
Contractor	X	X	X	X		X

54. PROJECT MANAGERIAL COMMUNICATIONS. DOTS project status is reviewed on a monthly basis by ARD-100, at FAA Headquarters. These reviews assess the technical, schedule, and cost status of the program. ARD-100 at FAA Headquarters defines and coordinates procurement, delivery, installation, testing, and logistic support requirements. FAA Logistics Center support approach and equirements relative to DOTS implementation and support were examined and found unnecessary in the NAS Integrated Logistic Support Management Team meeting (NAILSMT). Associated decisions were recorded in NAILS Management Team minutes, distributed to participants and reflected in updates to the Integrated Logistics

Support Plan (ILSP). General information relative to DOTS procurement and implementation status is disseminated to the affected regions and throughout FAA Headquarters through periodic project status memoranda. Additional managerial tools for the DOTS project, such as plans, reports, documents, briefings, meetings, working groups, teams, etc, are as follows:

a. Project Status, Meetinss. These meetings will be held (regularly/as needed) by ARD-100 to provide general- purpose progress reporting, discussion and resolution of problems, requests for information, and policy notification, on a direct basis. Program office will determine necessary participants.

b. Regional Status Reports. Regular reports will be submitted to ATR-300. ATR-300 will coordinate with regions and field facilities. These reports will cover technical progress and cost performance associated with the preparation, installation, integration, and testing at each site, and will be submitted on a schedule to be determined by the DOTS program manager.

c. Program Management Status Reports (PMSRs). These reports, submitted by the DOTS Contractor to the DOTS program office, describe work progress, updated milestone schedules, and any actual or potential problem areas encountered during the course of implementing DOTS,

d Regular Overview Meetings (ROMs). These meetings, to be conducted by the Contractor, will provide a program overview and detailed discussions of selected areas. The meetings will provide Government and contractor management with an insight into the Contractor% technical progress, program planning, and overall management approach and progress. Technical progress reporting will individually identify hardware and software program status. Status and information presented at the meetings will reflect at least 30 days currency. Agendas for forthcoming meetings and minutes of past meetings will be submitted by the Contractor for Government approval prior to each ROM. Topics of discussion to be addressed at the ROMs will include, but will not be limited to, the following:

1 Risk and problem identification, ranking, avoidance, reduction; and control.

2. Establishment of schedules including critical path identification and performance baseline.

3. Progress tracking and reporting of milestones.

4 Subcontractor management, including technical effort status, identification of potential problem areas, and cost and manpower expenditures.

5. Program manpower and cost expenditures during the preceding 30-day period and cumulative to date.

6 Implementation activities for Configuration Management (CM) and control, with particular emphasis on computer programs and computer data CM and control, including a current listing by the Contractor of Configuration Item Development Records (CIDRs).

7 Logistics support status, including technical manual development efforts and training program implementation status.

8. Manufacturing status.

9. System performance analysis and simulation status.

10. System testing.

11. Government-Contractor relationships.

e. Contractor Work Breakdown Structure (CWBS). This will be generated and maintained by the Contractor throughout the course of the contract, and will be used as a framework for contract planning, budgeting, managing, and reporting the status of cost, schedule, CM, technical, and logistics achievements. CWBSs will be submitted to the Government for review and approval. The CWBSs will include all subcontracted work. In addition to the CWBS, the Contractor will also generate and maintain a Work Breakdown Structure (WBS) dictionary that will provide for cost account level management.

f Program Milestones and Schedules. These will be developed by the Contractor, and will include milestones for testing, engineering, logistics, CM, manufacturing, and other elements of the contract as necessary. The Contractor will develop an integrated summary network on a time-frame basis to illustrate the sequence of work identified by the CWBS elements and tasks, and the interdependencies of the CWBS elements. The network will include all specified program milestones, formal reviews, data submittals, delivery information, and other significant events and activities that relate system program planning to performance and cost objectives. These planning tools will help assure that deliveries and milestones specified in the contract for contract end items are met, and will be subject to Government approval.

g <u>NAILS Management Team (NAILSMT)</u>. Logistics support and resultant requirements relative to implemented DOTS will be identified and coordinated through the NAILSMT. Associated decisions will be recorded in NAILSMT minutes, will be distributed to participants, and will be reflected in updates to the Integrated Logistics Support Plan (ILSP).

