

The Development of Operational Scenarios for VAMS/SEA Concept Evaluations

Starting Point:

Principal Assumption: To be successful, the evaluation of VAMS Concepts is an intellectual problem for which the solution must be based in reality, not theory.
Therefore:

1. Identify National Air Space (NAS) stakeholders and their VAMS programmatic concerns.
2. Understand market-oriented alternatives to meeting stakeholder concerns.
3. Analyze the interaction between the application of a concept's core ideas, new technologies, costs, schedule, and VAMS program goals.
4. Develop Concept Evaluation scenarios that can determine if the implementation of a VAMS Operational Concept is likely to produce measurable benefits for the various stakeholders. Evaluation methods will utilize fast time modeling, real-time simulations, and analytic studies.

Scenario Requirements – The Stakeholders

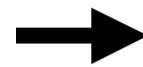
Who Will Use the Concept Evaluation Results and for What?

- **NASA: Promising concepts to pursue**
- **FAA: Promising concepts to support**
- **Air carriers: Impacts of potential concepts on their operations, revenues, and costs**
- **Manufacturers: Impacts of potential concepts on their products, revenues, and costs**
- **Pilots: Impacts of potential concepts on their tasks**
- **Air traffic controllers: Impacts of potential concepts on their tasks**
- **General aviation: Impacts of potential concepts on their operations, access to services, and costs**
- **Cargo carriers: Impacts of potential concepts on their operations, revenues, and costs**
- **Airport operators: Impacts of potential concepts on their operations, revenues, and costs**
- **Flying public: Impacts on air travel service, safety, security, and travel costs**
- **General public: Impacts on noise and air pollution, safety and security**
- **U.S. Government**
 - **Executive Branch – Office of Management and Budget: Benefits and costs; feasibility and directions of concepts; relation to related NASA programs**
 - **Congress: Benefits and costs to stakeholders; feasibility and directions of concepts**

Framework for VAMS/SEA Operational Scenario Requirements Definition

Operational Concept Description

1. **Scope:** issues, NAS Domain, challenges, assumptions
2. **Top Level Descriptions:** core ideas & functions
3. **Detailed Descriptions:** performance, roles, responsibilities @ humans & machine, human factors, user interfaces
4. **NAS Infrastructure & Technology Impacts:** transition planning, architecture, technology requirements
5. **NAS Operational Risks:** ensuring system integrity and redundancy, security, safety
6. **Key Project Attributes:** benefits/metrics, cost/metrics



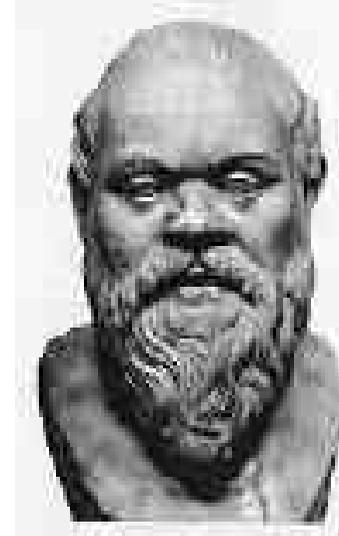
Concept Analysis



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Development of Stakeholder Viewpoints (questions to be answered)*



***Essentially a Socratic Method of Investigation:**

Socrates assumed that truth is embodied in correct definition. Precise definition of terms is held to be the first step in the problem solving process.

“One cannot know a thing until it is thoroughly defined.”

Questions serve as a logical, step-wise guide for analyzing a VAMS Concept from stakeholder viewpoints. Operational scenarios are key elements in the definition of how a concept will work. In terms of evaluation, the scenarios will provide a means for reality testing a concept.



Operational Scenario Requirements Definition

VAMS/SEA is using a reiterative structured analysis to define Operational Scenarios for each of the VAMS concepts. This analysis is founded in dialogue of which the TIMS are an integral part.

This is similar to Socrates' use of the dialectic.

