20 TRAFFIC FLOW MANAGEMENT

Air traffic management (ATM) encompasses traffic flow management (TFM) and air traffic control (ATC) capabilities and is designed to minimize air traffic delays and congestion while maximizing overall NAS throughput, flexibility, and predictability.

This section addresses the functionality and evolution of the national and local TFM components of the ATM architecture. The description of TFM functionality includes capabilities at the Air Traffic Control System Command Center (ATCSCC) with some functionality distributed to traffic management units (TMUs) at air route traffic control centers (ARTCCs), at high-activity terminal radar approach control (TRACON) facilities, and at the highest-activity airport traffic control towers (ATCTs). To avoid duplication, only TFM functionality is described in this section. For descriptions of ATC functionality, see Section 21, En Route; Section 22, Oceanic and Offshore; Section 23, Terminal; and Section 24, Tower and Airport Surface.

TFM is the strategic planning and management of air traffic demand to ensure smooth and efficient traffic flow through FAA-controlled airspace. To support this mission, traffic management specialists (TMSs) at the ATCSCC and traffic management coordinators (TMCs) at local facilities (ARTCCs, TRACONs, and towers) use a combination of automation systems and procedures known collectively as the TFM decision support systems (DSSs). Modernizing the TFM DSSs includes new capabilities that will provide:

- More timely and precise data exchange between traffic managers and airline operations centers (AOCs)
- Enhanced analytical and display capabilities to facilitate FAA and industry collaboration in response to temporarily reduced NAS capacity
- More precise tools to analyze flow control data, performance, and decisionmaking.

These TFM DSS enhancements are expected to reduce industry operating costs by reducing flight delays, providing more predictability, and giving users operational control over their resources. Presently, sites with operational prototypes have experienced operational benefits.

The future TFM is based on the concept of operations (CONOPS), which has the goals of increased safety and improved traffic flow, and supports Free Flight concepts. This CONOPS relies on a substantial increase in data exchange and collaborative decisionmaking between NAS users (e.g., revenue carriers, business aircraft, general aviation, military, and international aviators) and FAA service providers (e.g., air traffic control and traffic flow management) and on development of improved NAS flow analysis and prediction tools.

The FAA will provide NAS users with data on the status of NAS resources and conditions, while NAS users will provide their daily operating schedules, intent, and preferences to the FAA. This data exchange is expected to improve the decisionmaking process for both FAA and NAS users. Collaboration will allow airline operators to have a much stronger voice in decisions that affect their fleet productivity rather than having those decisions imposed upon them. NAS users will be involved in collaborative decisionmaking in three ways: (1) providing real-time data to the NAS, (2) when appropriate, actively participating in flow strategy development and selection, and (3) modifying their operations to meet the collaboratively determined flow initiatives.

NAS flow analysis and prediction tools will support the collaborative development, selection, and implementation of changes in flow restrictions in the NAS. This will benefit both users and the FAA by ensuring that the NAS is operated efficiently.

20.1 TFM Architecture Evolution

Implementation of TFM services is limited by existing TFM technology, which includes hardware, operating systems, and various programming languages that have become obsolete and are unsupportable. To support current flow management capabilities and planned enhancements, the TFM infrastructure will be upgraded to an open client-server infrastructure.

The envisioned TFM capability upgrades fall into these functional areas:

- *Data Exchange:* Access to more timely and accurate information
- *Collaborative Decisionmaking:* Improved communications with users for operations negotiations
- *NAS Flow Analysis:* More automated tools to evaluate NAS status.

Specifically, these upgrades are based on the RTCA Free Flight Task Force 3 report (supplemented by Working Group 5 of RTCA Subcommittee 169), the FAA's interagency research and development plan, and the current CONOPS. The structured evolution of these capabilities is depicted in Figure 20-1. The infrastructure to support these new functions will be upgraded in a parallel effort.

The TFM architecture represents a phased approach to modernization. The approach will replace the current infrastructure (to include hardware, operating systems, program languages, and communication protocols using commercial off-the-shelf (COTS) data base management systems (DBMS) and a geographic information system (GIS)), improve current operating system functionality, improve the efficiency of existing functionality, and provide for the evolutionary implementation of new TFM capabilities. Central to the infrastructure evolution is a reengineering effort designed to provide an open-system, client-server infrastructure and modernized software architecture capable of supporting the increased functional capabilities.

The key objective of capability improvements will be incremental implementation of the high-benefit TFM capabilities as soon as possible. TFM software upgrades that are planned for the period between 1998 and 2015 are organized into four steps. Five upgrades to the TFM infrastructure are also planned for these steps. The following sections summarize the current system and the upgrades in each functional area for each step.