h <u>System Development Plan (SDP)</u>. This plan will be prepared by the Contractor and will encompass all phases of the integrated system engineering process, including the design, development, fabrication, factory acceptance testing, site installation, and site shakedown (acceptance) testing. The SP will include a description of the proposed methods to be utilized in performing various engineering studies and analyses. It will be subject to Government approval.

i. <u>Interface Control Documents (ICDs)</u>. These will be prepared by the Contractor to define the interface impact of DOTS associated with Hardware Configuration Items (HWCIs) and Computer Software Configuration Items (CSCIs). Engineering changes having interface impact on ICDs will be identified in Engineering Change Requests (ECRs).

j. <u>Software Development Plan (SDP)</u>. This plan will be prepared by the Contractor to document the design, development, code, integration and test, demonstration, implementation, documentation, operation, and support of all DOTS software. It will also include the methods and procedures to be used for the following:

1 Establishment of Software Development Files (SDFs), as described below, for all CSCIs, Computer Software Components (CSCs), and Computer Software Units (CSUs) developed during the course of the contract.

2. Establishment, operation, maintenance, and control of access to a Software Development Library (SDL), as described below. The SDP will be maintained and updated by the Contractor throughout the life cycle of the contract, and will be subject to Government approval.

3 Methodology for providing all information, data, documentation, and software needed to satisfy the Government% Independent Verification and Validation (IV&V) requirements.

k <u>Software Development Files (SDFs)</u> These files will document the Contractor% internal software configuration and will include as a minimum (1) design considerations and constraints, (2) design documentation and data, (3) schedule and status information, (4) test requirements, cases, procedures and results, and (5) software problem reports.

1 <u>Requirements Traceability Matrix (RTM)</u>. An RTM will be provided by the Contractor and, as required and appropriate, any subcontractors involved in the implementation of DOTS. The RTM will provide technical references, specifications, SDFs, and software requirements documentation. It will be organized and structured in such a way as to provide a critical tool in support of the software development process in terms of the design, programming, testing, management, and configuration control, while maintaining the computer program performance and capability requirements traceability.

m. <u>Independent Verification and Validation (IV&V)</u>. The Contractor will provide to the Government appropriate IV&V information, data, documentation, and software, including (1) applicable SDFs and the status of outstanding software problem reports, (2) information to support Government acceptance inspection, preparation for delivery, and installation and checkout procedures of the software, and (3) information for ensuring contractual compliance.

o. <u>Project Status Dissemination</u>. General information relative to DOTS procurement and implementation will be disseminated to required regions and divisions throughout the FAA by the DOTS program office.

P <u>Union Briefings</u>. Union bargaining unit representatives will be briefed as appropriate on the DOTS project and expected effects on the maintenance technician work force at local, regional, and national levels. Other briefings will be made as required.

q <u>Letters of Agreement</u>. Appropriate letters of agreement between FAA organizations will be generated to provide mutual technical assistance, expertise, and support in the procurement and implementation of DOTS as needed. These letters of agreement will be generated or coordinated by the Program Office.

55. <u>IMPLEMENTATION STAFFING</u>. No peculiar site staffing requirements are associated with achievement of the pre-operational phase of DOTS implementation. Implementation will be accomplished with existing personnel.

56. **PLANNING AND REPORTS.** The documentation (plans, procedures, and reports) referenced in this PIP in relation to DOTS implementation is as follows:

a. DOTS Integrated Logistic Support Plan, 03/21/91

b. DOTS Master Test Plan, 06/04/91

c. DOTS Contractor Test Plan, 01/31/91

d. DOTS Integration Test Plan and Procedures, 04/12/91

e. OT&E Shakedown Test Scripts, Procedure, and Reports,03/31/91

f. Deployment Readiness Review (DRR) Report, 06/28/91

57 APPLICABLE DOCUMENTS. The following documents are referred to in this PIP, and provide technical specifications, information, policy, and directives that are applicable to this implementation. Conflict between these and other documents should be brought to the attention of the DOTS Program Manager (ARD-100) for resolution.

a. FAA-xxxxxxx, DOTS Specification, x/x/xx

b. DOTS Integrated Logistics Support Plan, xx/xx/xx

c. DOTS Subsystem Training Plan, xx/xx/xx

d NAS Project Status and Baseline Schedule Change Control Procedures

e. NAS Program Deployment Readiness Review, Draft FAA Order and ADL Memorandum (07/09/91).