Socrates believed that through the process of structured dialogue (dialectic), where all parties (stakeholders) to the conversation were asked to clarify their ideas, the final outcome of the conversation will be a clear statement of what a concept means.

The scenario requirements analysis is evolutionary: with each concept deliverable and at ensuing TIMS, the SEA team will reassess the evolving operational concepts with a common structured analysis. It will refine scenario elements, evaluation metrics, and the methods that will be used to evaluate each concept through ongoing conversation with the concept developers and stakeholders.

VAMS/SEA Concept Analysis Structure

- 1. Identify the stated objectives of the VAMS concept.**
- 2. Define the NAS operational constraint or constraints being targeted by the concept (i.e. airline scheduling, airport design, weather, etc.)**
- 3. Specify the core ideas supporting the concept mindful that the functions of these ideas must logically address means of reducing the specific NAS capacity constraints identified in step 2.**
- 4. Identify critical areas of concept implementation risk. Risk factors include technology, safety, security, cost, and environment.**
- 5. Develop likely stakeholder questions to be answered through concept evaluations.**
- 6. Define critical operational scenario elements required to evaluate a concept.**

VAMS Concepts included in scenario requirements analysis:

- 1. Advanced Airspace System – NASA Ames**
- 2. Massive Point-to-Point On-Demand – Seagull**
- 3. Capacity Increasing ATS – Boeing**
- 4. Automated Surface Traffic Control – Metron**
- 5. All Weather - Metron**
- 6. Centralized Terminal Operation Control – Northrop Grumman**
- 7. Surface Operation Automation Research – Optimal Synthesis**
- 8. Terminal Area Capacity Enhancing Concept – Raytheon**
- 9. University Concepts – A. Zellweger, et al.**
- 10. Wake Vortex Avoidance – NASA Langley**
- 11. FACET – NASA Ames**

Stakeholder Questions & Scenario Elements

Examples from analysis of Seagull MPTP Concept

<p>1. What kind of commercial passenger air carrier operations will be needed to support massive point to point air travel? What will the airline fleets look like? What will the airport operations look like?</p>	<ul style="list-style-type: none"> ▪Development of a probable range of passenger demand assumptions driving MPTP city-pair air carrier operations ▪Fleet mix vis. airport operational scales (the kinds of aircraft serving various kinds of airports) ▪Aircraft operational costs (by aircraft type and by carrier type) ▪Flight deck & AOC technology requirements and equipage rates and costs ▪ATM infrastructure and operations requirements and costs
<p>2. How much will massive point to point air travel cost the public?</p>	<ul style="list-style-type: none"> ▪Market share by carrier type vis. passenger arrival/departure distribution ▪Airport access infrastructure requirements & costs ▪Environmental factors ▪Flight deck & AOC technology requirements and equipage rates and costs ▪ATM infrastructure and operations requirements and costs

Result 1: Definition of a Common set of evaluation questions.

These will be the conversational starting point for reiterative concept analyses.

- 1. How much increase in NAS capacity will be gained from the concept?**
- 2. What are the safety impacts?**
- 3. What are the security impacts?**
- 4. How does the concept impact human factor issues for AT controllers, pilots, airline operations centers, and other relevant participants?**
- 5. What is the magnitude of other benefits provided by the concept? E.g.: Efficiency (total and for individual stakeholders); Predictability; Access and Mobility?**
- 6. What will be the benefits to various stakeholder groups?**
- 7. What are the environmental impacts? E.g.: Noise, Emissions, Energy use, Quality-of-life**
- 8. How robust is the concept regarding conditions under which it will operate?**
- 9. How does the concept affect the operations and planning of the major participants in the NAS?**
- 10. What will be the total cost and costs to various stakeholder groups?**
- 11. What is the likely level of support by various stakeholders in factors critical to concept implementation? E.g.: Equipage required by aircraft operators; Work process change; NAS infrastructure investments**

Result 2: Definition of a Comprehensive set of operational scenario requirements resulting from analyses of eleven VAMS initial concept deliverables. Sandy Lozito is the manager and guardian of these definitions.