

Metrics for VAMS

January 14-15, 2003

Presented to:

Technical Interchange Meeting 3, VAMS

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Why Metrics for VAMS?

- Uses of metrics
 - » Make and justify decisions of whether concept is promising and will be pursued in research
 - » Show impact of VAMS project
- What are criteria for deciding whether concept is promising to pursue?
 - » Does the concept provide a meaningful benefit?
 - » Are the costs to implement and operate acceptable?
 - » Does the concept not degrade safety or the environment?
 - » Is the concept likely to be implemented?
 - » Is the concept of interest to stakeholders?

Approach to Design Actionable Measures

1. Requirements for measures
 - » Who will use the measures?
 - » What decisions will each audience make with the measures?
2. Narrative Framework to present measures
 - » What message will be told to each audience?
 - » How do we present the desired messages?
3. Quantitative and Qualitative Measures
 - » What quantitative and qualitative measures will we use?

1. Requirements for Measures

- » Who will use the measures?
- Developers
 - » Program managers
 - » NASA management
 - » Concept developers contractors
- Service providers
 - » FAA
 - » Airports
- Industry
 - » Aircraft operators
 - » Airframe and avionics manufactures
- Funders
 - » OMB
 - » Congress

1. Requirements for Measures (cont'd)

Common Set of Evaluation Questions

-  How much capacity will be gained from the concept?
-  What is the magnitude of other benefits provided by the concept?
-  What will be the benefits to various stakeholder groups?
-  What are the safety impacts?
-  What are security impacts?
-  What are the environmental impacts?

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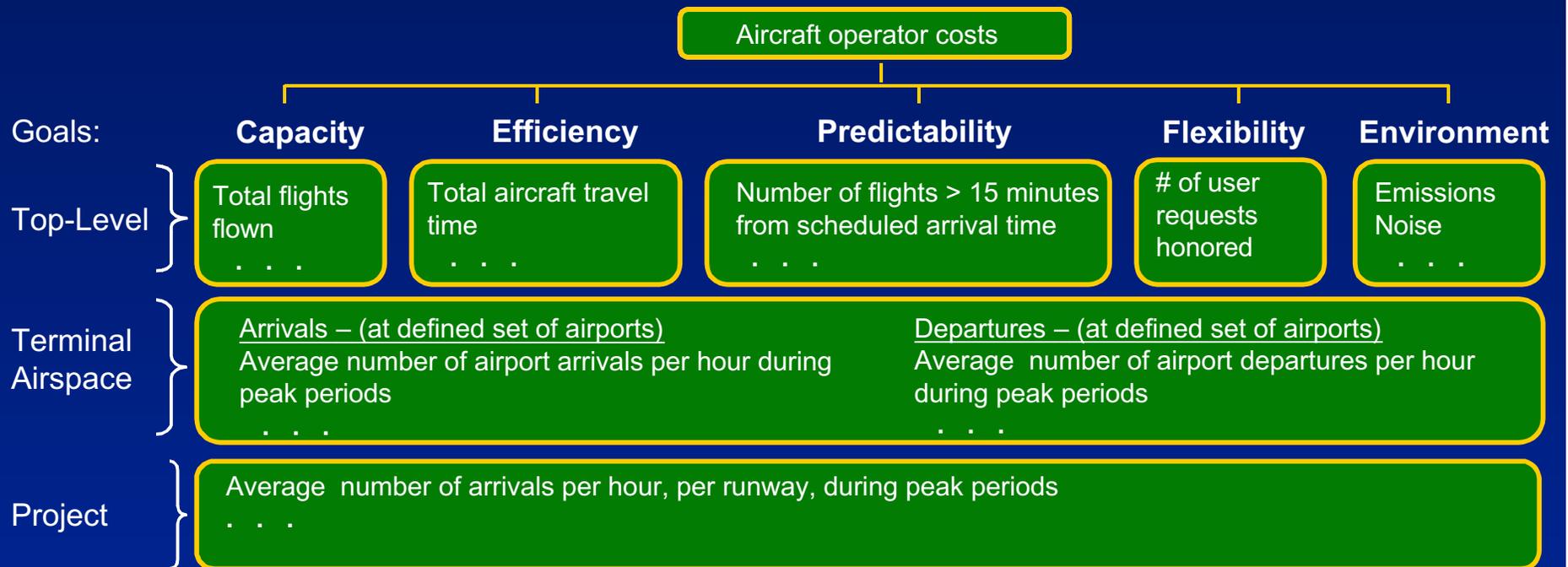
1. Requirements for Measures (cont'd)

