Qualitative Requirements
For An
Indian Air Traffic Flow Management System

February 9, 2011

Prepared by the
Volpe National Transportation Systems Center

For the
Federal Aviation Administration

For use by the
Airports Authority of India
# Table of Contents

1. Introduction .................................................................................................................. 1  
   1.1 Background ............................................................................................................... 1  
   1.2 Purpose ................................................................................................................... 1  
   1.3 Document Organization ......................................................................................... 1  

2. Overview of Future ATFMS ....................................................................................... 2  
   2.1 Organizational Structure ....................................................................................... 2  
   2.2 Roles and Responsibilities .................................................................................... 2  
       2.2.1 General responsibility of CCC ................................................................. 3  
       2.2.2 General responsibility of ACC TMU ......................................................... 3  
       2.2.3 General responsibility of APP TMU ........................................................ 3  
       2.2.4 General responsibility of TWR TMU ......................................................... 4  
   2.3 ATFMS Architecture and Supporting Infrastructure .............................................. 4  

3. Operational Requirements ......................................................................................... 6  
   3.1 Strategic and Pre-Tactical Operational Requirements ........................................... 6  
       3.1.1 Strategic Capacity Management .................................................................. 6  
       3.1.2 Pre-Tactical and Special Event Planning and Management ....................... 6  
   3.2 Tactical Operational Requirements ....................................................................... 7  
       3.2.1 Traffic Situation Monitoring and Problem Identification ......................... 7  
       3.2.2 Flow Problem Resolution ......................................................................... 8  
       3.2.3 Flight Plan Execution ................................................................................. 8  
   3.3 Logging and Post Analysis Operational Requirements ......................................... 8  
       3.3.1 Data Logging ............................................................................................... 8  
       3.3.2 Real-time and Post Analysis ...................................................................... 9  
   3.4 Collaborative Decision Making (CDM) ............................................................... 9  
       3.4.1 Common situational awareness ................................................................. 10  
       3.4.2 Distributed Planning ................................................................................. 10  
       3.4.3 Analytical Capability ................................................................................. 10  
   3.5 Infrastructure Support .......................................................................................... 10  
       3.5.1 Airspace System Definitions ...................................................................... 10  
       3.5.2 Centralized ATFMS Processing ............................................................... 11  
       3.5.3 Distributed Dissemination and Modeling ................................................. 11  
       3.5.4 System Level Interfaces .......................................................................... 12  
   3.6 System Security ..................................................................................................... 12  
       3.6.1 User and Process Identification and Authentication .................................... 12  
       3.6.2 ATFMS Access ............................................................................................ 13  
       3.6.3 Security Management .............................................................................. 13  
       3.6.4 Network Security Protection ................................................................. 14
4. Functional Requirements ................................................................. 15
4.1 Geographical Data Requirements .................................................. 15
4.1.1 Input Geographical Data ......................................................... 15
4.1.2 Dynamic Sector Processing ..................................................... 16
4.2 Scheduled Flight Data Processing .................................................. 16
4.2.1 Source Schedule Data ............................................................. 16
4.2.2 Schedule Data Processing ....................................................... 16
4.3 Flight Plan Processing ................................................................. 17
4.3.1 Flight route - Filed Flight Path ............................................... 17
4.4 Flight Modeling ............................................................................ 17
4.4.1 Flight Profile Modeling ........................................................... 17
4.5 Situation Awareness and Problem Identification ............................. 18
4.5.1 Common Situational Awareness ............................................. 18
4.5.2 Capacity Prediction ................................................................. 19
4.5.3 Demand Prediction ................................................................. 19
4.5.4 Congestion Identification and Reporting .................................... 20
4.6 Weather Data Processing ............................................................ 20
4.6.1 Common weather picture ....................................................... 20
4.6.2 Reliable Weather Data Input Requirements ............................... 21
4.6.3 Update Frequency ................................................................. 21
4.6.4 Weather Information Dissemination ........................................ 21
4.6.5 Tailored Weather Data ........................................................... 22
4.7 Flow Initiative Planning ............................................................. 22
4.7.1 TMI Modeling ........................................................................ 22
4.7.2 TMI Impact Assessment ........................................................ 25
4.7.3 TMI Coordination and Collaboration ....................................... 25
4.8 TMI Implementation ................................................................. 25
4.8.1 Communication and Distribution of Initiatives ............................ 26
4.8.2 TMI Monitoring and Evaluation ............................................. 26
4.8.3 TMI Termination ................................................................. 26
4.9 Information Management .......................................................... 26
4.9.1 Automated Collection and Distribution .................................... 26
4.9.2 Data Recording .................................................................... 27
4.9.3 System Performance Assessment ............................................ 27
4.10 ATFMS Training ........................................................................ 27
4.11 Infrastructure Support ............................................................... 28
4.11.1 Centralized Air Traffic Flow Management Processing ............. 28
4.11.2 Distributed Dissemination and Modeling ................................................................. 29
4.11.3 System Level Interfaces .......................................................................................... 29
4.12 System Performance .................................................................................................. 30
  4.12.1 Communication .................................................................................................... 30
  4.12.2 Operational Availability ...................................................................................... 30
  4.12.3 Reliability ............................................................................................................. 30
  4.12.4 System Recovery and Data Backup ..................................................................... 30
5. Appendix A. References ............................................................................................... 31
6. Appendix B. Abbreviations and Acronyms .................................................................. 32

**Table of Figures**

- Figure 1. ATFM Organizational Structure ..................................................................... 2
- Figure 2. High-Level ATFM Architecture ..................................................................... 5

**Table of Tables**

- Table 1 TMI Modeling Parameters ............................................................................. 22
1. Introduction

The implementation of an Air Traffic Flow Management (ATFM) capability in India will require the development and implementation of capabilities beyond the air traffic management (ATM) capabilities currently operating in India. Required operational and functional capabilities will support a range of ATFM needs. Several will enhance current planning capabilities, while others will provide new functions that will enhance India’s ability to manage anticipated air traffic demand in a safe and efficient manner.

1.1 Background

The Airports Authority of India (AAI) has recognized that as demand on India’s airspace continues to increase, the need for improving the efficiency and effectiveness of its air traffic management capabilities becomes increasingly important. The introduction of an ATFM function to complement the ATM functions that already exist will provide the additional planning and management capabilities needed to effectively handle that growth. A planning effort is currently underway to develop and implement an ATFM function for India. That effort has resulted in the generation of concept of operations [Reference 1]. It is being used to guide the definition and development of the necessary infrastructure and decision support technologies. It also provided the primary basis from which these qualitative operational and functional requirements have been derived. These requirements specify the types of ATFM operations and functions that ATFM specialists and other users will be required to perform. The decision support and information exchange functions that are needed to enable the execution those operations and functions are included as part of the requirements presented in this document.

1.2 Purpose

This document presents a set of high-level operational and functional requirements that will be useful for defining and scoping the detailed requirements needed to procure and build the ATFM System (ATFMS) envisioned by AAI. The ATFMS facilitates collaborative flow management during all phases of ATFM operations including: Strategic, Pre-tactical, Tactical and Post Analysis. The qualitative requirements are presented at a high-level in order to not dictate a specific design or technology.

1.3 Document Organization

This document is organized as follows:

- Section 1, Introduction, presents the intent of this document and describes its contents.
- Section 2, Overview of Future ATFMS, presents a brief description of the concept the operational and functional requirements are to support. Emphasis is placed on describing organizational structure, roles and responsibilities of the major organizational elements, and anticipated infrastructure and automation support.
- Section 3, Operational Requirements, presents the operational capabilities the different ATFM units must be able to provide on a regular basis. These capabilities are based on the tasks the ATFM specialists must perform through the four ATFM phases.
- Section 4, Functional Requirements, specifies the ATFM functions that the ATFM specialists and other users will be required to perform and the decision support and information exchange functions that are needed to enable the execution ATFM operations and functions. Interface requirements with systems external to ATFM, such as ATC, Airspace Management, and airspace user systems are also addressed.
2. Overview of Future ATFMS

India’s future ATFMS will be built upon the AAI’s current organizational structure. Current responsibilities will be expanded to support new functions, such as collaborative planning, or enhanced functions, such as implementing new tactical Traffic Management Initiatives. These new functions will support the implementation of a nationwide system for the systemic management of local, regional, and national level air traffic flow problems.

2.1 Organizational Structure

ATFM will be managed through the use of flow management units at each of the different AAI operational levels.

![Figure 1. ATFM Organizational Structure](image)

The ATFM organizational structure breaks into three layers. The first layer is the AAI Central Command Center (CCC). The second layer includes all the eleven (soon to be 4 and then 2) Area Control Center (ACC) Traffic Management Units (TMUs). The third layer includes selected Approach Control facilities with Approach Traffic Management Units (APP TMUs) and selected Airport Traffic Control Tower (ATCT) facilities with Airport ATC Tower Traffic Flow Management Units (TWR TMUs).

2.2 Roles and Responsibilities

The different ATFM units will be responsible for collectively identifying and resolving demand/capacity imbalances for airports and all airspace under AAI control. However, in carrying out this shared responsibility, traffic management units at the individual facilities will have operational responsibilities consistent with their associated geographic areas. Overall responsibility for the coordination and execution of Traffic Management Initiatives (TMI) will reside with the CCC’s flow management positions.
An overriding theme of ATFM is that decisions to implement TMIs impacts flows beyond just the local problem and thus cannot be made at any single level of management. Instead, they must be made collaboratively across the various levels (components) of TMUs and include system stakeholders.