20.1.1 TFM Architecture Evolution—Step 1 (1998)

TMUs are located at the ATCSCC, all ARTCCs, and high-activity TRACONs. Some high-activity ATCTs have a subset of TFM functionality. Located near Washington, D.C., in Herndon, Va., the ATCSCC is a national facility dedicated to systemwide domestic and international planning and coordination. Once the sole location for traffic management activity in the NAS, the ATCSCC

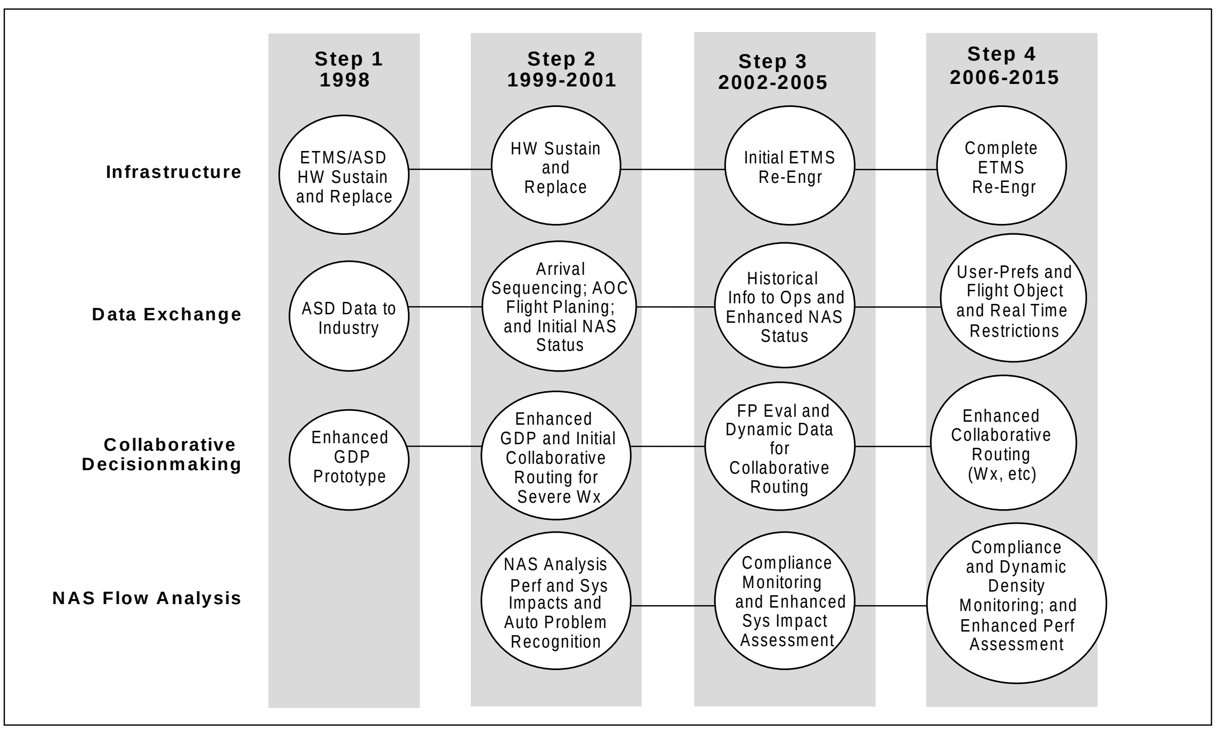

Figure 20-1. TFM Evolution

has evolved into a network of facilities with these key responsibilities:

- Monitoring air traffic and the status of airports and airspace across the NAS
- Coordinating with TMUs at local facilities to plan and implement restrictions as needed
- Assessing NAS performance and working toward long-term improvements
- Providing a central point of contact for NAS users and TMCs.

The TMSs at the ATCSCC monitor traffic, weather, resource capacity, and equipment status across the NAS to develop a systemwide perspective of NAS traffic flows and the implications of local situations (i.e., situations that affect the operations of a single en route center or a single approach control facility). TMSs are trained to work toward systemwide efficiency without allegiance to an individual en route center, approach control facility, or tower.

ARTCC and TRACON facility TMCs generally manage traffic situations affecting their airspace. They coordinate with neighboring facilities through the ATCSCC as needed and report status information to the ATCSCC. However, when traffic situations have broad impacts or when the underlying cause is extreme or long-lasting, the ATCSCC takes the lead in planning and coordination.

The ATCSCC develops flow management strategies that are implemented through the Ground Delay and Ground Stop programs, which are designed to respond to current capacity limitations due to adverse weather, runway closings, or other causes. The ATCSCC also oversees the National Route Program and monitors traffic at airports included in the Managed Arrival Reservoir program. Brief descriptions of these programs follow.

