

NASA VAMS

Technical Interchange Meeting #3

Capacity Improvements Through Automated Surface Traffic Control

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Presented at NASA Ames Research Center
Moffett Field, CA
January 14-15, 2003

Outline

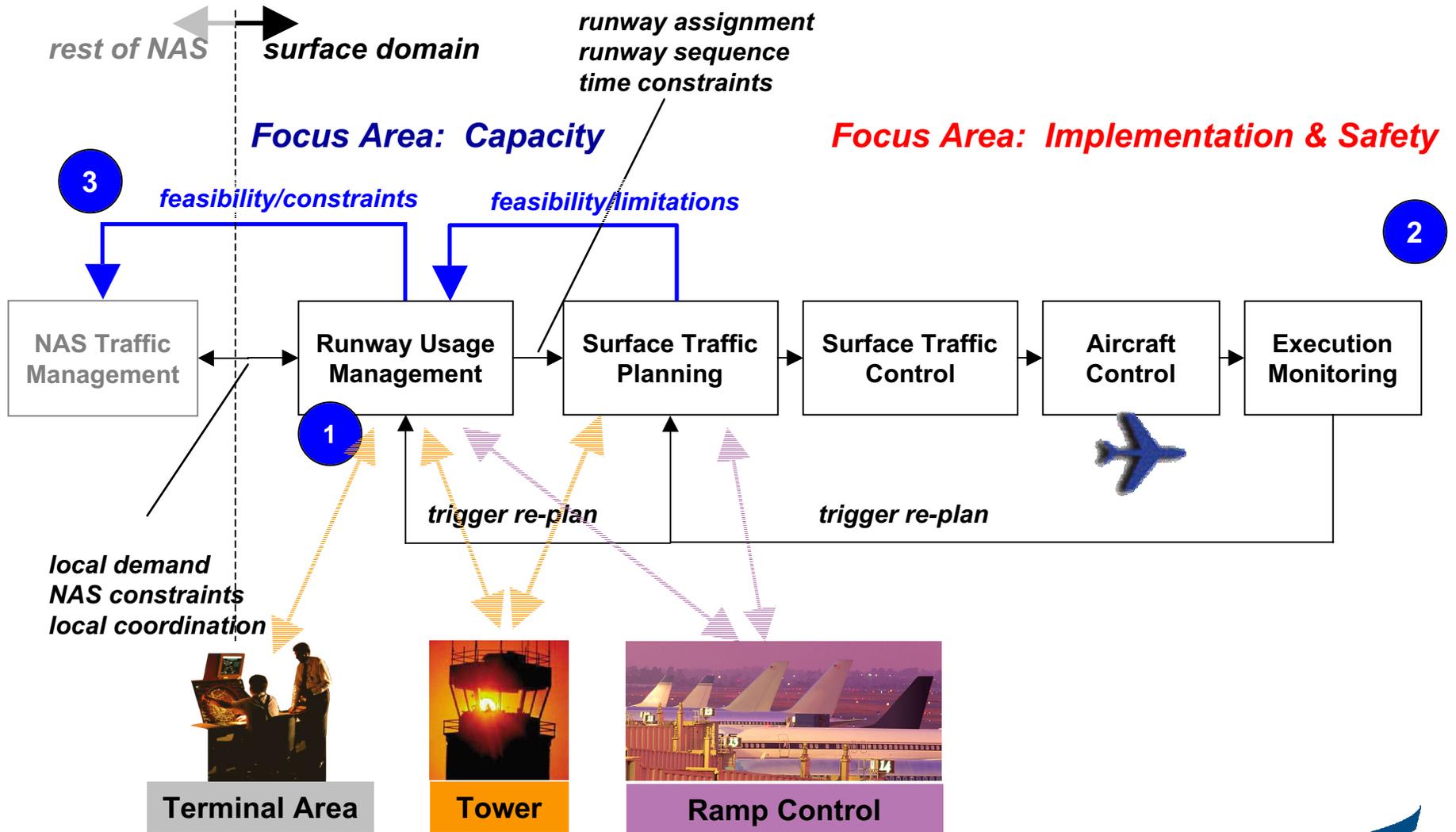
- **Concept Overview**
- **Core Ideas**
- **Benefit Mechanisms and Metrics**
- **Self-Evaluation Approach and Simulations**
- **Summary**