2.2.1 General responsibility of CCC

The CCC has the primary ATFM responsibility for India. The CCC should be established and adjusted to meet the demand of ATFM of India in both current operation, mid-term (3 to 5 years out) and future (5 to 20 years out) development. Specifically, the CCC is:

- Responsible for balancing capacity/demand at all major pacing airports within airspace for which AAI has control authority. This is achieved by analyzing capacity/demand imbalances using available manual and automation tools and defined processes and procedures.
- The final authority in resolving any conflicts concerning civil airspace capacity/demand.
- Responsible to ensure that a “system approach” to ATFM is utilized when consideration is being given to the implementation of Traffic Management Initiatives (TMIs).
- TMIs that cross ACC boundaries are the responsibility of the CCC. Authority for TMIs and operations that do not cross ACC boundaries may be delegated, through policy or procedures, to the appropriate ACC.

2.2.2 General responsibility of ACC TMU

In general, the ACC TMU is responsible to monitor air traffic operations within their area, participate in periodic nationwide planning conference calls for ATFM, help CCC develop and adjust TMIs, communicate with area airspace users and airports on flow problems. Specific responsibilities include:

- Identify and assess sector capacity decline due to weather, defense activity, aircraft operation, ATC facilities operation, ATC equipment outages, airport impacts, etc.
- Help APP TMUs in its area study capacity changes of relevant sectors, departure and arrival fixes, and airports.
- Collaborate with CCC to adjust the capacity threshold of sectors and arrival/departure rates at threshold airports.
- Analyze capacity/demand imbalance of area sectors based on flight plan and traffic in the air.
- Plan TMIs within its area of responsibility and inform relevant ATC positions.
- Feedback status of TMIs, planned and executed, to CCC. Suggest adjustment or termination of implementation.
- Carry out post evaluation of daily ATFM, and report evaluation results as required to the CCC.

2.2.3 General responsibility of APP TMU

In general the APP TMU is responsible to manage air traffic demand and constraints within their area of responsibility. Specific responsibilities include:

- Identify and assess sector capacity decline due to weather, defense activity, aircraft operation, ATC operation, ATC equipment outages, airport impacts, etc.
- Collaborate with relevant ACC TMU and TWR TMU to adjust the capacity threshold of sectors and arrival/departure rates threshold of airports.
- Collaborate with TWR(s) and ACC TMU to identify Airport Arrival Rate/ Airport Departure Rate (AAR/ADR), arrival and departure fix demand/capacity, and monitor the changes due to weather, military information, aircraft operation, ATC operation, ATC equipment, airport operation or other reasons.
- When required participate in nationwide ATFM decision making organized by CCC on its own initiative, invited by ACC TMU or invited by the CCC.
- Participate in decision making organized by ACC TMU for regional TMIs complying with flight plan and airport operation.
- Support relevant ACC TMUs in the development of regional TMIs.
- Feedback implementation status of TMIs and recommend operation plans to ACC TMU.
- Inform the relevant ATC position of ATFM initiatives.
- As required report statistical data to ACC TMU.

### 2.2.4 General responsibility of TWR TMU

In general, the TWR TMU has the responsibility to assist in the management of air traffic demand and constraint issues at the tower. Specific TWR TMU responsibilities include:

- Collaborate with APP TMU to identify AAR/ADR changes due to weather, military information, aircraft operation, ATC operation, ATC equipment, airport operation or other reasons.
- Collaborate with APP TMU and/or ACC TMU to properly adjust threshold of AAR/ADR and departure fix demand issues.
- When required participate in nationwide ATFM decision making organized by CCC on its own initiative, invited by ACC TMU, or invited by the CCC.
- Participate in decision making organized by ACC TMU for regional TMIs complying with flight plan and airport operation.
- Inform the relevant ATC position of ATFM initiatives
- Feedback implementation status to ACC TMU.
- Carry out post evaluation of daily ATFM, and report statistical data to ACC TMU.

### 2.3 ATFM Architecture and Supporting Infrastructure

The planning and execution of the flow management function will be supported by a range of automation systems. Those systems will provide for a variety of operational support capabilities. Figure 2 shows the high level architecture of the ATFMS. Critical to the success of ATFM is a supporting infrastructure that provides:

- Voice and data communication (depicted by the blue arrows in the figure) between all participants in the ATFMS;
- Seamless aircraft surveillance through all phases of flight that can provide a digitized national aircraft position mosaic that is available for use by all participants in the ATFM process; and
- A national weather picture that includes integrated weather sensor data and forecasts.
- Ground to ground voice and data communications between AAI and the numerous stakeholders (e.g., AOCs, military, airports) in order to implement ATFM CDM;
- Automation and display tools to aid all ATFM and CDM participants to maintain situational awareness and assess potential impacts of TMIs under consideration at any time.
Other future technology and facility enhancements assumed to be in place include:

- Upgrading of automation systems, such as Auto Track III, to include arrival and departure functions;
- Advanced Surface Movement Ground Control Systems (ASMGCS);
- Seamless integrated surveillance from departure to destination via radar, ADS-B, ADS-C, and Wide Area Multi-Lateration (WAM);
- Integration of radar with flight data processing;
- Improved information and control system interfaces between Approach Control (AC), Area Control Centers (ACCs), towers, and meteorological systems;
- Performance-based navigation with RNAV and RNP;
- More flexible routing, including connector routes in certain airspaces;
- Data communications via CPDCL (Mode S, VDL-2, FANS-1A); and
- Amalgamation of existing 11 ACCs into 4 ACCs initially and ultimately into 2 ACCs.
3. Operational Requirements

This section presents the operational capabilities required to implement ATFM as described in the Concept of Operations for Indian Air Traffic Flow Management. It addresses all four phases of ATFM: Strategic, Pre-tactical, Tactical and Post-operations. In addition, the ATFMS operational requirements for Collaborative Decision Making (CDM), Infrastructure Support, System Performance, and System Security are also presented.

3.1 Strategic and Pre-Tactical Operational Requirements

Strategic and pre-tactical flow management consists of activities that take place before the day of operations. These activities may take place from one day, up to several months, prior to the day of operations.

3.1.1 Strategic Capacity Management

Strategic capacity management addresses the identification and resolution of structural, procedural or technical deficiencies within ATFM operations that constrain the capacity associated with anyone of the airspace or airport resources. In support of strategic capacity management, ATFM specialists shall:

- Analyze post operations data to assess system performance at all levels of the ATFMS to identify recurring positive and negative system performance trends and the conditions that contributed to that performance.
- Develop and coordinate strategies for resolving problems found during the course of post operations analyses.
- Evaluate the effectiveness of the current and planned airspace structure to identify where flows can be made more effective.
- Evaluate the effectiveness of ATFM decision support tools in meeting the demands of anticipated operations, and where deficiencies are noted; identify needed enhancements or new functions.
- Accept user requests for future flight day demand and capacity projections and disseminate that information to qualified users

3.1.2 Pre-Tactical and Special Event Planning and Management

As one gets close to a specific day of operations, opportunities to make improvements involving air space design, procedural or decision support tool improvements decrease. However, the ability to predict flow problems and develop more specific flow management strategies improves. From a week to the day before a specific day of operations, ATFM specialists concentrate their efforts on planning for events with a high probability of occurring, and that will be resolved through the use of current procedures and decision support tools. ATFM specialists shall:

- Update, monitor and analyze demand predictions for the subject day of operations to identify potential demand/capacity imbalances that might require ATFM intervention.
- Inform airspace users and other ATFM units of potential demand/capacity imbalances that might require ATFM intervention.
- Several days prior to a specific day of operations, develop and coordinate general flow strategies for addressing demand/capacity imbalances expected because of historical trends or anticipated severe weather, military exercises or special events.
- Prior to a specific day of operations, perform a comparison of anticipated demand (scheduled and unscheduled) and predicted capacity (factoring in forecasted weather) to develop a general plan of operations for that day.
• Coordinate or collaborate, where appropriate, with airspace users on strategies for adjusting flight plans or schedules to meet anticipated capacity shortfalls.

### 3.2 Tactical Operational Requirements

Tactical flow management will focus on the management of events unfolding on the day of operations that could result in excessive delay or flight schedule disruption at any point within the system. This shall include:

• Analyzing projected demand based on flight plans submitted in the strategic and/or pre-tactical phases, or revised on the day of operations.
• Monitoring traffic demand and resource capacities for potential capacity/demand imbalances causing excessive delay in the system.
• Resolving airport and airspace demand/capacity imbalances, where warranted. This shall include defining flow initiatives for balancing flows across arrival fixes, determining departure release time to merge departure into en route flows, limiting traffic flow into congested sectors, and coordinating flight plan changes to deal with routes closed by weather.
• Coordination and collaboration, where required by procedures, with adjacent facilities and associated airspace users.

#### 3.2.1 Traffic Situation Monitoring and Problem Identification

The ATFMS shall provide assistance in managing periods of congestion causing excessive delay. The determination of what constitutes excessive delay shall be made by the ATFM specialists with the aid of information and decision support tools that will assist them in determining the ability of available capacity to handle current or projected demand. ATFM specialists in all four layers of the ATFM structure shall participate in monitoring and assessing operations in India’s airspace. The scope of their monitoring and assessment responsibilities shall be consistent with their geographic areas of responsibility.

To ensure a broad understanding of operations in India’s airspace, ATFM specialists within the CCC, ACC TMUs, APP TMUs, and TWR TMUs shall share in the responsibility for reporting on the status of resources within their areas of responsibility. This shall include sharing of information on changes in capacities for airport arrivals, airport departures, sectors, routes fixes, navigational aids, equipment outages and staffing shortages. All ATFM specialists at air traffic operations facilities should:

• Be aware of the traffic flow situations in the areas under their jurisdiction;
• Be aware of predicted flow, capacity, and the operational conditions of their areas of responsibility;
• Take account of the operational status of neighboring areas and other areas around India;
• Possess the ability and methods to collaboratively take effective measures to identify various traffic factors in order to eliminate the imbalance between air traffic demands and system capacity utilizing the least restrictive measures required;
• Continually monitor and adjust those measures as the situation requires; and
• Document all significant activity and actions to assist in post event analysis.