- **Ground Delay Program (GDP).** This program delays aircraft for a specific amount of time after their requested departure time in order to achieve a desired arrival rate at a destination airport. Appropriate departure delays are calculated to avoid excessive airborne holding. Controlled departure clearance times or estimated departure clearance times are assigned by a computer program at the ATCSCC, sent to host computers at the en route centers, and printed on flight strips. A prototype Ground Delay Program Enhancement system is being evaluated at the ATCSCC and selected AOCs.
- **Ground Stop Program.** This program stops all departures selected by the ATCSCC to a specific destination airport.
- **National Route Program (NRP).** This program allows flight planners to request use of specific routes in the NRP. Because the requested routes span en route center boundaries, the ATCSCC coordinates this program.
- **Managed Arrival Reservoir (MAR) Program.** For designated airports, this delay program eliminates the routine use of miles-in-trail restrictions on arrivals. The ATCSCC coordinates with local facilities to designate participating airports, and it monitors the actual use of airborne holding.

20.1.1.1 Current Infrastructure

Currently, the fundamental component of the TFM infrastructure is the Enhanced Traffic Management System (ETMS). ETMS provides a network of processors and workstations used by TMSs and TMCs to track and predict traffic flows, analyze effects of ground delays or weather delays, evaluate alternative routing strategies, and plan flow patterns.

ETMS data management and processing is centrally performed via the TFM hub. The hub is the processing engine that drives ETMS, and data provided by the TMUs are the basis for ETMS processing. The hub establishes and maintains a flight data base of active and proposed flights within the United States and adjacent oceanic air space. This data base is compiled from flight data submitted by the ARTCCs and some TRACONs and flight service stations (FSSs). Weather data, facility configuration, and facility status are maintained in separate hub data bases. ETMS has three major components:

- Applications at the ATCSCC that support national analyses
- Functions that centrally manage the ETMS wide area network (WAN) communications

by processing and distributing messages to all sites

- Aircraft situation display (ASD) functions that support AOCs, TMUs at local facilities (ARTCCs, TRACONs, towers, and regional facilities), and other users.

The current ETMS uses Apollo/Hewlett Packard processors for TMU display functions, hub routing and message processing, and ATCSCC functions. ETMS uses a point-to-point, proprietary communications system that features centralized processing with a star topology to connect the various TFM sites. ETMS applications were developed using Apollo processors and operating systems that are obsolete and no longer supported. The ETMS hardware and operating systems currently are being upgraded, and an effort is underway to translate the applications software to C language. This effort includes defining an application interface to use the transmission control protocol/Internet protocol (TCP/IP) socket-based interface and acquisition routers supporting the transition of communications to TCP/IP, which will be accomplished in Step 2.

20.1.1.2 Current Functionality

ETMS supports TMSs in assessing traffic demand by displaying, on a national scale, traffic location and volume and predicting air traffic flow hours in advance. ETMS is a tool for dynamically analyzing projected flow into sectors and airports, enabling preventive action to ensure that controlled areas are not overloaded.

ETMS provides these functions:

- **Traffic Display.** By monitoring the ASD, TMCs can evaluate traffic flow, demand, and available capacity at the national, regional, and local levels.
- **Congestion Prediction.** TMCs can anticipate periods of congestion with the monitor alert, which compares the expected number of aircraft at specific resources (e.g., airports and sectors) against established thresholds.
- **Arrival Analysis.** When arrival demand at an airport is predicted to substantially exceed capacity for an extended period of time, the TMSs at the ATCSCC can invoke a capability to develop a GDP.

ETMS extracts official scheduled data from the Official Airline Guide (OAG) and combines the data with data in the TFM hub. Data from these sources are used to produce the ASD. The GDP is used when air traffic demand is expected to exceed the arrival capacity at an airport for an extended time period. This situation is prevented by delaying takeoffs of some of the aircraft destined for that airport. GDPs use predictions of demand and capacity to produce a schedule of departure delays.

A version of ASD is available to industry and provides a national-level aircraft situation data feed to industry, enhancing the FAA's and industry's collaborative decisionmaking.

TMSs implement cross-NAS traffic restrictions, facilitate coordination among domestic and international service providers, and interact with AOC facilities and other NAS users. The ATCSCC mission is to balance air traffic demand with system capacity. It also uses the central altitude reservation function (CARF), the special use airspace (SUA) management system (SAMS), the dynamic ocean tracking system plus (DOTS Plus), and the high-altitude route system (HARS).

CARF manages military flight plans. SAMS provides historical data of SUA usage by both military and civilian air traffic. DOTS Plus calculates preferred oceanic tracks based on current wind conditions and records the assignment of flights to tracks. HARS provides routing for military aircraft over the contiguous United States.