58 CONTRACT MANAGEMENT. Management of the DOTS contract will be performed by the Contracts Division (ALG-300), Acquisition and Material Service (ALG-1), of the FAA, as described below.

a. A Contracting Officer (CO), designated by the Advanced Automation Branch (ALG-360), will perform general procurement and contract management activities relative to the DOTS contract. This will include monitoring Contractor deliveries, conducting progress reviews as necessary, and performing any other duties required to ensure that the terms of the contract are met by the Contractor.

The CO is the only person authorized to make any changes that will affect the price and equipment quantities, deliverables, or schedules.

b A Contracting Officer's Technical Representative (COTR), designated by the DOTS Program Manager (ARD-100), will provide technical guidance and direction to the contractor within the scope and life of the DOTS contract.

59. CONFIGURATION MANAGEMENT. ARD-100 is responsible for configuration management for each DOTS site, during the installation of DOTS, from the time of delivery through completion and signing of Form FAA-256 at FAA support sites. The DOTS Contractor will provide the COTR or his designee with a Configuration Items (CI) index list. This CI list will contain the part nomenclature, revision level, and engineering release number for all equipment the Contractor has installed at each site.

CHAPTER 6. PROJECT FUNDING

60 PROJECT FUNDING STATUS, GENERAL. Funding for this project in the amount of $3.46 million has been obligated. These funds will be used for the design, development, and fabrication of 12 production models of DOTS, See Figure **6.1**

Figure 6.1

PROJECT		RESOURCES		FY90	FY91	FY92	TOTAL
DOTS		BUDGET	RE&D	1.5	0.6	0.3	2.4
Spons.	ATR-300		F&E		0.75	0.31	1.06
Govt.			'Total	1.50	1.35	0e61	3.46
Contre	TAMSCO	STAFFING					
	AvTec		FAA HQ	1.0	2.5	2.5	6e00
	Embry R		FAATC		1.0	1.0	2e00
	Amer Air		Total	1.0	3.5	3.5	8e00

61. REGIONAL REQUIREMENTS, Limited funding for such regional activities as implementation planning and site preparation will be budgeted by ARD-100. Additional funding for FAA site preparation, installation, checkout, and acceptance test support will be budgeted through FY-92. ARD-100 will provide funds to each site, through Project Authorization (PA) funds, as required, to furnish the sites with DOTS. The funding will support the following:

a. Site Preparation, The cost of materials used in performing required site preparation (if any) will be funded. by the sites,

b Site Installation, All installation costs against Facilities and Equipment (F&E) will be funded by ARD-100.

c. Installation Planning. Regional installation planning, development and validation activities will be the responsibility of the regions where the DOTS is installed,

d. Training. Funding for initial training will be provided by ARD-100. Pre-requisite and refresher training will be funded through ASM-120.

62. SITE PREPARATION FUNDING,

63-69. RESERVED.

CHAPTER 7. DEPLOYMENT

70. GENERAL-DEPLOYMENT ASPECTS. Deployment of DOTS to the field will be coordinated through ARD-100 with the Contractor, A NAS Change Proposal (NCP) will be initiated and will be coordinated through the ARD-100 Configuration Control Board (CCB) to bring the procured DOTS into the NAS inventory. A Configuration Control Decision (CCD) will be issued, approving and detailing DOTS deployment and implementation, Program Office coordinates scheduled installation with ATR-300 prior to installation, At the time of installation, Program Office will brief site personnel. Other deployment aspects associated with DOTS implementation will be discussed below.

a. NCPs Supporting DOTS Implementation, NCPs are being initiated and coordinated through ARD-100 to support DOTS implementation, as follows:

1. A space NCP is being generated at each of the facilities where the DOTS is to be located (Oakland, New York and Anchorage ARTCCs).

