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Architecture & Requirements Development for the Next Generation Air Transportation System

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Agenda

- Approach
- Evolution of NGATS Architecture
- NGATS Operational Requirements Database
- NGATS Enterprise Architecture Development
- Summary

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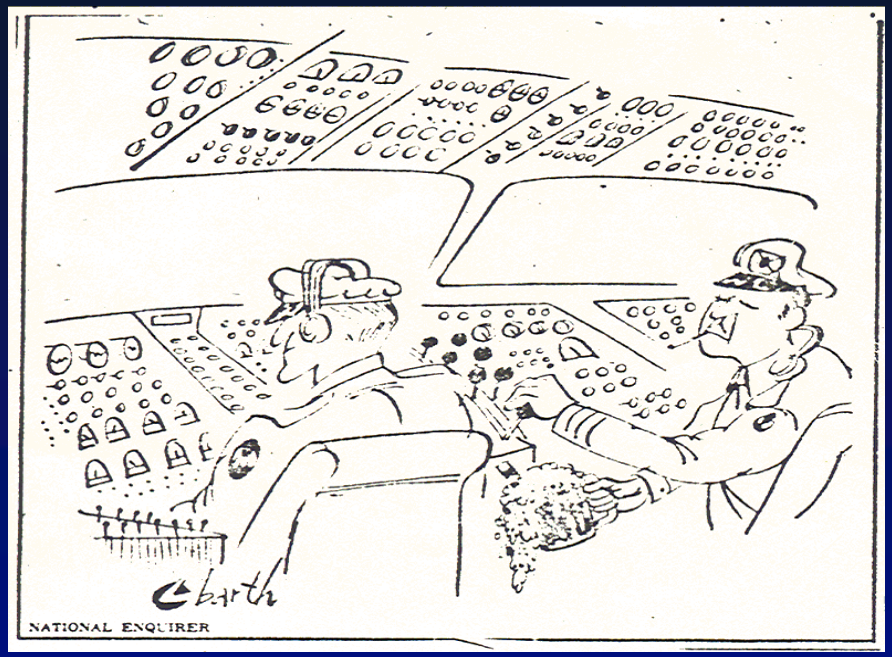
Regarding the Flight Deck of the Future…



Law Number XIV:

After the year 2015, there will be no airplane crashes. There will be no takeoffs either, because electronics will occupy 100 percent of every airplane's weight.

[Norm Augustine, "Augustine's Laws," 1997]

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Many Stakeholders – Many Visions

ICAO

Eurocontrol

NIA

RTCA

FAA

ATA

AOPA

IATA

DoD

JPDO

CANSO

NASA

How to Sort it all out???

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Approach

- **Spiral Development Approach**
  - ***Start with limited-scope pathfinder for proof of concept, followed by spirals of increasing breadth and depth***

- **Work Products**
  - ***NGATS Operational Capabilities Database***
    - Organize various stakeholder ATC capabilities into a common logical analysis structure in order to identify convergences and divergences as well as identify gaps
  - ***Scenarios and Vignettes***
    - Use to provide an operational context to identify key operational capabilities and expose transformational aspects of NGATS
  - ***Develop Transition Plans***
    - Depict time-phased sequence of intermediate capabilities occurring between the present and end-state generations of ATC systems
  - ***Enterprise Architecture Artifacts***
    - Activity-based methodology to develop static and dynamic Transition oriented DoDAF enterprise artifacts comprising operational views (OV-1, OV-3, OV-3, OV-5, OV-6c) and system functional views (SV-5, SV-5, SV-8)