Airspace users and the CCC shall be responsible for ensuring the timely availability of information about changes in user demand. This broad sharing of information will support the collaborative identification of air traffic flow problems at the local, regional and national levels, and will facilitate arriving at a consensus on flow problem solutions.
The declaration of a flow management “problem” shall be made by ACC TMUs, for capacity/demand situations contained within its jurisdiction, or by the CCC, for capacity/demand imbalances which cross ACC boundaries. These units shall be responsible for:

- Analyzing demand/capacity information provided by the APP TMUs and the TWR TMUs to their respective ACC TMU
- Identifying the time and location where demand is expected to exceed capacity.
- Ensuring that the appropriate units are informed of the anticipated flow management problem.
- Providing the information upon which their assessment was based, to support collaboration with other units, and airspace users where appropriate, on the severity of the problem and the need for intervention.

### 3.2.2 Flow Problem Resolution

The resolution of air traffic flow problems shall be accomplished through a collaborative process. Except where delegated through policy or procedures, the CCC shall be the lead for the development, coordination and approval of TMIs. In carrying out these responsibilities, the CCC or responsible TMU shall coordinate with Airspace Users and other facilities to:

- Develop candidate resolution strategies.
- Assess the impact of those candidate resolution strategies on the projected capacity/demand imbalance.
- Define the specifics of the TMIs needed to implement a selected strategy, including what facilities and flights should be affected.
- Ensure that the appropriate facilities and airspace users are given timely notice of pending TMIs.

### 3.2.3 Flight Plan Execution

While the ATFM organizations of AAI will be responsible for the definition and implementation of TMIs, the actual execution of TMIs shall be a responsibility shared among ATFM specialists and air traffic controllers at en route sector, approach, and tower control positions.

When ATFM TMIs are implemented by the CCC, the CCC shall be responsible for disseminating the initiatives to the appropriate ACC TMU(s). The ACC TMU shall, in turn, be responsible for disseminating the TMI to the appropriate lower level ATFM and ATC positions. When available, the dissemination of the specifics of the TMIs shall be done through the use of automation.

### 3.3 Logging and Post Analysis Operational Requirements

#### 3.3.1 Data Logging

The ATFMS shall provide for recording, archiving, and analysis of ATFM operational data. The ATFMS shall record operations data for historical analyses, modeling, and reference, and for dynamic application for near-term flow planning and management. The system's data shall be available to authorized users in near-real time. It will provide a standard interface capable of supplying operational data to other AAI organizations and systems as well as providing information resources to system users and/or other governmental organizations. Recording, storage, and collection and communication servers will be strategically located at collector sites such as ACC TMUs, APP TMUs, and TWR TMUs and selected approach and tower facilities that do not have TMUs, with a central data administration, collection, and archiving function at the CCC.

The data that will be archived includes but is not limited:
• All input data to the ATFMS consisting of:
  o Aircraft position reports
  o Flight plans and flight plan amendments
  o Weather
  o Airline messages:
    o Slot substitutions
    o Wheels up/down
    o Ground system messages
    o Taxi time
    o Gate arrival/departure
    o Schedule data – such as Official Airline Guide (OAG)
• All trajectories generated by the ATFM
• All alerts generated by the ATFM such as sector overcapacity alerts
• All TMIs implemented and the aircraft affected by the TMI:
  o Delays on aircraft affected by the TMI
  o Reroutes generated by a TMI and respective aircraft affected by the reroute
• Actual route each aircraft flew

3.3.2 Real-time and Post Analysis

The ATFM data shall be used to increase the reliability and accuracy of the predictions of the flight trajectories of the aircraft. This data shall be made available in near-real-time to the ATFMS.

The first set of metrics that will be used to improve the ATFM system is the actual departure time versus predicted departure time. Historical data needs to be saved in order for this prediction to be improved. The actual may consistently be later than the predicted due to airport conditions, airline operations staff, etc. These may consistently be a constant or may change due to season or weather conditions. If this data is kept and then analyzed on a historical basis it can be used to improve the predictions of actual departure time. The same is true for actual arrival time versus estimated time of arrival. The data that needs to be saved for these analyses is estimated/actual time of arrival/departure and the exact route including the ascent and descent profiles that the aircraft actually flew. Keeping the historical ascent/descent profiles will greatly help in the arrival prediction. Other data inherent to improving these predictions are gate times and taxi times. When saving and analyzing this data the weather conditions also have to be saved, noted and factored into the analysis.

Post analysis data shall be required in order to provide ATFM specialists a means to analyze decisions and perform “what if” analyses. Analysis of how implemented TMIs affected the actual traffic including measures of delay on all affected flights shall be performed and archived. This will enable AAI to determine how effective their TMI solutions were, to correct identified deficiencies, and will enable them to develop a “play book” similar to the FAA’s.

3.4 Collaborative Decision Making (CDM)

Collaborative Decision Making (CDM) is a joint government/industry initiative aimed at improving air traffic management through increased information exchange among the various parties in the aviation community using improved automated decision support capabilities.
3.4.1 Common situational awareness

- Stakeholders and the AAI shall have a standardized web-, video- and/or telephony-based infrastructure for collaboration.
- Common displays shall be available to all stakeholders to achieve common situational awareness.
- Exchange of weather information among stakeholders shall be implemented in order to provide a more predictable system.
- Standardized message sets shall be developed to enhance interoperability and understanding.

3.4.2 Distributed Planning

- Equitable access to appropriate ATFM data information by stakeholders, especially airlines shall be provided.
- Rapid transmission of high bandwidth data shall be provided.
- Schedules shall be updated at a frequency to be determined by the stakeholders.
- Decisions made by the AAI or the airlines shall be disseminated to stakeholders.

3.4.3 Analytical Capability

- The ability to collect pertinent data and store for future analysis shall be provided.
- Analysis of data to translate the effects of TMIs into easily-understood products shall be performed.
- The capability to perform “what if” analysis and to assess ATFM performance during any given time-period shall be provided.
- The capability to expand the “what if” analysis to allow predictive assessments of the effectiveness of a given suite of TMIs shall be included.

3.5 Infrastructure Support

The most critical aspect of establishing an ATFM infrastructure is to support the primary goal of enabling common and shared situational awareness amongst all traffic flow management stakeholders. Shared situational awareness does not imply that all stakeholders have the exact same information or displays. Rather, it means all stakeholders should have access to information derived from a common information pool. The design of such an information sharing infrastructure should enable stakeholders to both gather appropriate levels of information from and submit information to a common set of data structures accessible to a greater or lesser extent by all users.

Such an information sharing infrastructure shall have the following capabilities.

3.5.1 Airspace System Definitions

While individual users and facilities will focus on different regions and aspects of traffic flow, they all need a common set of definitions. Coordinated operations among facilities will rely on common maps, element names, codes, air routes, and so on. Some of this is relatively static, other elements may change daily, and all users need to view the same data with a common understanding. Major elements of this common definition data are:

- A common surface map, digitally encoded, capable of being displayed in various formats and projections, including selectable elements such as:
  - Terrain features such as rivers
  - Navigation hazards (e.g., tall towers near airports)
  - Geopolitical boundaries and features
• Aviation-specific fixed points such as navigational aids, coordination (handoff) waypoints, airports, runways, traffic corridors
• Airspace volume restrictions (e.g., restricted use areas)

While the common data must be centrally controlled (in concept, at least), operational use generally calls for distributed data storage and management. Updates must be coordinated so that all users have the same edition of the airspace data. For performance reasons the data may be cached in local storage, but the controlled version governs all uses.

Aeronautical data may be characterized by its volatility (frequency of change). Fixed locations provide the backdrop for more rapidly changing data including weather information, airport status, and the location of aircraft. Static information can most conveniently be processed by a central organization and distributed periodically to field sites. The US National Airspace System, for example, employs a 56-day Chart Change Update schedule (with real-time amendments as necessary) to support the common view.

### 3.5.2 Centralized ATFM Processing

Dynamic traffic flow information, such as flight planning and aircraft position data, is typically generated locally across the airspace. This information must be collected and integrated to provide the common situation model needed for effective flow management. The infrastructure required to achieve this common view includes both distributed and centralized elements.

