NEXTOR Annual Research Symposium
November 14, 1997

Session III
Issues for the Future of ATM

Synthesis of a Future ATM Operational Concept

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ATM Concept Baseline Definition

Aslaug Haraldsdottir et.al.

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Introduction

"This statement of work describes a task that will define and document the probable evolution of the National Airspace System (NAS) through the year 2015, based on current documents and on-going work by the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), and industry."

(Project Statement of Work, drafted December 1996)

(Work commenced in early May 1997)

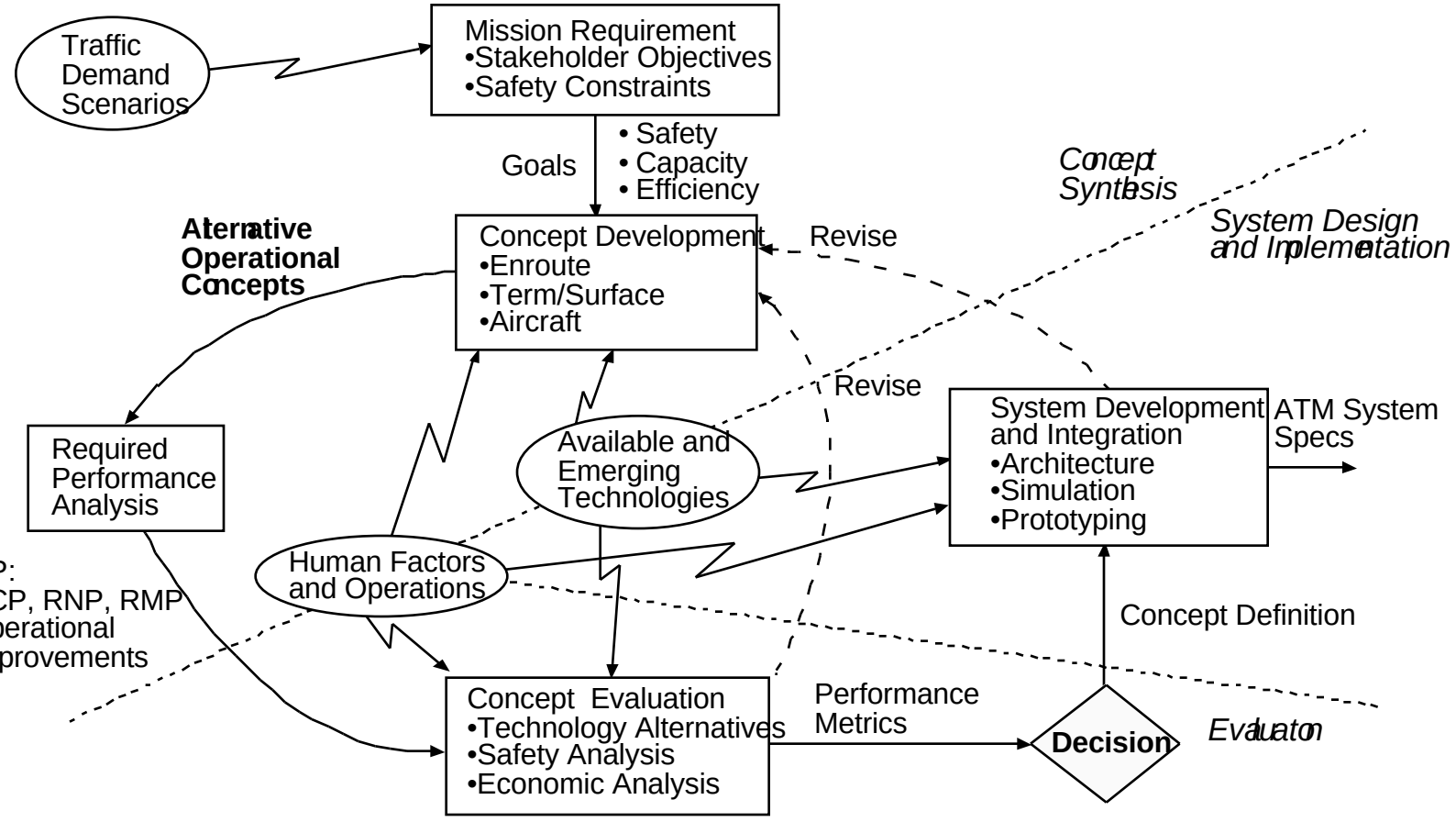
Project Participants

- FAA Operational Concept Development Team
- NASA Ames, AATT Program
- Boeing Commercial Airplane Group (Seattle)
- NEXTOR (FAA Center of Excellence in ATM Operations Research)
  - MIT
  - Berkeley

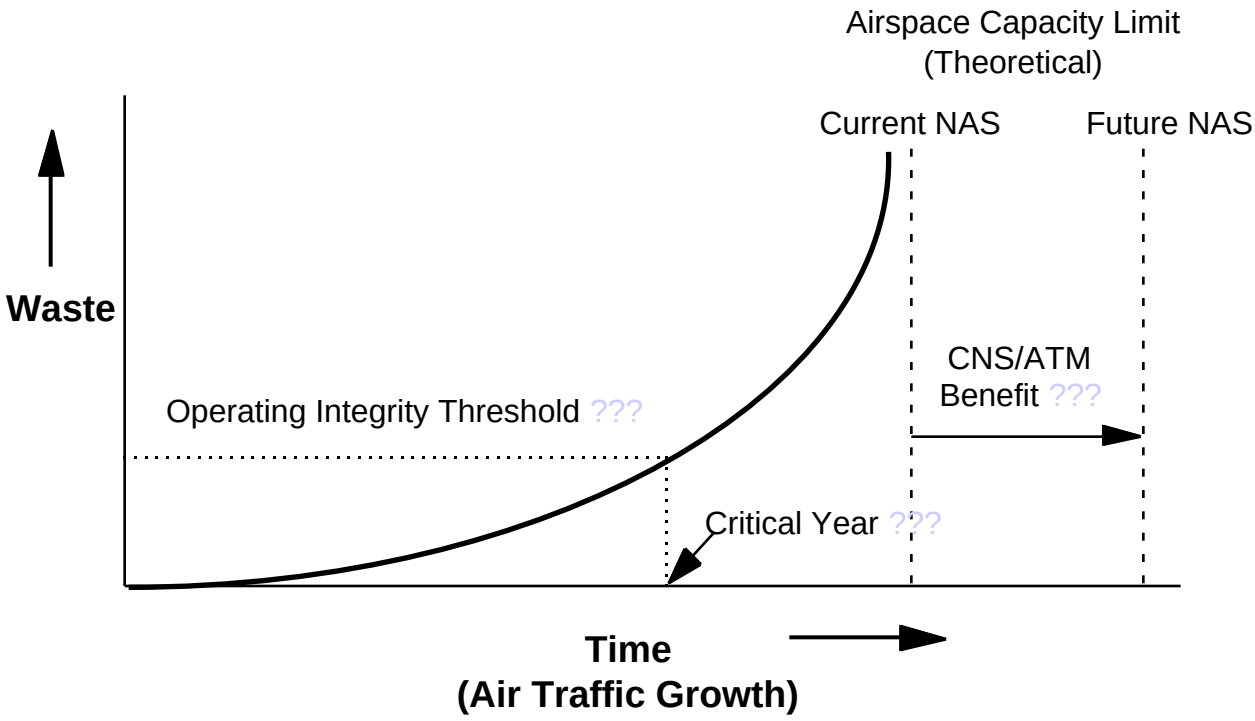
Preliminary Design Questions

- How big should it be?
  - capacity, access
- How much can it cost?
  - capital investment, operational efficiency, productivity and maintenance
- How well must it perform?
  - safety, sustainability