Aligned with NGATS JPDO Architecture Development Plans

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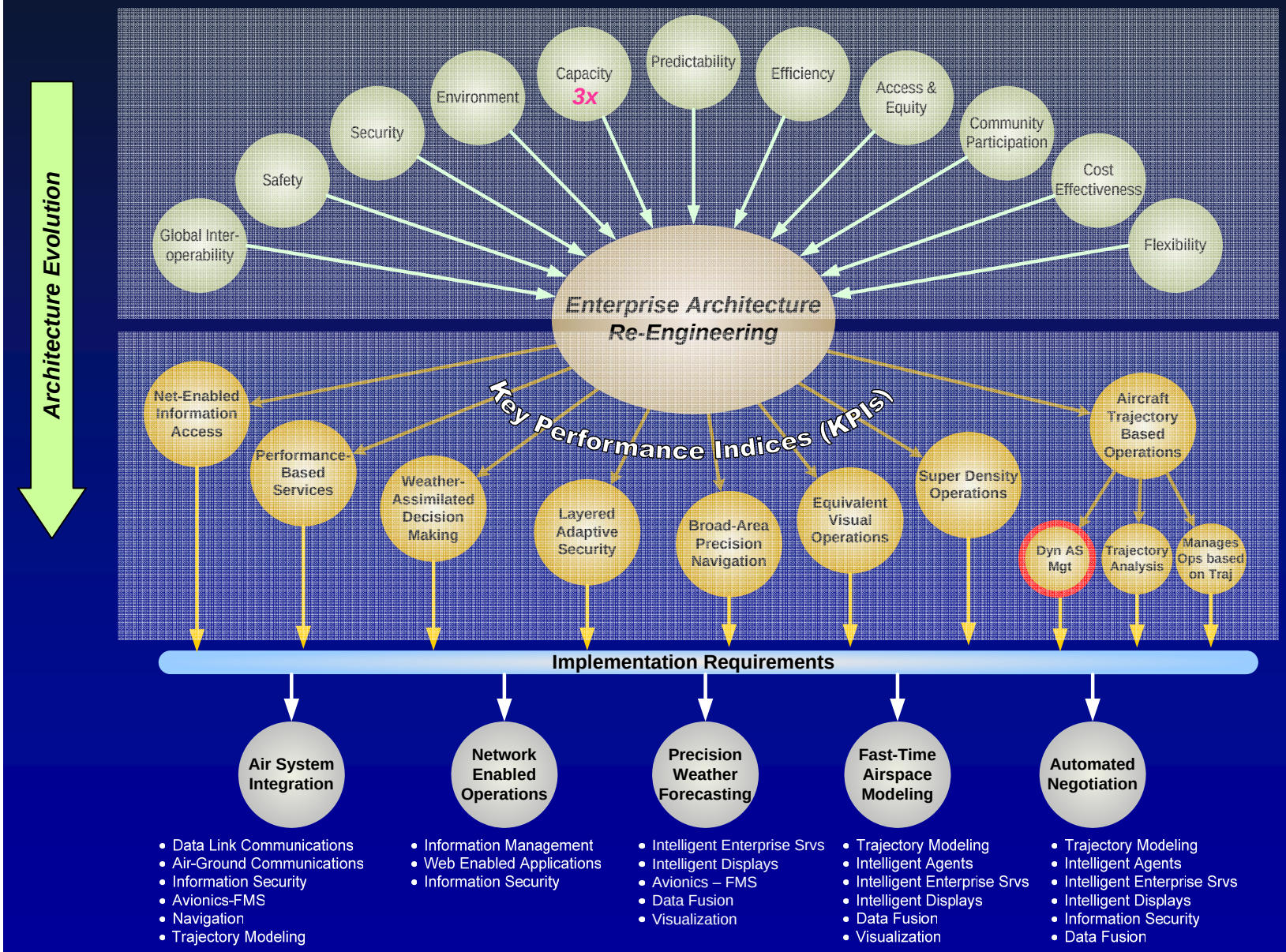
Evolution of NGATS Architecture



Key Result Areas [ICAO Expecta-tions]

ATM System Capabilities [JPDO]

Enabling Technology [LM]

Core Technologies [LM]

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On Equivalent Visual Operations

When a military AT controller requested a GA pilot confirm his position, the pilot responded…..

"Pease Approach, Grumman 73L is 1 mile north of the airport at 6,000 ft heading south……in the <u>blue</u> airplane.

….. to which the controller replied "they're all green to me"