Concept Overview

- **Need: *A more efficient and adaptive airport surface***
- **Answer: *Automated Surface-Wide Traffic Planning and Control***
 - Integrated Planning and Coordination of all Surface Movements (including runways)
 - Improved Information Exchange and Collaboration Within and Across Domains
- **Anticipated Effects:**
 - Eliminate Myopic Control of the Airport
 - Reduce Communication and Execution Lags
 - Support Dynamic Interaction with Terminal, En Route, and Airport Users

Result: Support greater NAS end-to-end throughput

Concept Overview

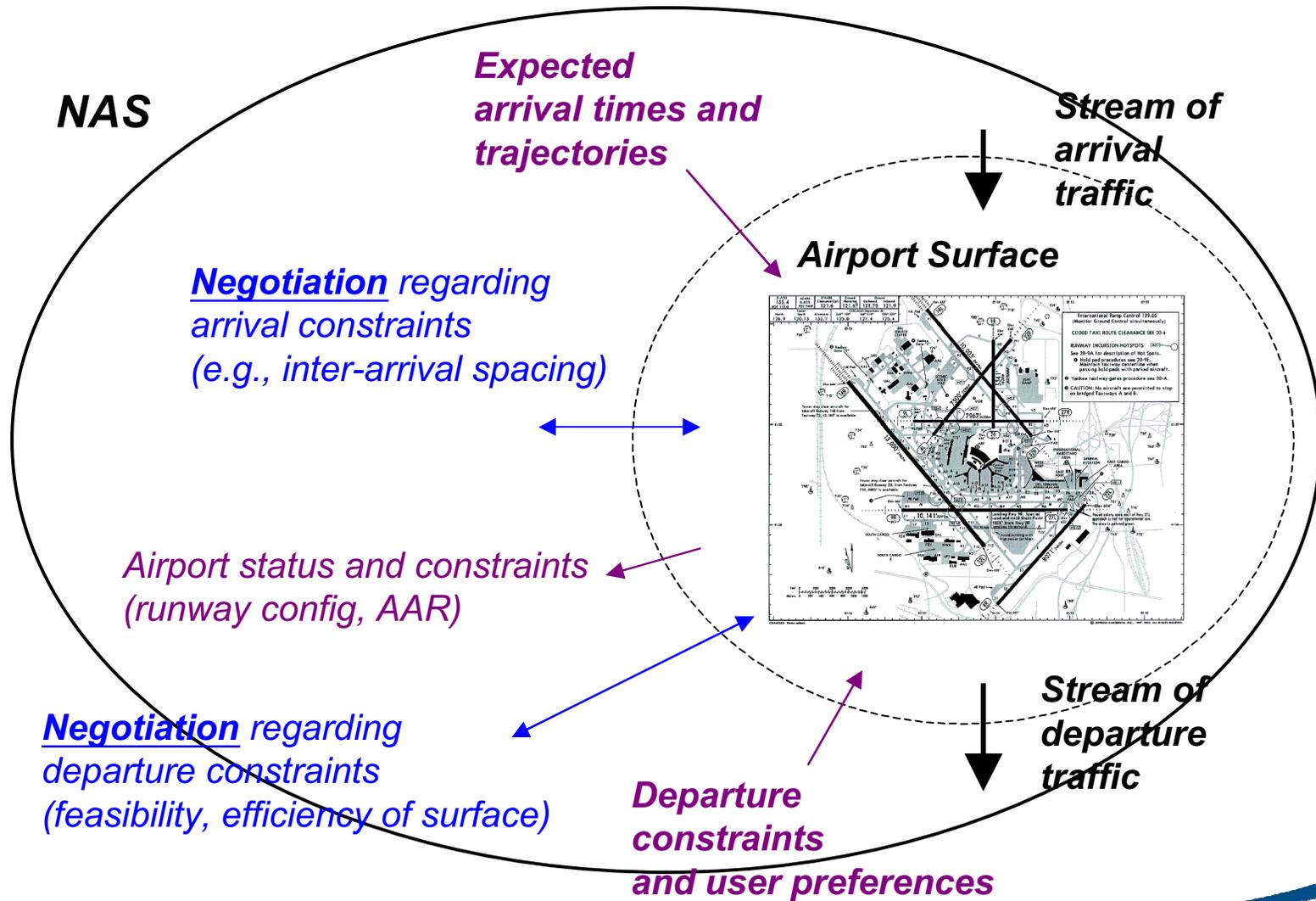


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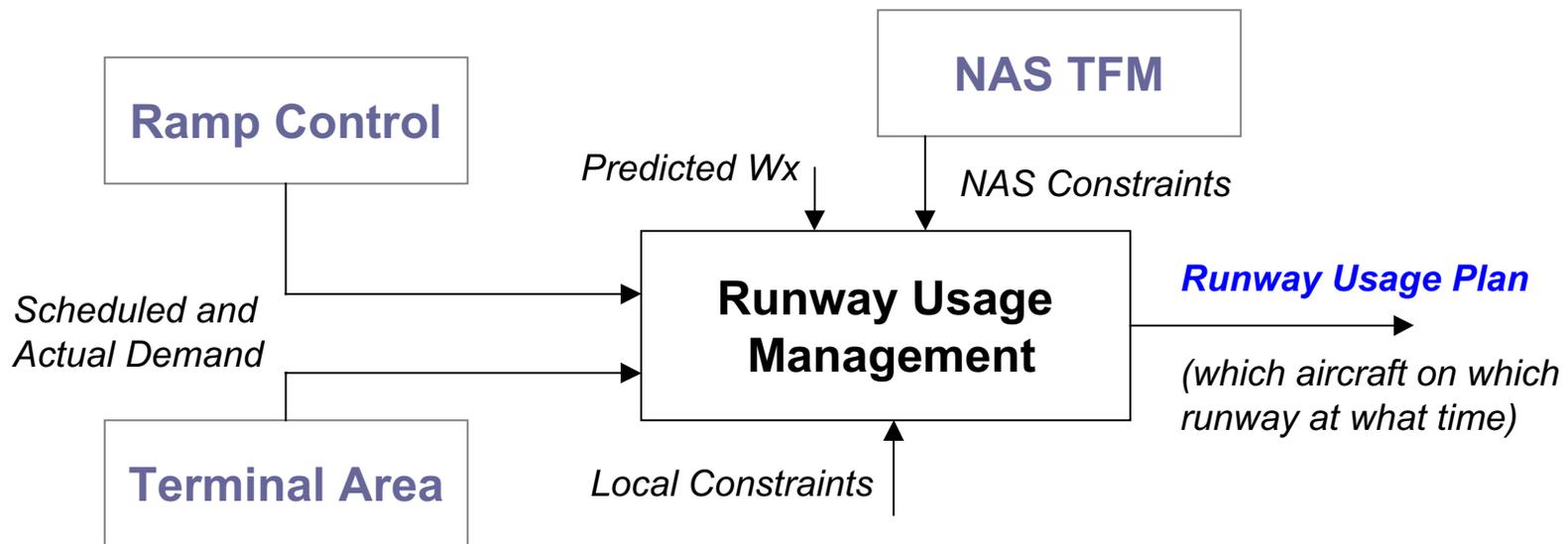