Mission, Requirements, Concepts and Architecture



NAS Capacity Study - Notional Capacity Effects



Source: American Airline NAS Capacity Study, 1997

NAS Capacity Study Conclusions

Cost Avoidance as Basis of Infrastructure Investment

4% Percent Growth in Enplanements and 2.3% Annualized Traffic Growth

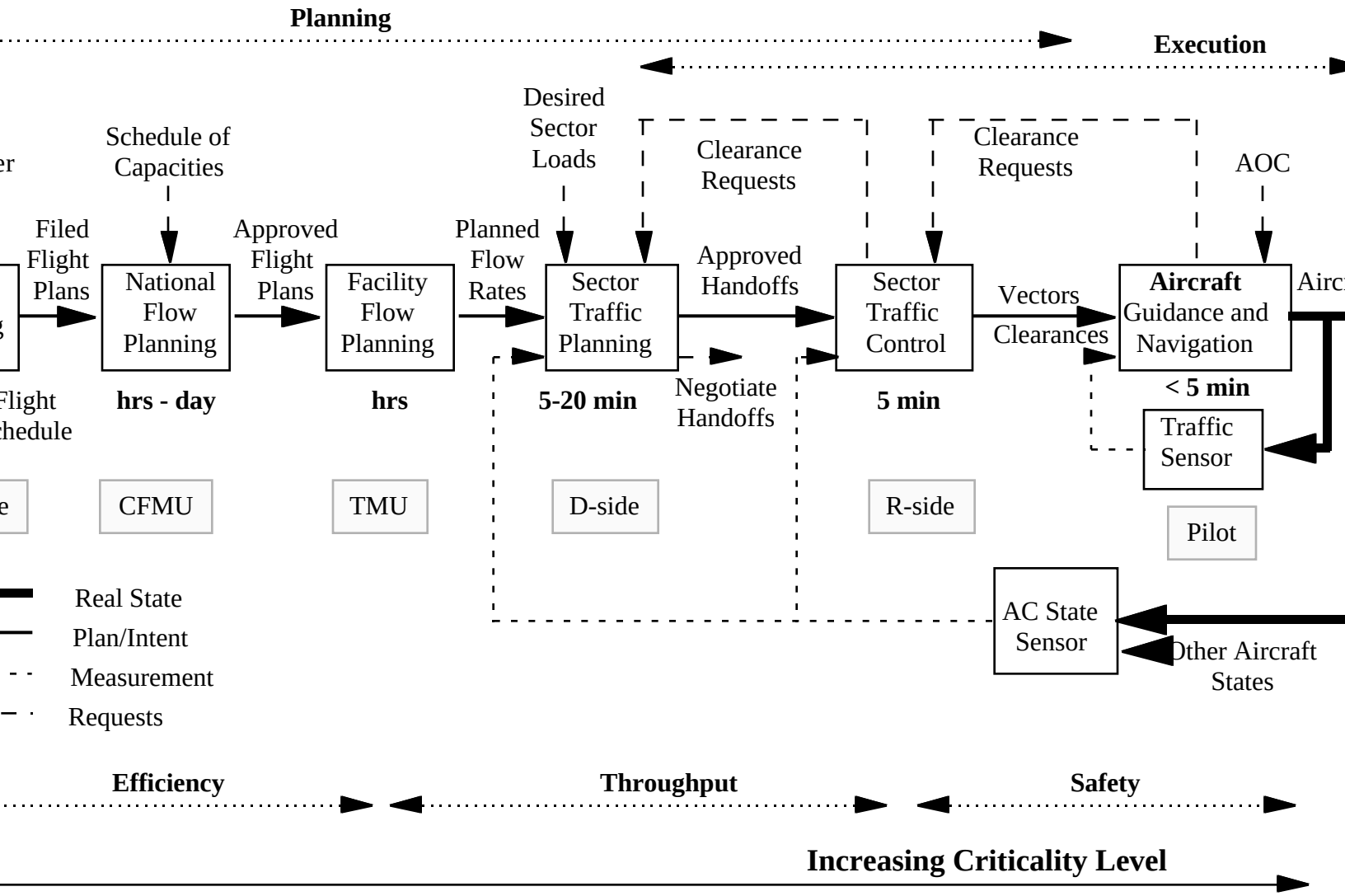
Airspace Delays will Dramatically Constrain Airline Operations and Scheduling Opportunities in the Next Decade