• Distributed data acquisition support, including:
  - interfaces to surveillance systems and other data sources (e.g., local weather)
  - processing (filtering, time stamping, metadata tagging, etc.) to support data quality and usability (e.g., data aging) analysis
  - interface(s) to centralized processing components

• Single traffic flow management processing with a co-located backup that generates:
  - Common traffic flow management geospatial display generation based on ATC surveillance inputs
  - Predictive traffic flows based on flight plan submissions and airline scheduling data
  - Modeling ability to inject projected weather or other flow constraints for predictive planning using projected traffic flows

• Data storage and archiving capability for:
  - Support of short-term post-event analysis and long-term historical trend studies
  - Management of standardized and reusable TFM actions such as pre-coordinated reroute plans for typical adverse weather conditions and planning for infrequent (but predictable) high-traffic occasions

• Back-up processor geographically separated for continuity of operations in an emergency situation
• Distribution interfaces to allow dissemination of traffic flow display data to subordinate traffic management units as well as collaborative decision making partners

### 3.5.3 Distributed Dissemination and Modeling

Traffic flow management is a mix of local and system-wide actions to monitor, forecast, and influence air traffic. At the local level, traffic managers need the ability to view local conditions (such as weather) in the context of broader events (such as inbound flights that may still be on the ground). Local TFM often involves coordination with other traffic management regions, based on a common situational view. The
ATFMS infrastructure must support this local/global integration of traffic flow information. Specific capabilities include:

- Common traffic flow management geospatial displays that can be focused and detailed for specific areas of responsibility for each separate traffic flow management unit
- Modeling to inject projected local weather or other flow constraints for predictive planning using projected traffic flows at separate traffic flow management units
- Transmission of individual traffic flow management unit actual or recommend TMIs to adjacent units and to the CCC for coordination and collaboration
- Impact modeling of various TMIs to allow consideration of the least restrictive initiative

### 3.5.4 System Level Interfaces

Traffic flow management operates, conceptually, on collections, or sets, of flights (rather than on individual flights). This requires continual data exchanges with the operational (tactical) aspects of air traffic including ATC and flight operations centers. The shared situational ATFM model provides a broader view than other air traffic operations. The ATFM infrastructure should provide mechanisms for sharing this view including the interface with:

- Air traffic flow management display information, directions, and TMIs with the automation systems used to support ATC functions in ACC, APP, and TWR facilities
- Information suppliers such as weather data, military airspace users, and other national ATM organizations
- Airspace users such as airlines and aircraft operators to provide consistent airspace status and collaborative decision support

### 3.6 System Security

Inappropriate access to, use of, or manipulation of ATFM capabilities and data can have extremely negative consequences on the operation of India’s air traffic management system. To prevent such misuse or abuse, the ATFMS shall possess system security functions that will provide the means for managing and controlling access to system capabilities and data.

System security functions will provide the means for ensuring that only the appropriate individuals and software systems are allowed to access the ATFMS functions and data. The information management and security functions shall provide for:

- User and process identification and authentication
- Authorized ATFMS access
- ATFMS security management
- Network security protection
- Application software and data protection
- Data structure integrity

### 3.6.1 User and Process Identification and Authentication

The ATFMS shall provide identification and authentication functions to establish and verify authorized ATFMS users. Those functions shall provide:

- The means for identifying and authenticating system users, with a user being defined as a human, device or process.
- The capability to assign a unique identifier to each authenticated user, each subsystem process (including those not running on behalf of a human user).
The capability for each person or software process to identify itself before an ATFMS action is initiated on the behalf of that person or software process. This is particularly important for the case of non-AAI (i.e., airspace users involved in the CDM related activities) users of ATFM data or system functions. For example, one airline user should not be allowed to access data of another airline.

The capability for restricting ATFMS actions on behalf of an entity until that entity has been successfully authenticated.

The capability for an authorized security administrator to incorporate installable authentication mechanisms into the ATFMS.

The capability to audit all uses of the identification and authentication functions.

The means to record and archive the actions of all entities.

### 3.6.2 ATFMS Access

The system shall be designed to control system use and the distribution of system data only to authorized users. ATFMS access control functions will be incorporated in the system to enforce AAI policies, procedures and memoranda of agreement with non-AAI organizations, (e.g., airlines participating in the CDM process) governing use of AAI decision support automation. Those functions shall provide:

- The capability for an authorized security administrator to add or delete system users
- The capability for an authorized security administrator to define functions to be associated with each user
- The capability to allow mapping of different access privilege levels for users to be permitted to perform different functions
- The capability for controlling the establishment of a user session on the ATFMS through the use of user IDs and password protection
- The means to prevent logging in simultaneously on the same account (as defined by a unique user ID and password combination) from two different workstations
- The capability to automatically record access history information
- The capability for an authorized security administrator to retrieve and display access history information for an individual, device, or process

### 3.6.3 Security Management

Security management is directed to the management of several aspects of the ATFMS security attributes, security-related data, system operations, and system functions.

Management of security attributes allows authorized security administrators control over the data that define the degree of access and process control being applied by the security related ATFM functions. To support security management, the ATFMS shall:

- Provide the capability to restrict the ability to determine and disable, enable and modify the security behavior of the ATFMS to only authorized security administrators
- Provide the capability to initialize security attributes with default values selected by an authorized security administrator
- Provide the capabilities for an authorized security administrator to select the security attributes to be associated with an entity, and to assign values to those attributes
- Provide the means for auditing all modifications to the behavior of the ATFMS security functions
3.6.4 Network Security Protection

Because of ATFM’s need for collaboration and data exchange with organizations that operate outside the AAI information network, network security protection is more critical for ATFM than the ATC-related components of the AAI information and communication infrastructure. Network security protection is directed towards maintaining:

- Protection of network communications between the ATFMS and other AAI systems
- Protection of network communications between the ATFMS and systems that are not a part of the controlled AAI communication infrastructure, such as airline systems or commercial weather service providers
- Countermeasures corresponding to special or unique vulnerabilities of the ATFMS

In addition, the ATFMS shall:

- Provide suitable tools and capabilities to protect against cyber attacks, including computer viruses and worms
- Provide the capability to detect and remove malicious code and data (e.g., viruses and worms) upon request
- Provide the capability to “push out” security updates or patches from one or more distribution locations to individual software components
- Provide the capability to generate an audit record that identifies all attempted violations of the security policy enforced by security policy enforcement technology

3.6.5 Application Software and Data Protection

The application software and data protection functions specify ATFMS security policies for protecting the ATFMS’s application software and data. The ATFMS shall:

- Enforce ATFMS access control policy to objects, based on attributes or named group of attributes
- Enforce rules specified by an authorized security administrator to determine if an operation is allowed among controlled subjects and controlled objects
- Be able to detect the modification of software and/or data, substitution of data, reordering of data, or deletion of data for all ATFMS application data and software code transmitted between separate parts of the ATFMS
- Provide the capability to freeze and/or eliminate access to compromised or unauthorized computer system accounts
- Provide, in the event of an actual computer network attack, the capability to isolate the affected workstation or network
- Provide the capability to close all remote maintenance ports on routers, firewalls, servers and electronic phone switches, disconnect itself from the Internet/Intranet
- Provide the capability to authenticate the source of all data from sources outside of the ATFMS before entry of that data into the ATFMS
- For all network interfaces, provide the security administrator with the capability to define rules of acceptance (e.g., filtering) based on at least the following attributes: packet source, packet destination, protocol type (e.g., IP, X.25) protocol service (e.g., TCP, UDP0, and rate limits
- Provide the capability to generate audit records that identify the successful or unsuccessful import/export of user data, including any security attributes
- Provide the capability to filter data sent to different non-AAI users
4. Functional Requirements

This section presents the functional capabilities required to implement ATFM as described in the Concept of Operations for Indian Air Traffic Flow Management. It addresses the following functional requirements:

- Geographical Data Requirements
- Schedule Data Processing
- Flight Data structure Maintenance
- Flight Plan Processing
- Flight Modeling
- Situation Awareness and Problem Identification
- Weather Data Processing
- Flow Initiative Planning
- TMI Implementation
- Information Management
- ATFMS Training

4.1 Geographical Data Requirements

The ATFM system (ATFMS) receives geographical data files whenever the geographical data changes from other elements of the ATM system.

The traffic manager can graphically display this geographical data on the Traffic Situation Display (TSD) and use the geographical data to interpret flight paths that support the generation of aircraft situation and capacity situation data.

The ATFMS may at any time send messages to redefine sector boundaries. These messages frequently create larger sectors in times of light traffic (such as late night) and restore a more fine-grained sectorization at busier hours of the day. They are also used to re-configure sectors in response to wind changes or changing patterns of air traffic.

4.1.1 Input Geographical Data

The following data shall be received into the ATFMS system:

- Fixes - reporting points in India including aliases and holding fixes
- Airspace fixes (arrival, departure, en route, military, oceanic)
- Landing facilities - airports in India
- Airspaces – military and civilian sector and facility responsibility boundaries in India
- Sector stratifications (low/high/super high)
- Airways – India’s airways
- Navigation Aids
- Oceanic airways - selected off-shore airways.
- DPs - the Departure Procedures, formerly known as Standard Instrument Departure routes (SIDs)
- STARs - the Standard Terminal Arrival Routes.
- Military training routes
- Coded departure routes

The following information about neighboring airspace (oceanic, neighboring countries) shall also be provided:
- Fixes
- Landing facilities - airports
- Airspaces - sector definitions and stratifications within the country’s jurisdiction
- Airways
- STARs
- Restricted Areas - the boundaries for restricted areas

Other Data to be provided includes:
- ICAO location identifiers
- Foreign location identifiers
- Flight information regions (FIRs)
- World geographical boundaries

### 4.1.2 Dynamic Sector Processing

ATFMS uses a dynamic model of airspace sectors in order to provide users with accurate and up-to-the-minute information, including sector loading information. At the same time, the ATFMS retains the capability to display baseline sector information, including baseline sector loading, so that users have information to support their decisions as to when and how to re-sectorize. Users will have the ability to modify sector capacity.

### 4.2 Scheduled Flight Data Processing

The airlines scheduled flights are available from either filed flight plans or from a commercial source such as the Official Airline Guide (OAG). This schedule data could contain the flight schedules for 45 days in advance. The ATFMS uses this data to provide schedule information to the traffic manager and to provide scheduled flight data for the traffic demand predictions.