20.1.2 TFM Architecture Evolution—Step 2 (1999–2001)

As part of Free Flight Phase 1 Core Capabilities Limited Deployment (FFP1 CCLD), AOCs and ATM personnel will use collaborative decision-making (CDM) capabilities to enhance flight planning. The FAA will provide participating AOCs with aggregate demand lists, anticipated airport acceptance rates, arrival rates, and parameters for anticipated ground delays. In the two-way exchange of information, AOCs will respond to the FAA with flight cancellations and revised schedules.

The FFP1 CCLD capabilities to be used for TFM include:

- *Enhanced ground delay program:* Uses two-way data exchange between the FAA and AOCs to facilitate better ground delay decisions
- *NAS status information:* Provides the NAS operational status to AOCs to promote a shared understanding of NAS traffic management decisions
- *Collaborative routing:* employs electronic chalkboards to share real-time traffic flow information with users to discuss potential routing alternatives around severe weather.

AOCs and the FAA will have the opportunity to access system performance, operational benefits, and acceptability. With positive results, these CDM capabilities will be fully developed, integrated, and deployed to suitable locations.

20.1.2.1 Infrastructure Enhancements

During this period, infrastructure enhancements will include TFM sustainment (hardware and operating systems), year-2000 compliance, and hub hardware replacement. This step replaces unsupportable software and hardware components. It is a stopgap effort to pave the way for future open system enhancements. Obsolete proprietary communications will be replaced with new software and hardware supporting TCP/IP. This is an essential step that forms the foundation for the migration of TFM infrastructure and functionality to an open systems environment. Installations of ETMS at new locations (TRACONs and ATCTs) will continue (refer to Sections 21, En Route; 22, Oceanic and Offshore; and 23, Terminal). The weather and radar processor (WARP) will become the primary source of ARTCC and ATCSCC weather data and will interface with TFM decision support systems (DSSs) that require weather support. ETMS will interface with the Standard Terminal Automation Replacement System (STARS) via a one-way interface.

20.1.2.2 Functional Enhancements

Data Exchange

Data exchange enhancements planned for this step include:

- *Enhanced Data Exchange for GDP:* Will provide data exchange to support collaborative decisionmaking between the FAA and AOCs to facilitate ground delay decisions by the FAA and efficient scheduling decisions by the airlines. NAS users provide actual cancellation and delay information to the FAA. The FAA will provide aggregate demand lists, anticipated airport acceptance rates, arrival rates, and parameters for anticipated ground delays. This updated current-day schedule information will become the basis for improved GDPs and more accurate monitor and alert predictions, which will reduce adverse schedule impacts on NAS users.
- *Arrival Sequence Display, Increment 1:* Will display arrival traffic schedules in TRACON TMUs as soon as a flight is airborne. This initial increment will be directed at TRACONs with a single dominant carrier.
- *NAS Status, Increment 1:* Will provide airport-related NAS status information, which is readily available from current systems and sensors, to other FAA facilities and to NAS users. Data for major airports are expected to include current and planned airport configurations, equipment status, arrival and departure rates, and weather data.
- *AOC Flight Planning, Increment 1:* Will provide the ability to exchange additional flight planning information with AOCs. This includes sharing constraint information (e.g., airport capacity), demand projections, and user schedule updates.
- *Post-Flight NAS Analysis, Increment 1:* Will provide historical information to service providers and users for post-operations analysis and long-range planning. This initial increment addresses information that is available in current systems or with minimal data entry.

Collaboration

Collaboration enhancements planned for this step include:

- *GDP Enhancements, Increment 1:* Will provide flight schedule monitor (FSM) that evaluates users' responses to plans for GDPs. The GDP improvements in Increment 1 to be incorporated into the FSM include:
  – *Ration by schedule* uses the OAG schedule and updates from users as the basis for the

GDP. It ensures that airlines are not penalized for exchanging real-time schedule updates with the FAA.

– *Schedule compression* improves the current substitution process to allow more flights into slots available due to cancellation, thereby compressing the overall departure schedule.

- *GDP Enhancements, Increment 2:* Will include:

  – *Flight substitution simplification* allows users to identify which flights are assigned to which arrival slots.

  – *Control by time of arrival* gives users more control over scheduling their own aircraft and managing delays en route.

- *Collaborative Routing, Increment 1:* Will provide static data for use during periods of capacity restrictions typically caused by adverse weather. Several methods will be explored that allow participants to interactively determine general rerouting of aircraft around areas experiencing unexpected disruptions.

NAS Analysis and Predictions

NAS analysis and predictions enhancements for this period will include:

- *Performance Assessment, Increment 1:* Will establish and validate the metrics for measuring real-time NAS system performance from user and service provider perspectives. The performance assessment function records, stores, manages, and facilitates access to NAS performance data.
- *Automated Problem Recognition:* Will develop an early warning capability to recognize and measure projected resource demand and inform service providers and users when capacity is projected to be exceeded. More accurate projections of resource bottlenecks can be predicted because the airlines provide timely information about current flights.
- *System Impact Assessment, Increment 1:* Will help increase the understanding of system changes by developing fast-time simulation capability, thereby allowing more timely assessment of schedule changes, flight cancellations, and other operational modifications made by decisionmakers.