Concept Relationship to NAS



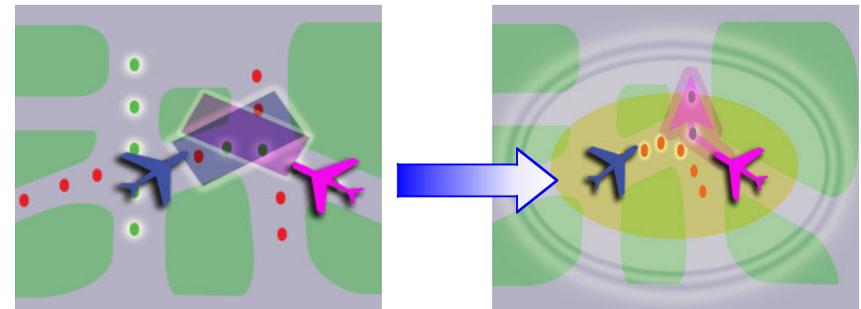
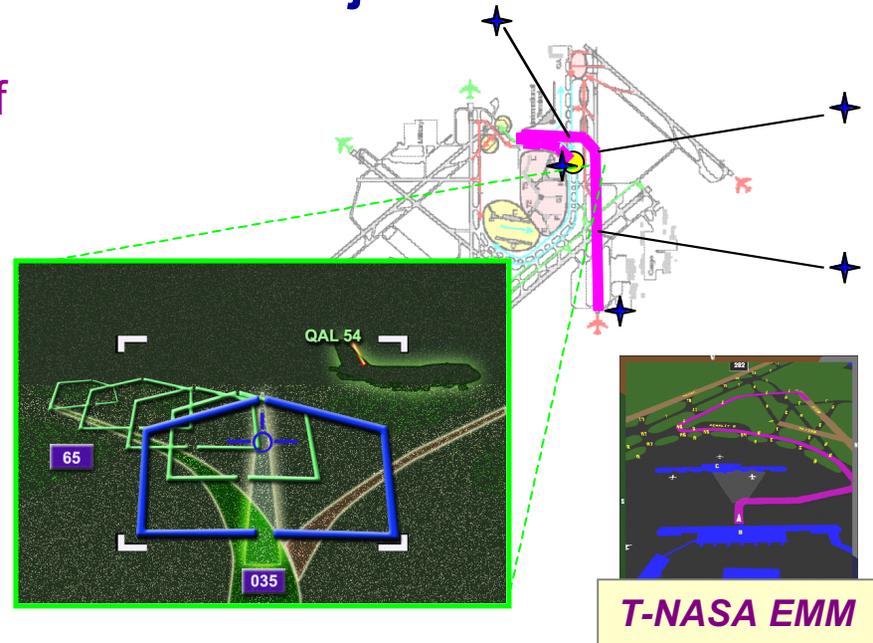
Core Idea 1: Collaborative Runway Management

- **Configuration Planning**
 - set which runways in use
- **Runway Assignment and Sequencing**
 - which aircraft on which runway and in what order
- **Runway Slot Scheduling**
 - which aircraft in which slot



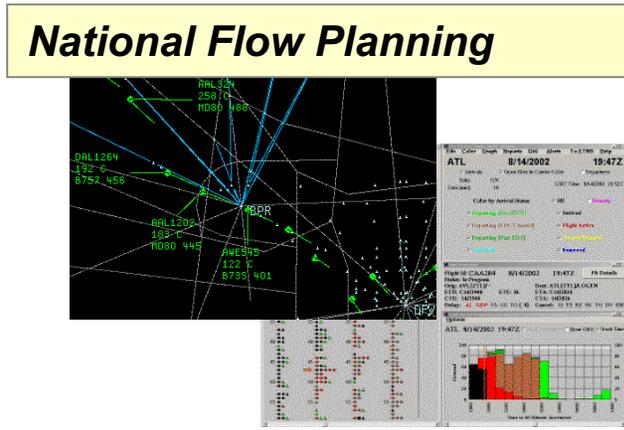
Core Idea 2: Surface-Wide Planning/Control

- **Develop coordinated, time-based surface trajectories for all aircraft:**
 - landing/spot through spot/takeoff
 - algorithmically conflict-free
- **Deliver clearances automatically to flight deck**
 - via voice, datalink, or visual (issue of **complexity**)
- **Parallel Conformance Monitoring to insure safety**
 - immediate conflict resolution
 - trigger re-plan

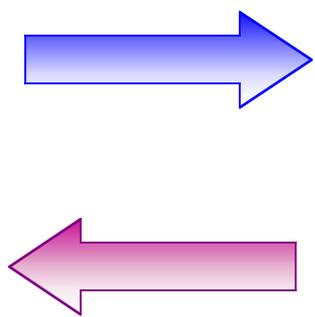


Core Idea 3: Interaction with NAS TFM

- **Planned Surface Capability Assessment**
 - Determine feasibility of scheduled demand given predicted conditions
 - Feedback surface capabilities (AAR, ADR) as a function of various metrics (e.g., equity, delay, etc.)
- **Keep a running record of actual achieved surface performance under observed conditions**
 - historical database (NAS “memory”)



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Local Flow Planning

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Benefit Mechanisms

- **Where will the value come from?**
 - Enable use of existing but commonly “lost” capacity (e.g., unused slots)
 - Enable complementary concepts by supporting increased capacity in other domains
 - Provide greater flexibility to incorporate and satisfy user preferences
 - *Create new capacity*
- **Classes of Metrics**
 - Throughput (achieved AAR, ADR – relative to planned)
 - Off-time Delay
 - Taxi-Out Fuel Burn
 - Accommodation of User Preferences and Constraints