2. A baseline case file is being generated by ASE-600 for the DOTS once the Functional and Physical configuration Audits (FCA & PCA) are completed.

b Initial Deliveries, Delivery by the Contractor of the production DOTS of the initial contract phase will begin XX months after the date of contract award, and will be coordinated by ARD-100. Delivery of the systems will be as follows:

(1) NY ARTCC NY ARTCC NY 1 DOTS system for shakedown testing

(2) OAK ARTCC Oakland, CA 1 DOTS system for shakedown testing

(3) ANC ARTCC Anchorage, AK 1 DOTS system for shakedown testing

c. Software and hardware will be provided to the sites by Contractor. Contractor will install and test systems at each site, as well as train site personnel. Installation and use instructions for the software will also be provided by ARD-100. Sites will receive DOTS equipment from the Contractor as required, up to the equipment quantity allocation defined in paragraph 72 herein, Delivery of DOTS by the Contractor will be to each site,

d. Site Deliveries. Deliveries of DOTS hardware and software will be according to published contractor delivery schedule and will be coordinated by ARD-100.

e. Deployment Readiness Review (DRR). As required by AAF policy issued in a memorandum dated xx/xx/xx, a DRR will be conducted by ARD-100 prior to operational use at the first operational site, The formal DRR briefing to AAF-1 will occur after the DOTS is installed at the designated test site, and after integration testing is conducted by ACN-110. The results will be briefed in a DRR report to AAF-1.

1. The purpose of the DRR is to determine site and personnel readiness to deploy (i.e., to install, integrate, operate, and support) the DOTS in an operational environment. The outcome of the DRR report Will be a deployment decision, and may involve the resolution of action items identified during the DRR process,

71. SITE PREPARATION. Preparation requirements and equipment set-up instructions supporting site implementation of DOTS will be developed by ARD-100 distributed to the affected sites, The instructions will contain detailed equipment set-up instructions supplementing those issued by the vendor with the equipment, as well as site cabling and power requirements and testing procedures, to verify system readiness; Site preparation activities will be performed by the regional AF divisions and/or sectors. Specific site preparation requirements will vary in accordance with the site-peculiar needs of an ARTCC, GNAS sector office, or an FAA support site.

a. Site Access Requirements. Since all DOTS hardware, components are COTS, no abnormal site access requirements are anticipated.

b Floor Loading Requirements. No unusual floor loading requirements are anticipated.

c. Cabling Requirements. Cabling external to the DOTS, such as power cables and communications cables, will be supplied by the FAA to each site prior to the installation. Cabling to connect the DOTS equipment to existing equipment will also be supplied by the Contractor.

d Power Requirements. Power requirements of DOTS is very nominal (see Section 32 on UPS herein) and should be well within the capability of any site,

e. Operating Environment, Each site will ensure that adequate environmental conditions are available to support DOTS performance after installation, Operating environment requirements associated with DOTS components are presented in Chapter 3 herein.

72 DELIVERY. Delivery will be per contractor accepted delivery schedules. Three FAA sites have been identified for receiving DOTS, as follows:

a. Oakland Air Route Traffic Control Center
b. New York Air Route Traffic Control Center
c. Anchorage Air Route Traffic Control Center
d. Delivery of DOTS will be as follows:

(1)	Oakland ARTCC	04/15/91
(2)	New York ARTCC	05/06/91
(3)	Anchorage ARTCC	05/19/91

73 INSTALLATION PLAN. The regional, ARD-100, and DOTS Contractor activities and responsibilities associated with the implementation of DOTS are defined in terms of the installation sequence that will be followed at the sites,

Representatives form the Program Office, ARTCC Facility, and the FAATC will observe the Contractor% installation and checkout activities, The Test director from the FAATC (ACN-110 & ASM-410), will define the procedures to be followed by site personnel for observing and evaluating DT&E testing and conducting and evaluating OT&E testing on the DOTS. Each site will be required to notify ARD-100 if any equipment necessary for installation is inoperable and cannot be repaired prior to scheduled installation.

74-79. RESERVED.

CHAPTER 8. VERIFICATION

80. **FACTORY VERIFICATION.** Factory acceptance tests will be conducted by the Contractor on the pre-pre-production DOTS in accordance with the approved test procedures and prior to shipment to the three locations cited herein in paragraph 70. All COTS equipment will be subjected to commercially-acceptable product testing procedures by the Contractor, in accordance with best commercial practice, prior to delivery to the sites.