20.1.3 TFM Architecture Evolution—Step 3 (2002–2005)

20.1.3.1 Infrastructure Enhancements

Throughout the evolution of the TFM infrastructure, new installations of ETMS at various TMUs and remote facilities will continue. The initial ATCSCC local information services will be available during this time period. The TFM network will begin to be converted to be compatible with local information sharing and the NAS-wide information network (see Section 19, NAS Information Architecture and Services for Collaboration and Information Sharing).

The reengineered TFM software will provide a modern, open-system architecture that will accommodate system maintainability, expandability, and increased processing requirements. It will replace custom code with a COTS data base management system and other COTS products. It will also integrate DOTS Plus, SAMS, CARF, and other new TFM capabilities, such as GDP enhancements.

By the end of Step 3, the flight data management (FDM) prototype will be implemented at the ATCSCC and interfaced to TMU workstations at selected ARTCCs for evaluation purposes. A modernized system is essential to the timely and cost-effective implementation of the TFM functional enhancements listed below.

20.1.3.2 Functional Enhancements

Data Exchange

Data exchange enhancements planned for this period include:

- *NAS Status, Increment 2:* Will provide static and some dynamic information on current and predicted restrictions and constraints, including active SUAs, agreements between facilities about crossing altitudes and speed, miles-in-trail, resource capacities, system outages, preferred routes, and weather conditions that could affect aviation.
- *Arrival Sequence Display, Increment 2:* Will provide real-time schedule updates of depar-

ture from the gate and airborne flight information, which will improve air carriers' planning. This increment will extend the initial capability to TRACONs with two dominant air carriers.

- *Post-Flight NAS Analysis Increment 2:* Will provide historical information to service providers and users for post-operations analysis and long-range planning.
- *AOC Flight Planning Increment 2:* Will provide the ability to use additional flight planning information within FAA automation systems.
- *Two-way ETMS-STARS interface:* Will enable the display of ETMS data on terminal and tower controller workstations.

Collaboration

Collaboration enhancements planned for this period include:

- *Collaborative Routing, Increment 2:* Will provide dynamic data for use by the FAA and NAS users.
- *Flight Plan Evaluation:* Will allow users to send a flight plan to the FAA to evaluate the route, altitude, and time of flight to determine whether the planned route will violate any NAS restrictions. The user receives feedback and can request the service provider to file the flight plan at both the ATCSCC and the appropriate ARTCC. This feedback is expected to include information about system constraints and options as well as operational rationale governing the acceptance, modification, or rejection of a flight plan at the time it is filed.
- *Collaborative Routing, Increment 3:* Will address severe weather avoidance areas with suggested reroutes during periods of capacity restrictions.

NAS Analysis and Predictions

NAS analysis and predictions enhancements for this period include:

- *Compliance Monitor, Increment 1:* Will evaluate and monitor NAS user compliance with collaboratively determined TFM solutions. This capability will allow TMSs to monitor and verify that users act in accordance with ATM restrictions. Industry participants are thus assured that they are not receiving any unfair operational penalty for participating.
- *System Impact Assessment, Increment 2:* Will develop fast-time simulation capability, allowing immediate assessment (within 5 minutes) of schedule changes, flight cancellations, and other operational modifications by service providers (based on expanded flight information). This provides decisionmakers with a better understanding of the impacts of specific actions.

20.1.4 TFM Architecture Evolution—Step 4 (2006–2015)

20.1.4.1 Infrastructure Enhancements

Infrastructure enhancements to the hardware and software will provide a COTS geographic information system, which will replace custom software. This will enable external queries in support of flight objects and provide the interface to FDM systems, local TFM functionality, and integrated arrival and departure schedules. Additionally, new ETMS installations at various TMUs and remote facilities will be completed.

The hardware and software will be fully compliant with the expanded information contained in the flight object. This will support distributed management of flight planning information, active flight information, and archived information, including post-flight analysis. The TFM infrastructure and applications will be fully integrated with the NAS-wide information network.

20.1.4.2 Functional Enhancements

The flight-object structure will be in place, and AOCs and other users will begin to use 4-dimensional (longitudinal, lateral, vertical, and time) trajectory information. The information captured will be closer to real-time than in the past. Tools will be updated to take advantage of the additional information in the flight object, such as gate preferences (see Section 19, NAS Information Architecture and Services for Collaboration and Information Sharing, for additional information about the flight object).