Self-Evaluation Approach

Local Assessment Of Potential Concept Benefits

Analytical Approach

Focus on Achieving “Ideal” Runway Sequences

- Use demand data only
- Apply various cost functions
- Identify sensitivity to surface routing capability

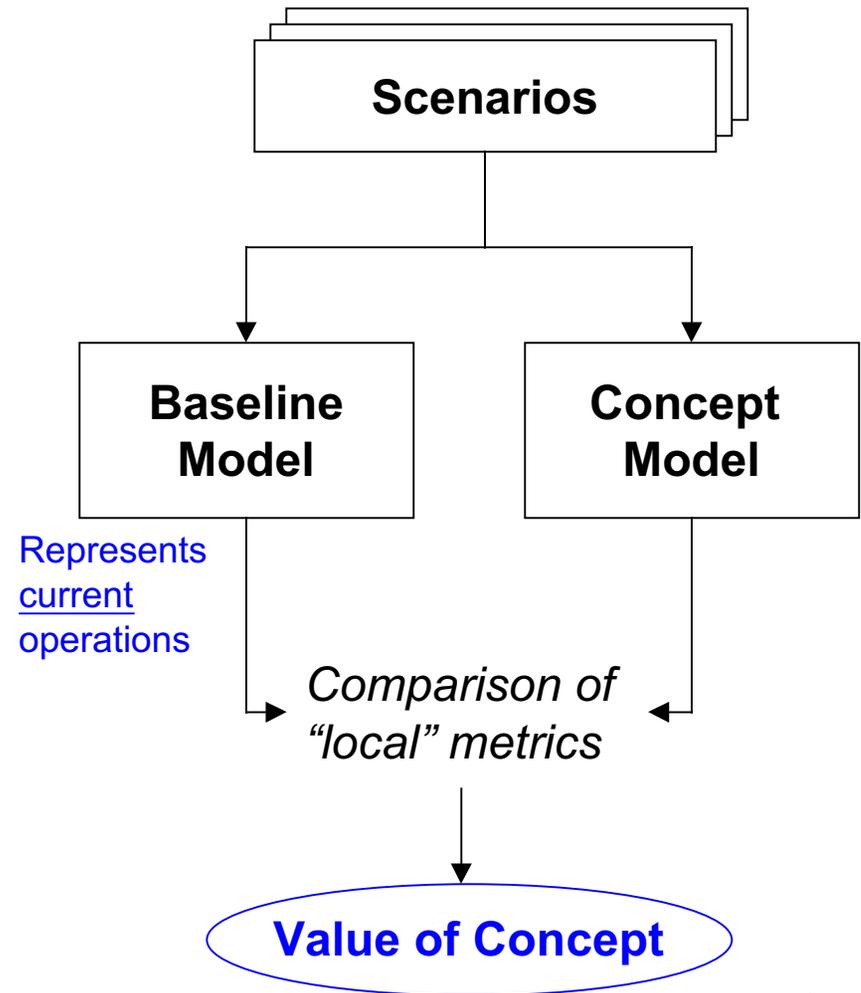
Simulation Studies

Develop Fast-Time Simulation Capability

- Model aircraft surface movement at various airports
- Include Terminal area airspace activity
- Leverage existing SMS environment and algorithms

Self-Evaluation Simulations

- **Create Simulations of Important Concept Elements**
 - Incorporate significant en route constraints on departures
 - Illustrate handling of user preferences
 - Assess sensitivity to uncertainty
- **Classes of Scenarios to Develop**
 - Abnormal Surface Events Impacting Arrivals/Departures
 - Weather Impacting Arrivals/Departures
 - En Route Departure Constraints
 - Impact of User Preferences
 - Current and Future Demand



Summary

- **Have Identified Two Focus Areas Related to Capacity and Implementation/Safety**
- **Core Ideas are Designed to Address Key Limitations in the Current NAS**
 - **Cognitive Processing, Information Availability, Communication and Execution Lags**
- **Explicitly Consider Interactions with Terminal Area and Ramp**
- **Phase Two Evaluation Studies will Consist of a Two-Pronged Effort**
 - **Analytic Investigation**
 - **Fast-time Simulations**