81. CHECKOUT. Checkout tests will be performed by the Contractor and by FAA at each site to verify the DOTS operational and performance capability after installation, Initially, checkout tests will involve the pre-production DOTS at the three locations listed in paragraph 70e As contract options are exercised and additional systems are delivered, the checkout tests will be conducted as appropriate at the sites listed in paragraph 72.

a. Contractor Checkout Tests. These tests will be designed to verify both operational performance and conformance with FAA standards. Tests will include product testing procedures, where appropriate,

b FAA Checkout Tests. These tests will include benchmark testing, conducted by ACN-110, to verify DOTS performance relative to FAA specifications and the Contractor% specifications (with regards to COTS).

82. CONTRACTOR INTEGRATION TESTING (CIT). Minimal CIT is required in the New York or Oakland ARTCC's since the only DOTS interface is through ARINC. Integration testing will have to be conducted with the Offshore Computer System (OCS) in the Anchorage ARTCC.

83. CONTRACTOR ACCEPTANCE INSPECTION (CAI). No CAI is required.

84 FAA INTEGRATION TESTING. NAS integration testing will be observed at the Oakland ARTCC by ACN-110, in accordance with the ACN-110 developed integration test plan approved by ARD-100. The project-level effort will encompass integrated testing of all Contractor supplied hardware and software,

85 SHAKEDOWN AND CHANGEOVER, Shakedown testing is an Operational Testing & Evaluation (OT&E) activity that will be performed by ASM-400 in accordance with the approved (by ARD-100) shakedown test plan. The tests will be performed at the key site in a live (real-time) environment, The shakedown test activities will assess the functional performance and operational suitability and effectiveness of the DOTS as interfaced with the oceanic air traffic management environment,

86. <u>JOINI ACCEPTANCE INSPECTION (JAI)</u>. The requirements for JAI in accordance with FAA Order 6030.45 are not critical to the deployment of the DOTS. There will be Memorandum of Understanding between ARD-100 and ASM-400 as to the handoff procedures for the secondary support of the DOTS and thezesponsibility of the sites where it is installed.

87-89. **RESERVED**.

CHAPTER 9. INTEGRATED LOGISTICS SUPPORT

90. MAINTENANCE CONCEPT. A Contractor Maintenance Logistics Support (CMLS) approach has been determined by the NAILS process to be the best option for the DOTS. The development Contractor (TAMSCO) will maintain the system until all Builds are completed and turned over to the FAA. The* CMLS contract will then be instituted with additional one-year options for the seven-year life cycle of the DOTS.

91 TRAINING. The Contractor has provided an initial 16 - hour training course for three persons at each site, Future training by the Contractor will be on an as needed basis, ATZ-100 will determine the Air Traffic training needs, AHT-500 will identify and analyze the available resources to conduct training, then provide a Procurement Request (PR) to the DOTS Program Office. ASM-260 will determine the Airway Facilities training needs, AHT-400 will identify and analyze the available resources to conduct training, then provide a PR to the DOTS Program Office:

92. SUPPORT TOOLS AND TEST EQUIPMENT. No special tools or test equipment is anticipated to implement DOTS. A Contractor Maintenance and Logistics Support contract (CMLS) will be in force in support of DOTS hardware and software, As part of the initial test and evaluation process occurring during system acquisition, a test log will' be maintained which will provide a listing and description of Support Equipment (SE) to the government which could be used as a baseline for SE procurement later on within the life Cycle of the DOTS system.

93 SUPPLY SUPPORT. The present support concept of complete contractormaintenance and support of workstation hardware and software negates the requirement for site and depot level sparing of those items, This will also negate the need for a formal provisioning conference for the DOTS.