#### 4.2.1 Source Schedule Data

The scheduled flight data should contain the following fields for each flight entry:

- Departure country code
- Departure airport
- Departure time
- Arrival country code
- Arrival airport
- Arrival time
- Flag code
- Aircraft type code
- Airline code
- Flight number
- Days of service
- Taxi or intrastate flight flag
- Effective date - date flight begins within period
- Discontinue date - date flight ends within period

#### 4.2.2 Schedule Data Processing

Airport and sector arrival times are required to respond to traffic manager requests for arrival and/or departure data for an airport and/or an ACC.
The ATFMS requires flight paths, ground speeds, and altitudes for scheduled flights to estimate the impact that the flight will have on the ATM system long before a flight plan is received. For this purpose, the ATFMS maintains a data structure of flight paths, cruising speeds, and cruising altitudes observed in recent flight plans. As the ATFMS adds a scheduled flight into the live data structure, it uses the most commonly filed flight path, speed, and altitude for the flight's city pair, airline, and/or aircraft type.

If a flight in the scheduled data does not correspond to a recently received flight plan (i.e., for a new flight), ATFMS uses a direct flight path between the departure and arrival airports for the flight. ATFMS constructs the flight path to look like a normal flight plan trajectory.

### 4.3 Flight Plan Processing

One of the most significant parts of the ATFMS is the processing that interprets the flight route from the filed or amended flight plan. The flight route is specified by as a sequence of fixes and routes, which can each be specified in a variety of ways. ATFMS parses the flight route text and translates it into a sequence of waypoints defined in latitude and longitude. ATFMS uses the waypoints of the flight path to draw flight trajectories on the TSD and to model the effects of the flight on airports, sectors, and fixes.

The geographical data is the main source of data required to process the flight route. ATFMS uses the geographical data to look up the positions of airports, fixes, and airways referred to by name in the flight route. ATFMS builds a special grid data structure from the geographical data, which is used to determine the interrelationship of the geographical data elements.

#### 4.3.1 Flight route - Filed Flight Path

A Flight route describes a flight path as a sequence of fixes and routes. A fix field can contain one of the following fix types:

- Airport
- Named fix (NAVAID or adapted)
- Fix-radial-distance
- Special Use Airspace name
- Latitude/longitude
- Flight Information Region (FIR) name

A route field may contain one of the following route types:

- Airway
- Fix-radial
- DP
- STAR

### 4.4 Flight Modeling

ATFMS flight modeling uses the waypoint list produced by the Flight route processing along with the other flight data to predict the impact of the flight on the airports, sectors, and fixes along its flight path. The modeling of a flight consists of three steps: determining the altitude and speed profile of the flight (i.e., what altitude and speed the flight will have at any point along its flight path); determining the flight events; and computing the event times. The flight events are airport arrivals and departures, sector entries and exits, ACC entries and exits, airway entries and exits, and fix crossings. Each flight event is defined as the event type, the position in latitude and longitude, the speed and altitude of the aircraft at the event, and the time of the event.
4.4.1 Flight Profile Modeling

The flight profile modeling estimates the altitude and speed of a flight as a function of its distance from the origin or destination airports. For the purposes of profile modeling, a flight can be broken down into three segments: the ascent phase, where the aircraft climbs from its origin airport to some altitude; the en route phase, where the aircraft travels at some altitude and speed; and the descent phase, where the aircraft descends to the destination airport. ATFMS will use custom ascent and descent profile data when it is available for a specific flight; otherwise, ATFMS will use the standard ascent and descent profile data that is stored in the aircraft profile data structure.

4.5 Situation Awareness and Problem Identification

ATFM specialists require information on current and future system demand, along with information on situations that will result in capacity reductions within the system for effective situation awareness and ATFM problem identification. Some of this information will be based on data collected and reported in real-time. The remainder will be generated through computer-based demand and capacity modeling.

4.5.1 Common Situational Awareness

The ATFMS shall support common situational awareness among ATFM specialists and between ATFM specialists and qualified airspace uses. Common situation awareness between ATFM specialists and ATC supervisors and between ATFM specialists and qualified airspace user personnel will be maintained by providing them with a shared knowledge of the following:

- Current positions of airborne civilian air traffic
- Current sector/airspace/runway configurations
- Current and predicted traffic loads for sectors and airports
- Current and forecasted convective weather
- Current and predicted instances of sector or airport capacity being exceeded by current or planned aircraft demand
- Special airport activities such as de-icing, closed runways, or taxi-way repairs/maintenance that will reduce an airport’s operating capacity
- Active and planned TMIs
- Availability of military/special use airspace for civilian use
- Special events that will result in higher than normal levels of traffic in a particular portion of airspace or at a specific airport
- Communication, surveillance or navigation equipment failures affecting ATC or ATFM service delivery
- Other information as appropriate/required (such as VIP flights)

Common aircraft situational awareness shall be accomplished by providing for the graphical display of current and predicted aircraft positions on a plan view situation display that includes sector boundaries, airways, fixes, sector and airport alert indicators, military airspaces, military airspace status, and weather information. The display of current aircraft positions shall present the positions of all airborne flights operating in India’s airspace, as detected by ATC surveillance systems. The display of predicted aircraft positions shall present the future positions of aircraft that are airborne or scheduled to be airborne at that time in the future. The user of the future traffic display function shall be able to display future aircraft positions at any selected future time within a parameter planning horizon. The future traffic display shall also support assessment of the impact of TMIs being planned by the CCC or ACC TMUs by providing for the display of future aircraft positions associated with the TMIs being assessed.
Airspace users qualifying for access to AAI data shall not receive all of the data made available to ATFM specialists. The CCC will be responsible for establishing the policies and qualifying criteria for airspace user access to AAI data.

Common situational awareness will be enhanced further by the sharing of system capacity related information. The ATFMS shall provide the means for collecting, processing, distributing and displaying current or proposed resource capacity information, traffic management initiative information, and resource configuration information, such as open and closed sectors, active runways at airports.

4.5.2 Capacity Prediction

The ATFMS shall provide continually-updated capacity predictions. It shall provide the capability to collect, analyze, project and display capacity information for all sectors, airports, and runways managed by India’s ATFMS. Capacity predictions for airports shall be provided by the TWR controllers, based on anticipated runway configurations, and the arrival and departure capacities associated with those configurations. For TWRs with a TMU, the capacity information shall be entered into the ATFMS by the ATFM specialist. For TWRs without a TMU, the capacity information shall be forwarded to the TWR’s parent ACC TMU. Arrival and departure capacities shall be expressed in terms of flights per hour, for specified hours of operations. For example, “arrival rate of 55 flights/hour (for both VFR and IFR); for an airport configuration using runways 1, 4, and 33; anticipated between the hours of 1300Z and 1700Z”.

For sectors, capacity shall be expressed in terms of an adaptable, static threshold that defines the maximum acceptable aircraft loading (i.e., aircraft count) for a specified time interval (e.g., 10 aircraft for a 15 minute time interval). The capacity value shall remain constant throughout that time interval. The determination of sector loading values, for sectors within an ACC, will be determined through a collaborative effort involving ATFM and ATC representatives from that ACC. The ATFMS shall provide a capability for electronically receiving and storing forecast sector loadings for a minimum forecast time horizon of six hours. The ATFMS shall provide the means for modifying stored forecast values, to accommodate changes in weather, traffic complexity, or other factors that may reduce the number of aircraft that could safely accommodated within a subject sector. Access to this modification capability shall be limited to designated specialists in the ACC TMU, and controlled through function access controls.

The ATFMS shall transmit, and make accessible for display, near-real-time and planning capacity data to all appropriate traffic management specialists and make that capacity data accessible to ATFM subsystems requiring that data.

4.5.3 Demand Prediction

The ATFMS shall support the continuous determination of flight demand on airport and ACC airspace resources. Airspace resources shall include sectors, airways and fixes. The ATFMS shall capture the predicted and actual demand on various ACC and airport resources. The predicted demand shall be based on airline schedule data. To support demand prediction, the ATFMS shall also capture actual flight demand, as scheduled flights may be cancelled, or new flights may be added on the day of operations.

ATFM specialists at all of the ATFM units, from CCC down to those selected TWRs with TMUs, shall have access to real-time traffic demand counts and predictions. The ATFMS shall be capable of providing that demand information in textual/list form and in a graphical representation that displays predicted individual aircraft positions based on their intended flight trajectory. In generating updates to demand predictions, the ATFMS shall include revisions made to airline schedules during the course of the day of operations. The ATFMS shall generate and maintain separate traffic demand counts for flights with statuses of scheduled, active, and airborne. Scheduled flights will consist of those flights that have flight plans submitted to the CCC, but have not been activated for processing by an ACC. Active flights will
consist of those flights whose flight plans have been activated, but have not yet departed. Airborne flights will consist of those flights that have departed and are being managed by ATC.

ATFM specialists at all of the ATFM units shall have the capability to select and display current and forecast demand for a user specified resource (e.g., flights traversing a route during a specified time period) on an on-demand basis.

4.5.4 Congestion Identification and Reporting

The ATFMS shall provide the capability for identifying three types of congestion problems:

- Airport demand/capacity imbalances
- Airspace demand/capacity imbalances
- Avoidance of unusable and undesirable air space

The ATFMS shall continually compare actual and predicted capacity and demand, and shall report the results of these comparisons to ATFM specialists and to qualifying airspace users. In reporting cases where anticipated demand is expected to exceed available capacity, the ATFMS shall:

- Automatically transmit and display congestion alerts
- Identify the time and specific location(s) where demand is predicted to exceed capacity at an unacceptable level
- Identify the specific aircraft involved in the demand/capacity imbalance, including their current flight status (i.e., scheduled, active or airborne)
- Quantify the extent of the demand/capacity imbalance

Within the CCC, ACC TMUs APP TMUs, and at the TWR TMU, specialists, who are assigned responsibility for monitoring and identifying airspace/airport capacity imbalances shall have access to capabilities for analyzing traffic demand on user designated volumes of airspace, airways or segments of an airway, navigation fixes, or airports. A user designated volume of airspace could be a sector, airspace affected by weather, or any arbitrary volume of airspace selected by a user. These capabilities shall provide the user with aggregate and flight specific information on aircraft involved, and volume and temporal characteristics of the predicted congestion. Flight specific information provided for aircraft involved shall include planned/filed route and altitude information, times when the flight is predicted to enter and exit the designated volume of airspace/airport, and controlling ACCs for the remainder of the aircraft’s flight. If the ATFM system identifies a flight as a candidate for rerouting, thereby improving the demand/capacity balance, it shall provide alternate routes for the flight.

