MODULE II

AIR SPACE
AND
AIR TRAFFIC MANAGEMENT

FUNCTIONAL STRUCTURE FOR AIR TRAFFIC MANAGEMENT

Current roles and responsibilities of system agents:

- Flow management and traffic separation, and the performance factors that combine to provide a safe minimum separation standard for a given operation.
- The technical and operational changes that are likely to be needed to support the system capacity, efficiency and safety goals for 2015.
- Overview of the CNS/ATM technologies that are likely to be needed to support the new operational concept.
- The airspace implications of the proposed operational improvements,
- Airport impact

OBJECTIVES OF AIR TRAFFIC SERVICES

1. Prevent collisions between aircraft.
2. Prevent collisions between aircraft on the maneuvering area and obstructions in that area.
3. Expedite and maintain an orderly flow of air traffic.
4. Provide advice and information useful for the safe and efficient conduct of flights.
5. Notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

CAPACITY AND SAFETY OF AIR TRAFFIC MANAGEMENT

- Throughput and Efficiency
- A Functional View of the Current Concept.
- Levels of Flow Planning in the System
- Levels of Plan Execution in the System

THROUGHPUT AND EFFICIENCY

It is important to consider the relationship between throughput and efficiency in the current system. There is a need on part of system users to retain a certain level of flexibility in routing to achieve an efficient operation. But, when considering that current separation assurance methods are fundamentally based on a controller‘s highly tuned knowledge of a sector and its fixed path geometry, it becomes apparent that flexibility could have a negative impact on airspace throughput. In addition, a controller handles more aircraft by assuming that pilots stick to their assigned trajectories with a high probability.

A FUNCTIONAL VIEW OF THE CURRENT CONCEPT, THROUGHPUT AND SAFETY

System throughput is a measure of the realized flow through the system in a given time period. Whereas separation standards are established through an analysis of collision risk, throughput is dependent on the controller‘s ability to accommodate traffic demand in the face of uncertainty and disturbances. Periods when demand exceeds capacity in parts of the system can cause an increase in collision risk, and it is important to include functions in the system that prevents such overload. In the NAS operation this is done through flow planning, where a planning horizon of 24 hours is both feasible and appropriate given the daily traffic demand cycle

LEVELS OF FLOW PLANNING IN THE SYSTEM

The traffic flow planning function is complicated by the fact that the system is subject to a variety of sources of uncertainty. The three most important ones for the daily plan are: Weather prediction uncertainty, which affect primarily the arrival phase of flights through airport arrival rates. Aircraft pushback readiness due to a variety of factors in aircraft turnaround at the gate, which affects primarily the departure phase of flights. NAS equipment status, which can affect any phase of flight, the uncertainty inherent in the daily flow plan often results in situations where the plan is out of phase with the unfolding situation, leading to possible overloads or wasted capacity.

LEVELS OF PLAN EXECUTION IN THE SYSTEM

Flight and flow plans in the system are executed through a number of functions, the primary ones being: Aircraft guidance and navigation, Separation assurance, Aircraft on-board collision avoidance.

DENSE TERMINAL AIRSPACE

- Efficiency in Dense Terminal Airspace
- Safety in Dense Terminal Airspace
- Separation Assurance and CNS/ATM Technologies
- Efficiency in Low Density Airspace
- Transition from Low to High Density Airspace
- Extended Terminal Areas

NATIONAL FLOW MANAGEMENT

- Planning for Operator Efficiency and Overload Protection
- Time Horizons and Coordination
- Information Flow and Collaborative Decision Making

PROPOSED CNS/ATM TECHNOLOGY IMPROVEMENTS

- Airspace and Airways
- Airports
- Flight Service Stations

AIRSPACE AND AIRWAYS

The NAS is currently operating at a throughput that is very close to saturation in many of the busiest terminal areas. In areas such as the northeast corridor, the upper airspace has also become quite congested. The concept presented here introduces step-by-step improvements in the system for increased throughput, where initially no major new technology will be required. However, as the system moves beyond the first steps in the transition, the implication is that higher performance levels will be required to achieve higher density operations where they are needed.

AIRPORTS

Airport construction and operational cost is a fundamental issue where economic growth vs. shorter term business objectives must be carefully weighed. As detailed in the NAS Stakeholder Needs report, the NBAA expressed concern about continued economical access to smaller airports, because their members see this as essential for the growth of small business outside the major population centers.

FLIGHT SERVICE STATIONS

The NAS Stakeholder Needs document details the concerns of the NAS users that rely on Flight Service Stations for information needed during flight planning. This concern is focused on flight safety related to weather conditions, and to airspace access through flight plan filing. It must be

kept in mind that the safety concern is supported by existing data on accident rates, and it is probable that improvements in content and presentation of weather information at Flight Service Stations would reduce the accident rate in this segment of the system. The cost is probably the primary issue here, and there is an immediate need for innovative economical solutions for this system component.

HUMAN FACTORS IN AIR TRAFFIC MANAGEMENT

The Role of Human Factors In Enabling Change:

- Baseline Data of Human Roles
- The Search For Greater Throughput And The Demands On The Human
- Involvement Of Human Factors From Concept Development Through Final Design
- Human Factors Support For Implementation, Education, And Training
- Designing To Support Human Performance Across The Entire Range Of System Operating Conditions
- Human Factors Issues Affecting Tactical Control
- Using Structure To Maximize Throughput
- Sharing Responsibility

SURVEILLANCE PERFORMANCE	CURRENT RADAR-BASED SURVEILLANCE SYSTEM PERFORMANCE
• Short Term Separation Assurance • Medium Term Separation Assurance • Medium Term Airspace Planning • Strategic/Long Term Planning and Flow Management	➢ SURVEILLANCE SYSTEM PERFORMANCE METRICS • Accuracy Metrics • Aviation Weather Performance

Available and Emerging Technology

1. **SYSTEM PERFORMANCE**
2. **COMMUNICATION PERFORMANCE**

- REQUIRED COMMUNICATION PERFORMANCE CONCEPT
- INSTALLED COMMUNICATION PERFORMANCE(ICP)
- ACTUAL COMMUNICATION PERFORMANCE(ACP)

3. **NAVIGATION PERFORMANCE**

- REQUIRED NAVIGATION PERFORMANCE CONCEPT(RNP)
- ACTUAL NAVIGATION PERFORMANCE CONCEPT

4**. COMMUNICATION SYSTEM**

- AIR/GROUND COMMUNICATION
- VOICE

5. **SURVEILLANCE PERFORMANCE**

- REQUIRED MONITORING PERFORMANCE(RMP)