94 VENDOR DATA AND TECHNICAL MANUALS. Technical documentation quality control procedures will be included in the Contractor% Quality Control Plan as approved by the Government. The Contractor will develop and deliver technical documentation to ARD-100 in accordance with the contract to cover the following items:

a. Software User's Manual
be Computer System Diagnostics
c. Computer System Operations
de Software Programmer/System Maintenance

e. Test Plan'
f. Test Procedures
g. Software Test Procedures
h. Software Test Plan
i. Quality Assurance Plan
j. Maintenance Plan
k. Functional Description
l. Software Product Specifications
m. System/Segment Specification
n. Software Detailed Design
o. Software Top Level Design
p. System Requirements
q System Development Plan
r: Software Development Plan
s. System Engineering Management
t. Master Milestone Schedule
u. Program Management
v. Contract Work Breakdown Structure

95 EQUIPMENT REMOVAL. No equipment removal will be required for the implementation of DOTS.

96. FACILITIES, Facility impacts associated with implementation of DOTS will be minimal. Coordination will be effected with site, sector, and regional offices, as required and appropriate.

97-99. RESERVED.

APPENDIX 1. GLOSSARY OF ACRONYMS

ACRONYM	MEANING
	A
AAC	FAA MIKE MONRONEY AERONAUTICAL CENTER '(organizational symbol for)
AAF	FAA ASSOCIATE ADMINISTRATOR FOR AIRWAY FACILITIES
A/C	AIR CONDITIONING
ACF	AREA CONTROL FACILITY
ACT	FAA TECHNICAL CENTER (organizational symbol for)
ADCCP	ADVANCED DATA COMMUNICATIONS CONTROL PROCEDURE
AEA	FAA EASTERN REGION
AF	AIRWAY FACILITIES
AFTN	Aeronautical Fixed Telecommunications Network
AAL	FAA ALASKAN REGION
ALG	FAA LOGISTICS SERVICE
ARD	FAA RESEARCH & DEVELOPMENT
ARINC	AERONAUTICAL RADIO, INC.
ARTCC	AIR ROUTE TRAFFIC CONTROL CENTER
ASE	FAA SYSTEM ENGINEERING
ASM	FAA SYSTEMS MAINTENANCE SERVICE
ASR	AIRPORT SURVEILLANCE RADAR
ATC	AIR TRAFFIC CONTROL
AWP	FAA WESTERN-PACIFIC REGION
	B
	C
CAI	CONTRACTOR ACCEPTANCE INSPECTION
CCB	CONFIGURATION CONTROL BOARD
CCD	CONFIGURATION CONTROL DECISION
CDR	CRITICAL DESIGN REVIEW
CDRL	CONTRACT DELIVERABLES REQUIREMENTS LIST
CI	CONFIGURATION ITEM
CM	CONFIGURATION MANAGEMENT
CO	CONTRACTING OFFICER
COTR	CONTRACTING OFFICER' TECHNICAL REPRESENTATIVE
COTS	COMMERCIAL OFF-THE-SHELF
CPU	CENTRAL PROCESSING UNIT
CSC	COMPUTER SOFTWARE COMPONENT
CSCI	COMPUTER SOFTWARE CONFIGURATION ITEM
CWBS	CONTRACTOR WORK BREAKDOWN STRUCTURE

D

DAC	DAYS AFTER CONTRACT AWARD
DCN	DESIGN CHANGE NOTICE
DOT	UNITED STATES DEPARTMENT OF TRANSPORTATION
DOTS	DYNAMIC OCEAN TRACK SYSTEM
DRR	DEPLOYMENT READINESS REVIEW
DS	DATABASE SPECIFICATION
D T E	DATA TERMINAL EQUIPMENT
DT&E	DEVELOPMENTAL TESTING AND EVALUATION

E

ECR	ENGINEERING CHANGE REQUEST
EEM	ELECTRONIC EQUIPMENT MODIFICATION
EIA	ELECTRONIC INDUSTRIES ASSOCIATION
EM1	ELECTROMAGNETIC INTERFERENCE

F

FAA	FEDERAL AVIATION ADMINISTRATION
FAATC	FAA TECHNICAL CENTER
FAT	FACTORY ACCEPTANCE 'TEST
FD	FUNCTIONAL DESCRIPTION
F&E	FACILITIES AND EQUIPMENT
FCA	FUNCTIONAL CONFIGURATION AUDIT
FY	FISCAL YEAR