4.6 Weather Data Processing

The primary role of aviation weather processing is to incorporate critical weather data affecting safety, schedule efficiency, and user operations into trajectory prediction. Weather information, both now-forecast and fore-forecast, is integrated with and supports ATFMS decision-oriented automation capabilities and human decision making processes.

Five major functional requirements exist to effectively use weather data in flight plan processing.

4.6.1 Common weather picture

The most important requirement for aviation weather data processing is to establish a reliable, common weather data set from surface, airborne, and satellite sources. Establishing this weather data set requires capabilities for:
The collation of weather data from available weather forecasting sources including the output of different forecast model data structures into a consistent set of usable aviation related data. A consistent set infers the same forecast conclusions are drawn regardless of the model.

Dissemination of weather data, either by subscription (push) or demand (pull) to all requesting users, including, but not limited to, AAI, AOCs, and flight crews.

Transformation of weather data from global, regional and/or local forecasts into aviation specific products depicting potential weather impacted airspace/airports (both now and forecasted) and providing estimates of reduced capacity and/or current or predictive no fly airspace.

Data needs to be segmented for the specific ATFM TMUs.

Aviation specific weather product use shall begin in the strategic phase of ATFM planning, using climatology to permit up to at least a 3 month pre-flight planning window. It shall include pre-tactical and tactical phases (from 72 hours and in) via reliable forecasts to allow for multiple pre-planned flight plans and airspace configuration scenarios.

### 4.6.2 Reliable Weather Data Input Requirements

- Convective weather predictive information shall be reliable enough to base proactive operational traffic flow management decisions.
- Automated ability to assess the quality/reliability of weather information forecasts to actual weather shall allow for continuous forecast and data quality improvement.

### 4.6.3 Update Frequency

- Real time/near real-time data for tracking/scheduling has variable update rates commensurate with the requirement to react to unanticipated, rapidly changing circumstances.
- Updates shall come from numerous sources and generate a constant stream of persistent and convective weather products such as growth and decay predictions for the next segment of time – nominally a two hour period. These updates are in turn used to update and refine other airspace tools.
- Winds aloft and precipitation data update rate shall be determined as a function of routing and dynamic weather change along the planned route.
- Updates shall be required every 30 to 60 minutes during times of weather constancy.
- Increased refresh rate shall provide meaningful weather updates when needed.
- Alerts, advisories, and warnings regarding significant weather changes shall be proactively disseminated as soon as they are known.

### 4.6.4 Weather Information Dissemination

Weather information shall be:

- Disseminated to the providers and users of the airspace system including:
  - All levels of the AAI organization
  - Airline and other fleet operators
- Provided in a format compatible with the user’s needs via templates that allow the repository to structure the data per user.
- It shall also ensure that
  - All end users have the same weather data.
  - An alert notification feature for real-time weather alerts, advisories, and warnings regarding significant weather changes
4.6.5 Tailored Weather Data

- Weather information that is disseminated shall be tailored to the operational needs of those interested parties, maintaining a consistent view of weather information.
- Versatile weather products shall allow user defined requests that tailor information presentation to the operational need of that user.
  - Allows for different resolutions, time scales, and geographic areas for different users viewing the same information (e.g., the information for an airport is at a higher resolution and more rapidly updated than that for adjacent en route locations).
  - Filters weather information to deliver the specific information a particular user requires, rather than sifting through volumes of information.

4.7 Flow Initiative Planning

ATFMS automation shall provide a set of capabilities for developing, evaluating and coordinating TMIs among the organizations associated with the subject flow problem. Those organizations could include the CCC, one or more ACC TMUs, APP TMUs, and/or TWR TMUs involved in the flow problem, and airspace users. These flow initiative planning capabilities shall provide automated decision support in the areas of TMI modeling, TMI impact assessment, and TMI coordination and collaboration.

4.7.1 TMI Modeling

CCC and ACC TMU ATFM specialists responsible for defining TMIs will be provided with decision support automation that will assist them in defining the specifics of desired TMIs. TMI modeling capabilities shall support the definition of the following TMI types:

<table>
<thead>
<tr>
<th>TMI Type</th>
<th>Modeled Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Level/Altitude</td>
<td>Required start and end time for the TMI</td>
</tr>
<tr>
<td>Adjustment</td>
<td>Required starting and ending location for the new altitude</td>
</tr>
<tr>
<td></td>
<td>Specific flights to be covered by the TMI</td>
</tr>
<tr>
<td></td>
<td>New required altitude for each flight</td>
</tr>
<tr>
<td></td>
<td>Effect of altitude change on each flight’s flight time and route length</td>
</tr>
<tr>
<td></td>
<td>Combined effect of TMI on projected sector aircraft loadings</td>
</tr>
<tr>
<td>In-trail Spacing</td>
<td>Required start and end time for the TMI</td>
</tr>
<tr>
<td></td>
<td>Required location where the required spacing is to be executed, typically a sector or ACC boundary crossing, a specified fix location, or a specified destination airport</td>
</tr>
<tr>
<td></td>
<td>For distance-based In-trail Spacing (Miles-in-Trail/MIT), the number of miles required between aircraft that meet a specific criteria. The criteria may be separation, airport, fix, altitude, sector, or route specific</td>
</tr>
<tr>
<td></td>
<td>For time-based In-trail Spacing (Minutes-in-Trail) the number of minutes required between aircraft that meet a specific criteria.</td>
</tr>
<tr>
<td></td>
<td>Effect of spacing TMI on each flight’s planned flight time</td>
</tr>
<tr>
<td></td>
<td>Combined effect of TMI on projected sector aircraft loadings</td>
</tr>
<tr>
<td>TMI Type</td>
<td>Modeled Parameters</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Reroutes</strong></td>
<td>• Required start and end time for the TMI</td>
</tr>
<tr>
<td></td>
<td>• Specific flights to be covered by the reroute TMI</td>
</tr>
<tr>
<td></td>
<td>• Required route change for each flight covered by the reroute TMI</td>
</tr>
<tr>
<td></td>
<td>• Effect of required route change on each flight’s flight time and route length</td>
</tr>
<tr>
<td></td>
<td>• Combined effect of TMI on projected sector and airway aircraft loadings</td>
</tr>
<tr>
<td><strong>Fix balancing</strong></td>
<td>• Required start and end time for the TMI</td>
</tr>
<tr>
<td></td>
<td>• Specific flights to be covered by the fix balancing TMI</td>
</tr>
<tr>
<td></td>
<td>• New/assigned fix for each aircraft, for the load balancing</td>
</tr>
<tr>
<td></td>
<td>• Effect of route change on each flight’s flight time and route length</td>
</tr>
<tr>
<td></td>
<td>• Combined effect of TMI on projected sector and fix aircraft loadings</td>
</tr>
<tr>
<td><strong>Airborne Holding</strong></td>
<td>• Required start and end time for the airborne holding</td>
</tr>
<tr>
<td></td>
<td>• Planned location for holding</td>
</tr>
<tr>
<td></td>
<td>• Specific flights to be covered by the airborne holding TMI</td>
</tr>
<tr>
<td></td>
<td>• Effect on each flight’s flight time and route length as a result of the TMI</td>
</tr>
<tr>
<td></td>
<td>• Combined effect of TMI on projected sector aircraft loadings</td>
</tr>
<tr>
<td><strong>Sequencing and Spacing Initiatives</strong></td>
<td>• Required start and end time for the TMI</td>
</tr>
<tr>
<td>(Departure, Arrivals, En route)</td>
<td>• Specific flights to be covered by sequencing TMI</td>
</tr>
<tr>
<td></td>
<td>• For Departure Sequencing: Target departure fix; Desired interval between aircraft; Departure times per flight to achieve the desired constant flow over a common departure fix; Departure airports included</td>
</tr>
<tr>
<td></td>
<td>• For Arrival Sequencing: Target arrival fix; Desired interval between aircraft; Fix crossing times per flight for aircraft destined to the subject arrival airport</td>
</tr>
<tr>
<td></td>
<td>• For En Route Sequencing: Designated merge fix; Desired interval between aircraft; Departure times per flight that will facilitate integration into the en route stream at the designated merge fix</td>
</tr>
<tr>
<td></td>
<td>• Effect of sequencing delay on each flight’s flight time</td>
</tr>
<tr>
<td></td>
<td>• Combined effect of TMI on projected fix and sector aircraft loadings</td>
</tr>
<tr>
<td>TMI Type</td>
<td>Modeled Parameters</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Ground Delay Programs (GDP)      | • Required start and end time for the GDP  
• Geographical scope of the GDP  
• Arrival airport that is the focus of the GDP  
• Departure airports included in the GDP  
• ACCs affected by the GDP  
• Specific flights to be covered by the GDP TMI  
• Revised departure time for each flight subject to the GDP  
• Airline flight cancellations and substitutions  
• Revised arrival times for each flight subject to the GDP  
• Flights  
  ○ Total  
  ○ Affected  
• Delays  
  ○ Average  
  ○ Min  
  ○ Max  
• Holding  
  ○ Average  
  ○ Min  
  ○ Max |
| Ground Stops (GS)                | • Anticipated duration of the GS  
• Aircraft or geographic criteria for selecting the aircraft to be covered by the GS  
• Geographical scope of the GS  
• Arrival airport that is the focus of the GS  
• Departure airports included in the GS  
• ACCs affected by the GS  
• Specific flights to be covered by the Ground Stop TMI  
• Combined effect of GS on subject arrival airport’s arrival demand levels, sector aircraft loadings  
• Flights  
  ○ Total  
  ○ Affected  
• Delays  
  ○ Average  
  ○ Min  
  ○ Max |

TMI modeling capabilities shall provide for the graphical display of modeled In-trail Spacing, Reroutes, Fix balancing, Airborne Holding, and Sequencing and Spacing (Departure, Arrivals, En route) TMIIs on a traffic situation display. Graphical or tabular data presentation techniques shall be used to show the results of Reroute, Ground Delay Program, Ground Stop, or Flight Level/Altitude Adjustment TMI modeling efforts.
To support reuse of TMIs that address problems that occur frequently, the TMI modeling capability shall allow the user to store modeled TMIs; retrieve them when desired; and make modifications to retrieved TMIs before assessing their potential impact.