Northeast “triangle”, Southeast and Southwest Regions Acute

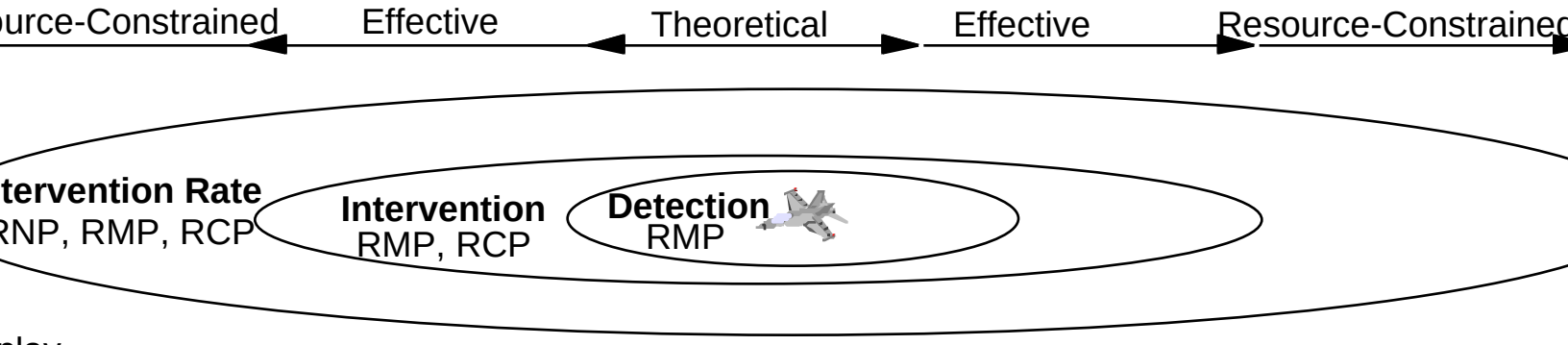
Reducing Separations (7 nm to 3 nm En Route; 4 nm to 2 nm in the Terminal; Wake Vortex from 4.5-1.9 to 2.5-1.5) and Adding Departure Runways can Provide 25+ Years of Operation

Source: American Airline NAS Capacity Study, 1997

ATM System Functional Structure



Separation Standard and Performance Factors



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Comm: a/g
Pilot
Closure Rate