Four-dimensional trajectories will be used in planning functions for the first time during this period. Negotiation of a proposed flight path will take into account NAS airspace status, and the flight object will be filed and updated as changes occur during the flight. This two-way data exchange will enable improvements to both the tactical and strategic DSSs to sequence aircraft to runways closest to the airline assigned gate and allow airlines to more effectively minimize their terminal turnaround time for aircraft.

Information available to service providers (e.g., TMSs and TMCs) will be greatly enhanced: NAS users and service providers can query the flight object and receive the status of any flight in the NAS. Simulation tools will allow NAS TMSs to anticipate and react more efficiently to dynamic changes in the NAS. Flight planning activity will be enhanced with more real-time data about the NAS and active and planned flights.

Traffic flow managers and controllers will have access to the same decision tools and flight objects. These tools, with adjustments to the look-ahead time, will become density tools for assessing the ripple affect of airspace changes. Modified trajectories can be developed collaboratively with AOCs, pilots, and other NAS users. The new trajectories can then be distributed to flight decks and downstream facilities. Traffic flow managers will have access to common ATM workstations as part of the TFM DSS.

Data Exchange

The data exchange enhancement for this period includes the Arrival Schedule Tool upgrade.

- *Arrival Sequence Display, Increment 3:* Will provide data/information to the airlines suitable for displaying arrival traffic schedules and real-time updates of flight plans and subsequently to the flight object when implemented.

Collaboration

The collaboration enhancement planned for this period is:

- *Collaborative Routing, Increment 4:* Will take into account other status information of the NAS, such as equipment availability, SUA availability, when suggesting reroutes due to severe weather avoidance.

NAS Analysis and Predictions

NAS Analysis and Predictions enhancements planned for this period include:

- *Performance Assessment, Increment 2:* Will expand the Increment 1 capability to establish and validate the metrics for measuring real-time NAS system performance from a user and service provider perspective. The system performance assessment records, stores, manages, and facilitates access to NAS performance data.
- *Compliance Monitor, Increment 2:* Will enhance the previous increment to accommodate new ATM collaboration information. It will evaluate and monitor service provider and NAS user compliance with collaboratively determined TFM solutions. This capability can be used by TMSs to monitor and verify that users act in accordance with ATM restrictions that may be imposed under the Free Flight concept. Industry participants are thus assured that they are not suffering any unfair operational penalty for participating.
- *Dynamic Density Monitor:* Will determine how best to measure density, including an enhanced monitor alert algorithm to measure the current (not predictive) state of traffic density.

20.2 Summary of Capabilities

The NAS-wide information network is designed to facilitate collaboration and information sharing between users and service providers. NAS users will be involved in collaborative decisionmaking by actively participating in flow strategy development, when appropriate, and by modifying their operations to meet air traffic flow initiatives. Collaboration and information exchange will reduce operational uncertainty, improve predictability, and enhance the decisionmaking process by allowing user input into decisions that affect daily operations. Daily system performance data will be recorded to enable quantitative measurements concerning the effectiveness and efficiency of NAS operations from both the FAA and user perspectives. These capacity-related metrics will include delays, predictability, flexibility, and accessibility.

The collaborative process establishes the data exchange capability that will be used to implement ration-by-schedule procedures. The procedures modify the GDP, using the airline schedule, as defined in the OAG as the baseline for allocating actual departures and predicting arrival times, rather than the individual flight estimate. The ATCSCC consolidates the schedule information and transmits it with information on airport arrival capacity constraints.

Control by time of arrival (CTA) provides users with more flexibility in operational planning. CTA uses arrival- rather that departure-based decisionmaking procedures, giving users more control over scheduling their own flights. Users will be assigned arrival times at destination airports and will be able to determine their departure and en route schedules to meet their designated arrival times.

Military scheduling agencies will provide real-time schedules for using SUA that allow sufficient time for service providers and users to incorporate it into their planning. As a SUA's status changes, the NAS is updated in real time, and commercial flights can be routed through it.[1]

Flight plan evaluation provides NAS users with immediate feedback about system constraints and options for their planned routes. This allows users to make timely revisions before submitting a flight plan. When a flight is airborne and operational factors dictate a reroute, the collaborative flight planning process will allow real-time changes, such as reroutes around severe weather or congested airspace. The airport configuration status will include active runway, equipment outages, weather, braking action, and visibility conditions. It will also include operational data, such as arrival and departure rates and types of approaches in use. The CDM process will also give users the opportunity to take part in deciding when equipment can be shut down for routine maintenance. See Figure 20-2 for a summary of the capabilities evolution.