G

GFS	GOVERNMENT-FURNISHED SOFTWARE
GNAS	GENERAL NAS
GFI	GOVERNMENT FURNISHED INTERFACE

H

HVAC	HEATING, VENTILATION, AND AIR CONDITIONING
HWCI	HARDWARE CONFIGURATION ITEM

I

I/O	INPUT/OUTPUT
ICD	INTERFACE CONTROL DOCUMENT
IFB	INVITATION FOR BID
ILSP	INTEGRATED LOGISTICS SUPPORT PLAN
IMCS	INTERIM MAINTENANCE CONTROL SOFTWARE
IV&V	INDEPENDENT VERIFICATION AND VALIDATION

J

JAI	JOINT ACCEPTANCE INSPECTION

L

LSA	LOGISTICS SUPPORTABILITY ANALYSIS

M

MCC	MAINTENANCE CONTROL CENTER
MCS	MAINTENANCE CONTROL SOFTWARE
MDT	MAINTENANCE DATA TERMINAL
MMS	MAINTENANCE MANAGEMENT SYSTEM
MOM	MONTHLY OVERVIEW MEETING
MPS	MAINTENANCE PROCESSOR SUBSYSTEM
MPSG	MAINTENANCE PHILOSOPHY STEERING GROUP
MSL	MEAN SEA LEVEL

N

NADIN	NATIONAL AIRSPACE DATA INTERCHANGE NETWORK
NAILS	NATIONAL AIRSPACE INTEGRATED LOGISTICS SUPPORT
NAILSMT	NAILS MANAGEMENT TEAM
NAPRS	NAS AUTOMATED PERFORMANCE REPORTING SYSTEM
NAS	NATIONAL AIRSPACE SYSTEM
NCP .	NAS CHANGE PROPOSAL
NE	FAA NEW ENGLAND REGION
NSN	NATIONAL STOCK NUMBER
NW	FAA NORTHWEST MOUNTAIN REGION

O

OATS	OFFICE OF AUTOMATION TECHNOLOGY AND SERVICES
OCS	OFFSHORE COMPUTER SYSTEM
OT&E	OPERATIONAL TESTING AND EVALUATION
ORD	OPERATIONAL READINESS DEMONSTRATION

P

PA	PROJECT AUTHORIZATION
PCA	PHYSICAL CONFIGURATION AUDIT
PIP	PROJECT IMPLEMENTATION PLAN
PIREP	PILOT REPORT (weather)
PLC	PROGRAMMABLE LOGIC CONTROLLER
PMDT	PORTABLE MAINTENANCE DATA TERMINAL
PMSR	PROGRAM MANAGEMENT STATUS REPORT
PSRB	PROGRAM STATUS REVIEW BOARD

Q

QA	QUALITY ASSURANCE
QRO	QUALITY & RELIABILITY OFFICER

R

RM	REMOTE MAINTENANCE
RMM	REMOTE MAINTENANCE MONITORING
RMMS	REMOTE MAINTENANCE MONITORING SUBSYSTEM
RMS	REMOTE MAINTENANCE SUBSYSTEM
RT	TEST REPORT
RTR	REMOTE TRANSMITTER/RECEIVER

S

SAT	SITE ACCEPTANCE TESTING
SCMP	SOFTWARE CONFIGURATION MANAGEMENT PLAN
SDR	SYSTEM DESIGN REVIEW
SEIC	SYSTEMS ENGINEERING INTEGRATION CONTRACTOR
SMM	SOFTWARE MAINTENANCE MANUAL
SO	FAA SOUTHERN REGION
SQAP	SOFTWARE QUALITY ASSURANCE PLAN
SRR	SYSTEMS REQUIREMENTS REVIEW
SS	SYSTEM/SUBSYSTEM SPECIFICATION
SW	FAA SOUTHWEST REGION

T

TBD	TO BE DETERMINED
TMU	TRAFFIC MANAGEMENT UNIT

U

UM/OM	USERS MANUAL/OPERATORS MANUAL
UPS	UNINTERRUPTABLE POWER SYSTEM
US	UNIT SPECIFICATION

V

Vac	VOLTS ALTERNATING CURRENT
VRTM	VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

W

Z

ZAN	ANCHORAGE ARTCC
ZNY	NEW YORK ARTCC
ZOA	OAKLAND ARTCC