Sensor
Display
Controller
Pilot

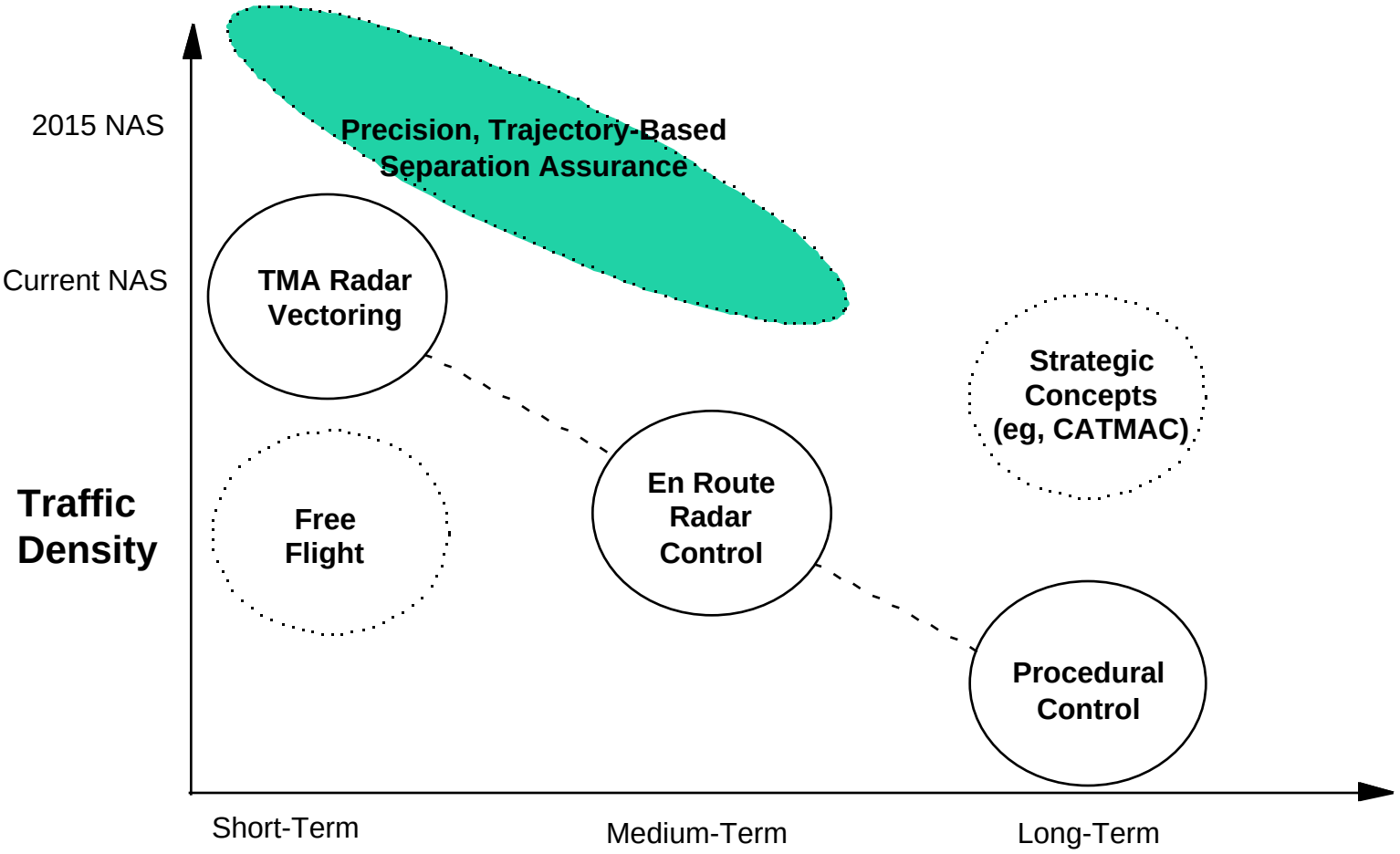
Required Element Performance

RxP = **f** (sensors, decision support, human)