20.3 Human Factors

Using complex automation systems to support human activity entails a common understanding of

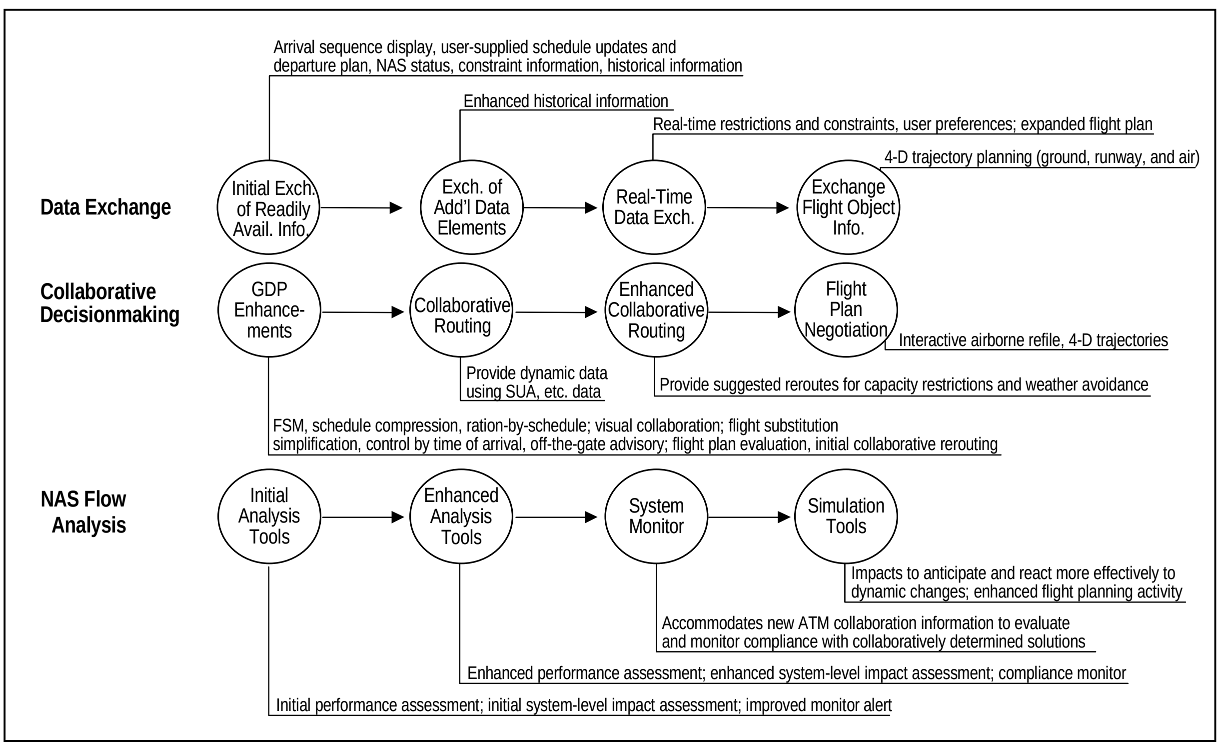

Figure 20-2. TFM Capabilities Summary

1. Generally, the SUA must be clear of commercial flights 30 minutes prior to being restricted to military operations.

intent of all the parties in the process. The collaborative decisionmaking process (already started with establishment of the airline operations center network (AOCNet) that provides information from the ASD to industry) will enable a closer coupling between AOCs and the FAA-projected traffic forecasts. This collaborative development approach ensures that both NAS users and service providers are an integral part of the design, development, and implementation of TFM capabilities. Improvements in throughput, workload, system confidence, and situational awareness will ensure that the capability will meet or exceed performance expectations.

The NAS architecture's increased level of effectiveness and efficiency of communications between service providers, facilities, and multiple users (including pilots and ground-based elements, such as AOCs) will improve the level of collaboration between parties in the system. This collaborative process involves more than just the transmittal of data across networks; it includes a coordinated understanding of the intents and motivations of the other parties. This communication, collaboration, and negotiation will be supported by various DSS tools to facilitate a rapid resolution to TFM situations. Communication methods and the information shared between parties will enhance the process of predicting the traffic flow constraints, evaluating candidate solutions, and executing the plans. The tools in place will be used by all the parties in the process and will provide for rapid and purposeful information exchange.

20.4 Transition

The transition for implementing the enhancements to the TFM Infrastructure in the three TFM functional areas is presented in Figure 20-3. The transition and the associated costs will be driven by increasing demand for the information and analytical tools necessary to implement TFM.

20.5 Costs

The FAA estimates for research, engineering, and development (R,E&D); facilities and equipment (F&E); and operations (OPS) life-cycle costs for TFM from 1998 through 2015 are shown in constant FY98 dollars in Figure 20-4.

20.6 Watch Items

Appropriate information standards and information security must be implemented to protect sensitive and company proprietary data.