Common Set of Evaluation Questions (cont'd)

-  How does the concept impact human factor issues for AT controllers, pilots, airline operations centers, etc.?
-  How robust is the concept regarding conditions under which it will operate?
-  How does the concept affect the operations and planning of the major participants in the NAS?
-  What is the total cost and costs to various stakeholders?
-  What is the likely level of support by various stakeholders?

2. Narrative Framework to Present Measures

- Example: Hierarchical framework – shows how individual concepts relate to goals



2. Narrative Framework to Present Measures (cont'd)

- Example: Flow framework – shows how activities produce benefits

Capabilities	Direct Impacts	Direct Impact Metrics	Benefit Impacts	Benefit Impact Metrics
<ul style="list-style-type: none"> Display in cockpit of surrounding traffic/equipment 	<ul style="list-style-type: none"> Pilot able to better identify aircraft to follow Pilot awareness of all proximate traffic positions 	<ul style="list-style-type: none"> Pilot response time for ATC traffic call-out Flight time from final approach fix to touchdown 	<ul style="list-style-type: none"> Reduced arrival delays Increased predictability of arrival times 	<p>SAFETY</p> <ul style="list-style-type: none"> Accident rate during final approach maneuvers <p>USER ENHANCEMENT</p> <ul style="list-style-type: none"> Arrival rate <p>FAA COST SAVINGS</p> <ul style="list-style-type: none"> Voice channel occupancy time



3. Measures: Common Set - Capacity

1. How much capacity will be gained from concept?

- Total flights flown (in a year)
- Total passenger trips (in a year)
- Total passenger revenue miles for selected metro-pairs (in a year)
- Total cargo moved (in a year)
- Average airport arrival rates during peak periods (total over year NAS-wide and annual average for selected airports)
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3. Measures: Common Set - Safety

2. What are the safety impacts?

- Number of accidents and accident rate (in a year)
- Number of fatalities and fatality rate (in a year)
- Number of incidents and incident rate (of particular type, e.g., runway incursions, loss of separation, operational errors, pilot deviations, etc.) (in a year)
- Precursor incident and procedural non-compliance by human operators in the system (scenario specific and real-time based measure)
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3. Measures: Common Set - Robustness

8. How robust is the concept regarding conditions under which it will operate?

- Average aircraft arrivals and departure during VFR versus during IFR weather
- Average and standard deviation of flight speed from gate departure to gate arrival (NAS-wide in a year and for representative sample of origin-destination pairs)
- Average recovery time from changing conditions, failures, or other negative events (from model/simulation results where possible)
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Next Steps

- Refine and focus metrics based on evolving detailed information on
 - » Concepts
 - What functions and impacts will the concepts provide?
 - How will they provide these functions and impacts?
 - » Evaluation models/simulation capabilities
 - What impacts can be evaluation with the models/simulation capabilities?

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Next Steps (cont'd)

Example: Refined questions for Massive Point-to-Point and On-Demand Air Transportation System

- ✎ How much of an increase to NAS capacity is the concept likely to achieve if implemented? How many airports are candidates?
- ✎ Can the massive point-to-point concept enable the same capacity during IFR conditions as in VFR conditions?
- ✎ Can the massive point-to-point concept reduce total travel time per passenger?
- ✎ What kind of airlines operations will be needed to support massive point-to-point air travel? What will be the costs of the required new technologies? What will the airline fleets look like?
- ✎ How much will massive point-to-point air travel cost airlines & public?
- ✎ How safe will massive point-to-point air travel be?
- ✎ How accessible will massive point-to-point air travel be to travelers?
- ✎ How much public resistance will there be to airport expansions? What kind of airport operations and how much of an environmental impact can communities tolerate in their neighborhoods?

Next Steps (cont'd)

- Examine how metric values be can calculated
 - » Fast time models
 - » Real-time simulation
 - » Analysis
- Develop evaluation frameworks for each concept
- Conduct manual simulation of evaluation process for select concept(s)