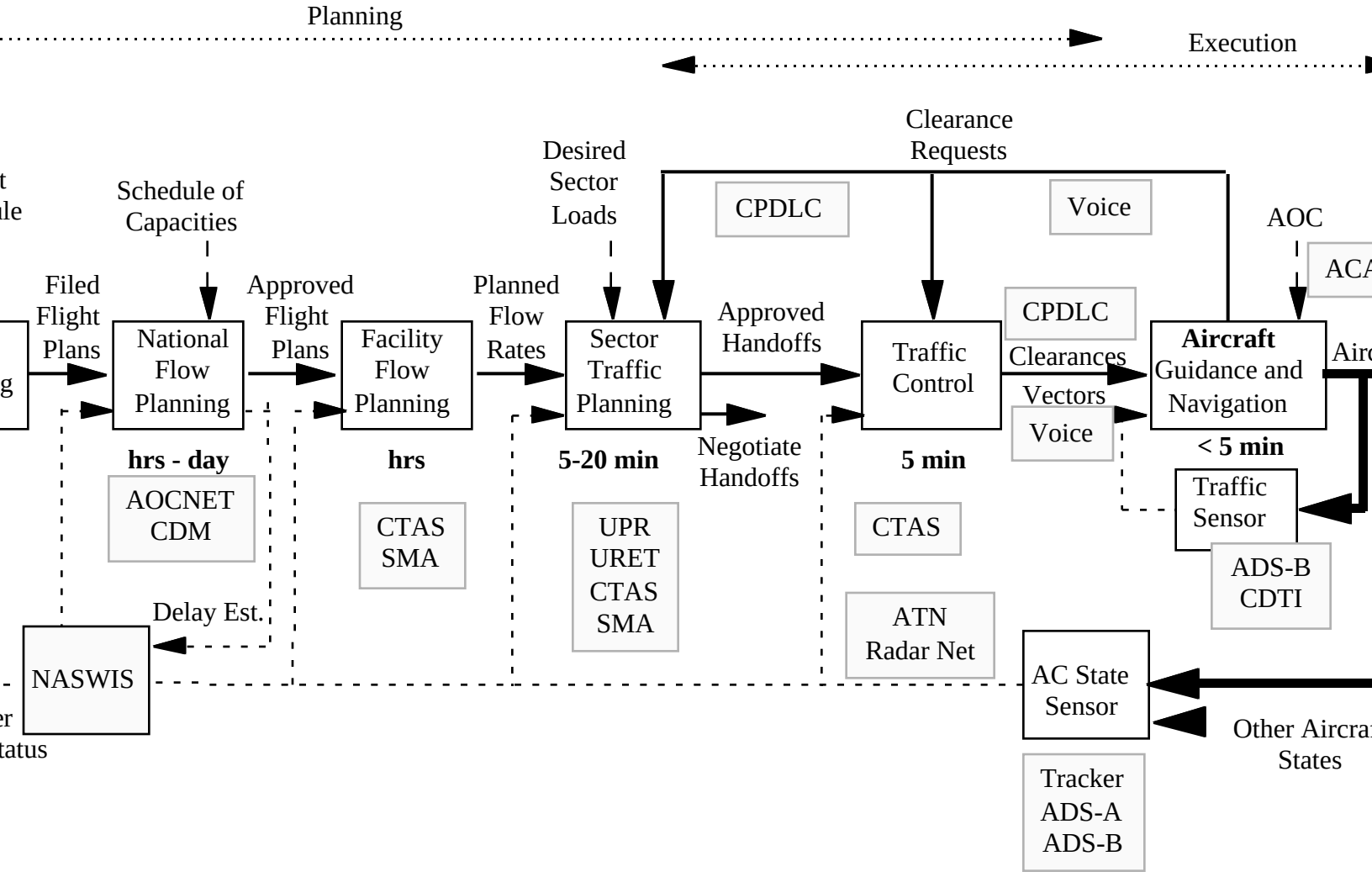
Required System Performance sets Separation Standard

RSP = **g** (RCP, RMP, RNP)