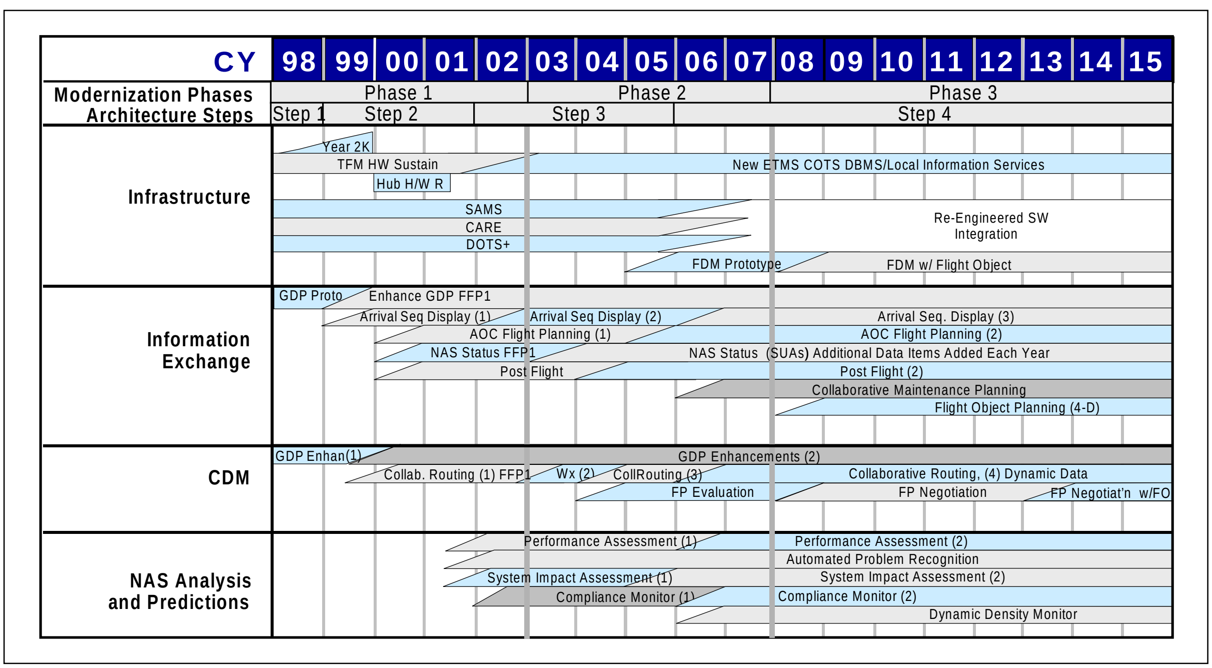

Figure 20-3. TFM Transition

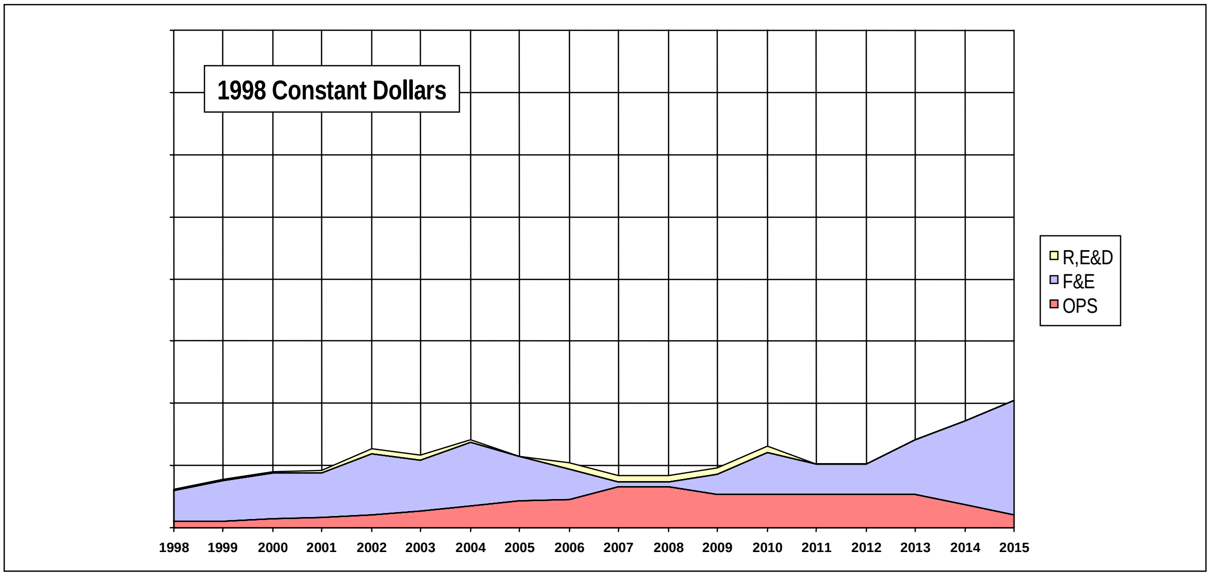

Figure 20-4. Estimated TFM Costs

PART III