4.7.2 **TMI Impact Assessment**

CCC and ACC TMU ATFM specialists defining TMIs will also be responsible for evaluating their effectiveness in resolving the subject flow problem. TMI impact assessment capabilities will be provided to assist them in carrying out this responsibility. The TMI impact assessment capability shall allow the user to evaluate the predicted effects of a modeled TMI before it is implemented. Measures of impact shall be specific to the type of TMI being evaluated. For instance, evaluation of proposed Ground Delay Programs will address the number of flights affected, total and individual flight delay that will result, and airport arrival demand reductions over time. Measures of impact for en route oriented TMIs such as In-trail spacing or airborne holding will address en route-related measures such as changes in sector traffic demand, traffic density levels, airway loading, and flight time and travel changes for affected flights.

To facilitate the interpretation of impact assessment results, results shall be quantified. For In-trail spacing, Reroutes, Fix balancing, Airborne Holding, and Sequencing and Spacing initiatives (Departure, Arrivals, En route) TMIs, results shall be presented in graphical form, as well as tabular, form.

For TMIs that will change the route or future projected en route position of aircraft, the impact assessment capability shall provide for the graphical representation of projected future positions of aircraft that are part of the TMI. The impact assessment capability shall also provide for the graphical display of projected changes to traffic demand levels for sectors, airways, fixes and other airspace related resources.

4.7.3 **TMI Coordination and Collaboration**

To facilitate the coordination and collaboration activities that must take place in the TMI planning and approval process, information sharing capabilities shall be provided for the person in charge of the approval process. Those capabilities shall include the capability:

- To select the graphical, tabular or textual information that person needs for a coordination or collaboration discussion.
- To select the individuals or TMU positions this information is to be shared with.
- For the user controlled sharing of that information.
- To conduct controlled access teleconferences, chat sessions, or video conferences.
- For electronic sharing of TMI planning information with all facilities and airspace users who will be affected by a TMI under discussion. TMIs to be covered include all of those listed under Table 1.

4.8 **TMI Implementation**

Once a strategy and associated TMIs have been agreed upon, there is the need to implement that strategy in a timely way. This requires disseminating the specifics of the strategy to the appropriate people and decision support systems. A single strategy will consist of action(s) that may include one or more TMIs. The ATFMS will support TMI implementation in a number of ways. The ATFMS shall provide the means for:

- Designating who is to receive information about the strategy
- Electronically communicating the elements of that strategy (i.e., TMIs, reasons for the TMIs, start and stop times, affected AAI facilities and airspace users, exceptions) to the appropriate:
  - ATFM specialist workstation or workstations
  - ACC TFM decision support system and/or data structure
ATC workstation or workstations
- ATC decision support system and/or data structure
- Airspace user data portal (airspace uses will be responsible for routing TMI implementation information to their appropriate decisions support systems and staff workstations)
- Internet access to allow for e-mail and/or web site data sharing (e.g. SharePoint)

### 4.8.1 Communication and Distribution of Initiatives

The ATFMS shall use available or planned AAI communication infrastructure and systems for the distribution of TMI advisories or directives, wherever possible. New communication capabilities shall be implemented to support information exchange requirements that cannot be satisfied with available or planned AAI communication infrastructure and systems. The implemented communication distribution system shall:

- Support the distribution of TMIs between ATFM units and the associated ATC unit supervisors located in their facility.
- Support the distribution of TMIS to stakeholders.
- Enable the collection of required ATFM input data from various sources.

### 4.8.2 TMI Monitoring and Evaluation

Whenever a TMI is implemented, the CCC and TMUs who assisted in that implementation will be responsible for determining if the TMI is resolving the flow problem as anticipated. ATFM automation shall support the real-time monitoring and evaluation of the effectiveness if TMIs after they are implemented. If a TMI is found to be ineffective or too restrictive in satisfying its intended objectives, the ATFM specialist involved in its creation and monitoring will be responsible for either changing elements of the TMI to improve its effectiveness or terminating the TMI. Decision support capabilities will be provided to support those duties. Those decision support capabilities shall:

- Continuously assess the conditions that led to the decision to implement a TMI
- Present quantified measures of the effectiveness of the TMI in meeting objectives
- Present alarms or other forms of notification to warn ATFM specialists that desired changes in traffic levels are not being achieved

### 4.8.3 TMI Termination

TMIs will be terminated when they achieve their desired objectives or it is determined through system monitoring and evaluation that they are ineffective in achieving those objectives. For both cases, the CCC shall have the means to communicate, through automation, a directive to terminate a TMI. Automated TMI ATFM decision support capabilities shall provide for the automatic formatting and routing of termination directives to the appropriate ATFM personnel, ATC personnel and airspace users.

### 4.9 Information Management

Information management shall be used to provide appropriate and timely information to parties engaged in the ATFMS of India, while simultaneously ensuring that only the appropriate software elements and system users are engaged in that information exchange process.

#### 4.9.1 Automated Collection and Distribution

The ATFMS shall automatically collect and distribute the necessary elements of information for appropriate ATFM decision makers and information consumers.
The ATFMS shall be designed in an open and flexible manner that will enable collection of various types of aviation data relevant to ATFM. In addition, the system shall standardize the process of adapting and ingesting new data sources so that new data that is vital to the use of the system can be easily integrated.

The ATFMS shall distribute data to end users as necessary to support decision support tools, analytical data collection systems, external system tools and users, and other consumers as necessary to satisfy the system’s requirements. The design of information distribution shall open and flexible to allow for ease of integrating new data sources and new data consumers. Although such an enterprise level system will have many different consumers of the distributed data, the method for distributing information shall be standardized so that system is maintainable.

4.9.2 Data Recording

The ATFMS shall provide for recording, archiving, and analysis of ATFM operational data.

The ATFMS shall record operations data to support training, historical analyses, modeling, and reference, and for dynamic application for near-term flow planning and management. The system's data shall be available to authorized users in near-real time. It will provide a standard interface capable of supplying operational data to other AAI organizations and systems as well as providing information resources to system users and/or other governmental organizations. Recording, storage, collection and communication servers will be strategically located at collector sites such as Area Control Centers and selected approach and tower facilities, with a central data administration, collection, and archiving function at the CCC.

4.9.3 System Performance Assessment

In order to achieve the organizational maturity of continual improvement, the ATFMS shall have the ability to collect information and to provide system efficiency metrics based on this information in a post-operational setting. The system shall enable system operators to monitor and analyze system performance. This monitoring shall enable an operator, on the day following operations, to determine whether operational decisions improved system efficiency. The system shall allow for both high level performance assessment and detailed analysis of local congestion points.

The system performance assessment information shall be available to all users of the system.

4.10 ATFMS Training

Effective daily use and application of the various ATFMS functions will require training at locations where those functions are installed and normally accessed. To facilitate that training, the ATFMSs shall be able to operate using either archived or real-time data. Operation of the ATFMS with archived data (hereafter referred to as the training mode) will allow operational hardware and software at an ATFM position to be used for:

- Familiarization and proficiency training on the decision support functions at an ATFM position
- Training of new personnel or personnel assuming new roles
- Refresher training

When an ATFMS unit is operated in the training mode, functions receiving and processing previously stored/archived data shall operate in the same way when receiving and processing real-time data. However, when in the training mode, transfer of data to other systems shall be inhibited. Despite the inability to share data between workstations, the training mode will still support training on individual ATFMS functions and operational applications of those functions.

When a workstation is configured in the training mode, it shall allow an instructor to:
Retrieve archived data (e.g., flight, airspace, weather, winds, airport.) needed to support a training exercise
Configure the workstation by designating the airspace and flights to be used in the training session
Disable the subject workstation from interacting with the operational/real-time system

When a workstation is configured in the training mode, it shall allow a student to:

- Access all of the functions associated with flight plan processing, situation awareness and problem identification, weather data processing, flow initiative planning, information management and infrastructure support
- Access all of the archived data required for the proper operation of the above functions

When in the training mode, a workstation shall provide the same level of performance provided when operating in the real-time/normal operating mode.

### 4.11 Infrastructure Support

The most critical aspect of establishing an air traffic flow management infrastructure is building an infrastructure to support the primary goal of enabling common and shared situational awareness amongst all traffic flow management stakeholders. Shared situational awareness does not imply that all stakeholders have the exact same information or displays. Rather, it means all stakeholders should have access to information derived from a common information pool. The design of such an information sharing infrastructure should enable stakeholders to both gather appropriate levels of information from and submit information to a common set of data structures accessible to a greater or lesser extent by all users.