Alternative Operational Concepts

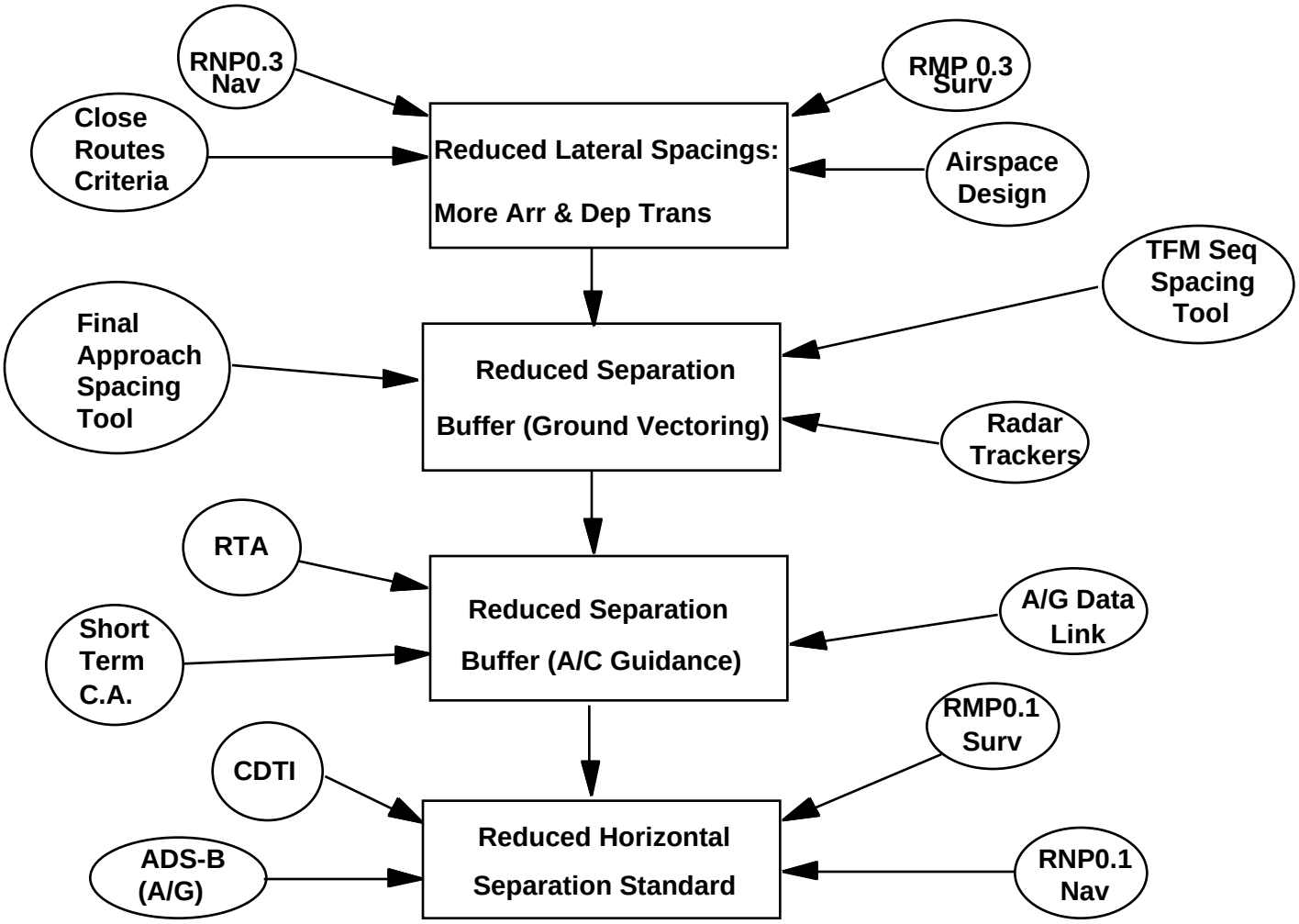


Proposed CNS/ATM Technologies



CNS/ATM Transition Logic Diagram NAS

Arr/Dep Trans (4) Improved Throughput Capacity



Future System Thrusts

- Uniform CNS Infrastructure Throughout NAS
- Performance-Based Access to Airspace and Services
- Airspace Configured Dynamically Based on Density Level
- Precision Trajectory-Based Separation Assurance
- User Flexibility in Low Density Airspace
- Collaborative Flow Management
- Separation Assurance Remains Shared Between Air and Ground

Conclusions

1 Traffic growth predictions indicate NAS traffic gridlock by 2006
   - terminal area will be the primary choke point
   - airline hubbing operations become infeasible
   - costs escalate and economic growth is hampered

2 Current approach to NAS modernization will not accommodate the predicted growth
   - pace is too slow to respond to market needs
   - system development process is inadequate
     - technology driven to point solutions

Recommendations

1 NAS capacity must be increased
  - additional/reliever airports and runways, and
  - higher terminal area traffic density
    - improvements in communications, navigation and surveillance for reduced separations
    - changes in the separation assurance work system to achieve capacity goals
    - coordinated traffic flow management that supports higher capacity and efficiency

2 A major change is needed in the system development process
  - high-level trades before major design decisions
  - concept validation must incorporate human factors and technology
  - determine level of risk and criticality requirements, ground and air