#### 4.11.1 Centralized Air Traffic Flow Management Processing

Dynamic traffic flow information, such as flight planning and aircraft position data, are typically generated locally across the national airspace. This information must be collected and integrated to provide the common situation model needed for effective flow management. The infrastructure required to achieve this common view includes both distributed and centralized elements.

- Distributed data acquisition support, including:
  - interfaces to surveillance systems and other data sources (e.g., local weather)
  - processing (filtering, time stamping, metadata tagging, etc.) to support data quality and usability (e.g., data aging) analysis
  - interface(s) to centralized processing components

- Single traffic flow management processor with a co-located backup that generates:
  - Common traffic flow management geospatial display generation based on ATC surveillance inputs
  - Predictive traffic flows based on flight plan submissions and airline scheduling data
  - Modeling ability to inject projected weather or other flow constraints for predictive planning using projected traffic flows
- Data storage and archiving capability
  - Support for short-term post-event analysis and long-term historical trend studies
  - Management of standardized and reusable TFM actions such as pre-coordinated reroute plans for typical adverse weather conditions and planning for infrequent (but predictable) high-traffic occasions
- Back-up processor geographically separated for continuity of operations in an emergency situation
- Distribution interfaces to allow dissemination of traffic flow display data to subordinate traffic management units as well as collaborative decision making partners

### 4.11.2 Distributed Dissemination and Modeling
Traffic flow management is a mix of local and system-wide actions to monitor, forecast, and influence air traffic. At the local level, traffic managers need the ability to view local conditions (such as weather) in the context of broader events (such as inbound flights that may still be on the ground). Local TFM often involves coordination with other traffic management regions, based on a common situational view. The TFM infrastructure must support this local-global integration of traffic flow information. Specific capabilities include:

- Common traffic flow management geospatial displays that can be focused and detailed for specific areas of responsibility for each separate traffic flow management unit
- Modeling to inject projected local weather or other flow constraints for predictive planning using projected traffic flows at separate traffic flow management units
- Transmission of individual traffic flow management unit actual or recommend traffic management initiatives to adjacent units and to the traffic flow management center for coordination and collaboration

### 4.11.3 System Level Interfaces
Traffic flow management operates, conceptually, on collections, or sets, of flights (rather than on individual flights). This requires continual data exchanges with the operational (tactical) aspects of air traffic including ATC and flight operations centers. The shared situational TFM model provides a broader view than other air traffic operations. The TFM infrastructure should provide mechanisms for sharing this view.

- Interface air traffic flow management display information, directions, and traffic flow management initiatives with the automation systems used to support ATC functions in ACC, Approach, and Tower facilities
- Interface with information suppliers such as weather data, military airspace users, and other national ATM organizations
- Interface with airspace users such as airlines and aircraft operators to provide consistent airspace status and collaborative decision support
4.12 System Performance

The hardware and software need to operate at sufficient speed to be able to process flight data information arriving at one minute intervals for all 6,400 flights in the ATFM system. In addition there needs to be enough reserve processing power to handle all user requests within 0.2 seconds.

The ATFM system shall be capable of updating all situational data within one minute. The ATFM shall be capable of responding to any user input within 0.2 seconds. The alert functions of the ATFM system shall be made known to the users at the CCC, ACC TMU, APP TMU and the TWR TMU within 0.2 seconds of being calculated. There should be sufficient processing power to calculate capacity/demand values and alerts for all airspace features in the system. There should be sufficient processing power to process 50 TMIs concurrently.

4.12.1 Communication

Sufficient to support all users at all locations with a 20% cushion over peak demand to support future expansion.

4.12.2 Operational Availability

Operational availability is achieved by running two independent servers that sit on two different networks that receive data from two different sensor networks.

4.12.3 Reliability

Each independent system and network shall be 99.999% available.

4.12.4 System Recovery and Data Backup

System recovery is accomplished by having a “hot backup” which is a second complete system always receiving the same data as the “operational” system and processing it at the same time. This is required because it would take too much time to bring up a cold system and get it operationally ready by loading all of the required data.
5. Appendix A. References

1. “Global Concept of Operations for Indian Air Traffic Flow Management”, Volpe Center, August 15, 2010
Appendix B. Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAI</td>
<td>Airports Authority of India</td>
</tr>
<tr>
<td>AAR</td>
<td>Airport Arrival Rate</td>
</tr>
<tr>
<td>AC</td>
<td>Approach Control</td>
</tr>
<tr>
<td>ACC</td>
<td>Area Control Center</td>
</tr>
<tr>
<td>ADR</td>
<td>Airport Departure Rate</td>
</tr>
<tr>
<td>ADS-B</td>
<td>Automatic Dependent Surveillance – Broadcast</td>
</tr>
<tr>
<td>ADS-C</td>
<td>Automatic Dependent Surveillance – Command</td>
</tr>
<tr>
<td>AFSM</td>
<td>Automated Flight Schedule Monitor</td>
</tr>
<tr>
<td>AIS</td>
<td>Aeronautical Information System</td>
</tr>
<tr>
<td>AOC</td>
<td>Airline Operations Center</td>
</tr>
<tr>
<td>AM</td>
<td>Airspace Management</td>
</tr>
<tr>
<td>APREQ</td>
<td>Call for Release Approved Request</td>
</tr>
<tr>
<td>ASMGCS</td>
<td>Advanced Surface Movement Ground Control Systems</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ATFAM</td>
<td>Air Traffic Flow Management</td>
</tr>
<tr>
<td>ATM</td>
<td>Air Traffic Management</td>
</tr>
<tr>
<td>ATN</td>
<td>Aeronautical Telecommunication Network</td>
</tr>
<tr>
<td>ATS</td>
<td>Air Traffic Services</td>
</tr>
<tr>
<td>ATSD</td>
<td>Air Traffic Situation Display</td>
</tr>
<tr>
<td>CAT</td>
<td>Category</td>
</tr>
<tr>
<td>CCC</td>
<td>Central Command Center</td>
</tr>
<tr>
<td>CDM</td>
<td>Collaborative Decision Making</td>
</tr>
<tr>
<td>CFR</td>
<td>Call For Release</td>
</tr>
<tr>
<td>CNS</td>
<td>Communications, Navigation, and Surveillance</td>
</tr>
<tr>
<td>CP</td>
<td>Capacity Position</td>
</tr>
<tr>
<td>CPDLC</td>
<td>Controller Pilot Data Link Communications</td>
</tr>
<tr>
<td>CTOT</td>
<td>Calculated Takeoff Time</td>
</tr>
<tr>
<td>EDCT</td>
<td>Expected Departure Clearance Time</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>FANS</td>
<td>Future Air Navigation System</td>
</tr>
<tr>
<td>FL</td>
<td>Flight Level</td>
</tr>
<tr>
<td>FPL</td>
<td>Filed Flight Plan</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>GDP</td>
<td>Ground Delay Program</td>
</tr>
<tr>
<td>GS</td>
<td>Ground Stop</td>
</tr>
<tr>
<td>IATA</td>
<td>International Air Transport Association</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>IDS</td>
<td>Information Display System</td>
</tr>
<tr>
<td>IGI</td>
<td>Indira Gandhi International Airport</td>
</tr>
<tr>
<td>ILS</td>
<td>Instrument Landing System</td>
</tr>
<tr>
<td>IBAA</td>
<td>India Business Aviation Association</td>
</tr>
<tr>
<td>KMIT</td>
<td>Kilometers-in-Trail</td>
</tr>
<tr>
<td>METAR</td>
<td>Meteorological Aviation Report</td>
</tr>
<tr>
<td>MIC</td>
<td>Manager in Charge</td>
</tr>
<tr>
<td>MID</td>
<td>Meteorological Information Display</td>
</tr>
<tr>
<td>MINIT</td>
<td>Minutes-in-Trail</td>
</tr>
<tr>
<td>NOTAM</td>
<td>Notice to Airmen</td>
</tr>
<tr>
<td>PIP</td>
<td>Post Analysis &amp; Information Dissemination Position</td>
</tr>
<tr>
<td>RNAV</td>
<td>Area Navigation</td>
</tr>
<tr>
<td>RNP</td>
<td>Required Navigation Performance</td>
</tr>
<tr>
<td>RVR</td>
<td>Runway Visual Range</td>
</tr>
<tr>
<td>SFP</td>
<td>Special Flight Position</td>
</tr>
<tr>
<td>SID</td>
<td>Standard Instrument Departure</td>
</tr>
<tr>
<td>SITA</td>
<td>Societe Internationale de Telecommunication Aeronautiques</td>
</tr>
<tr>
<td>SNOTA</td>
<td>Special Notice to Airmen</td>
</tr>
<tr>
<td>STAR</td>
<td>Standard Terminal Arrival</td>
</tr>
<tr>
<td>SUA</td>
<td>Special Use Airspace</td>
</tr>
<tr>
<td>TAF</td>
<td>Terminal Area Forecast</td>
</tr>
<tr>
<td>TMI</td>
<td>Traffic Management Initiative</td>
</tr>
<tr>
<td>TMS</td>
<td>Traffic Management Specialist</td>
</tr>
<tr>
<td>TMU</td>
<td>Traffic Management Unit</td>
</tr>
<tr>
<td>TWR</td>
<td>Tower</td>
</tr>
<tr>
<td>VDL</td>
<td>VHF Data Link</td>
</tr>
<tr>
<td>VIDP</td>
<td>Indira Gandhi International Airport</td>
</tr>
<tr>
<td>VIP</td>
<td>Very Important Person</td>
</tr>
<tr>
<td>UFO</td>
<td>Unidentified Flying Object</td>
</tr>
<tr>
<td>WAM</td>
<td>Wide Area Multi-Lateration</td>
</tr>
</tbody>
</table>