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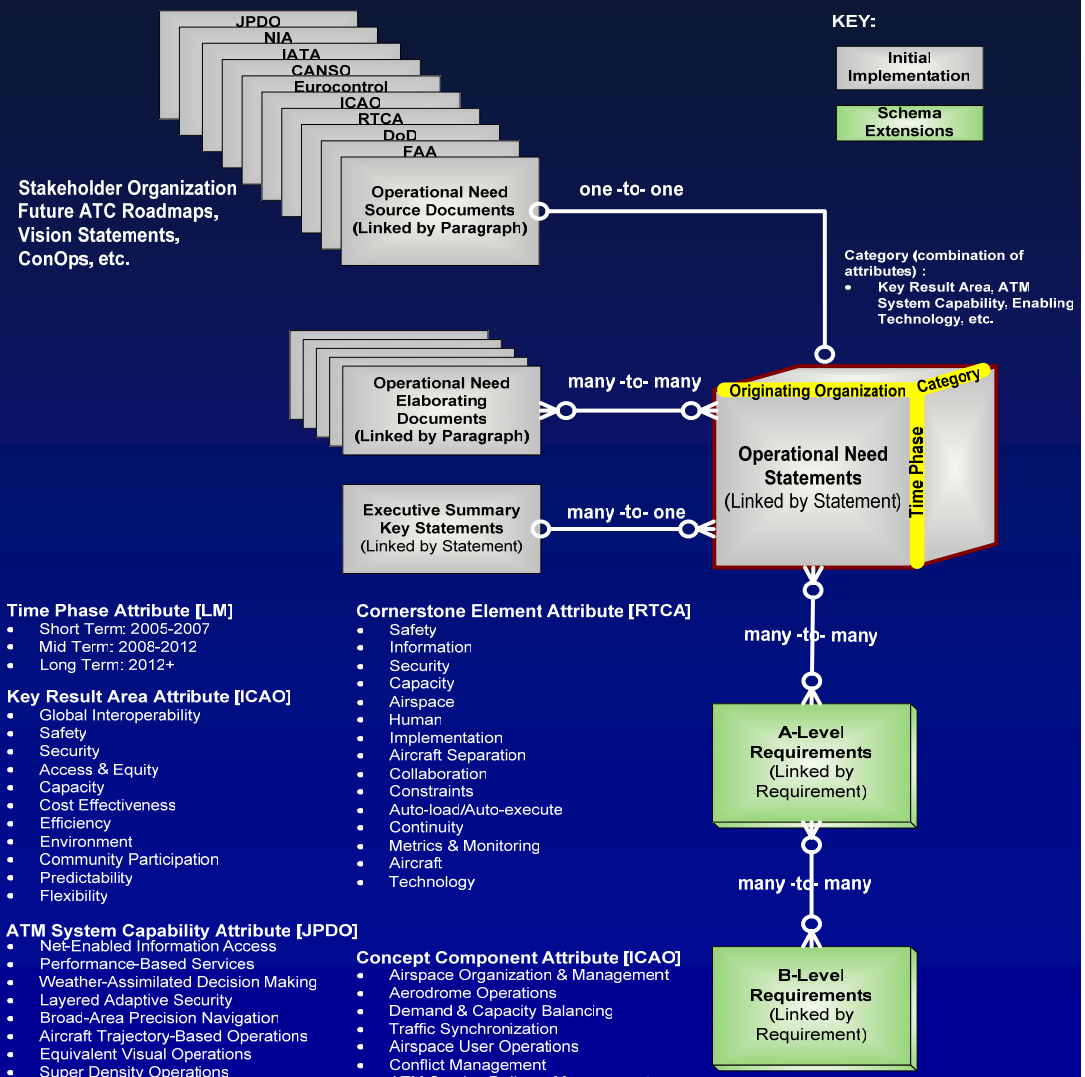
NGATS Operational Requirements Database

- Captures ICAO key result areas, JPDO ATM system capabilities, enabling technologies and many of the global ATM stakeholders operational needs and vision roadmaps
- Provides views from stakeholder perspective with ability to filter on one or more attributes
- Using these attributes, one can parse the operational need statements for redundancy or shortfalls



Time Phase Attribute [LM]
- Short Term: 2005-2007
- Mid Term: 2008-2012
- Long Term: 2012+

Key Result Area Attribute [ICAO]
- Global Interoperability
- Safety
- Security
- Access & Equity
- Capacity
- Cost Effectiveness
- Efficiency
- Environment
- Community Participation
- Predictability
- Flexibility

ATM System Capability Attribute [JPDO]
- Net-Enabled Information Access
- Performance-Based Services
- Weather-Assimilated Decision Making
- Layered Adaptive Security
- Broad-Area Precision Navigation
- Aircraft Trajectory-Based Operations
- Equivalent Visual Operations
- Super Density Operations

Enabling Technology Attribute [LM]
- Air System Integration
- Network Enabled Operations
- Precision Weather Forecasting
- Fast-Time Airspace Modeling
- Automated Negotiation

Cornerstone Element Attribute [RTCA]
- Safety
- Information
- Security
- Capacity
- Airspace
- Human
- Implementation
- Aircraft Separation
- Collaboration
- Constraints
- Auto-load/Auto-execute
- Continuity
- Metrics & Monitoring
- Aircraft
- Technology

Concept Component Attribute [ICAO]
- Airspace Organization & Management
- Aerodrome Operations
- Demand & Capacity Balancing
- Traffic Synchronization
- Airspace User Operations
- Conflict Management
- ATM Service Delivery Management

> ***"The Value of information about information is often greater than the value of the information itself"***
>
> **[Nicholas Negroponte, "Being Digital," 1995]**

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NGATS Operational Capabilities Database

- **Dynamic Airspace Management Extract**

Object No.	Operational Need Statements	Key Result Area [ICAO]	ATM System Capability [JPDO]	Enabling Technology [LM]	Organization	Phase
6.0-6	Real-time reassignment of airspace between facilities to meet contingencies	Safety	Inter-Agency SSA	Network Enabled Operations	RTCA	Long Term
		Capacity	Dynamic Airspace CM	Automated Negotiation		
		Efficiency	Cross-Domain Integ			
		Flexibility				
3.0-36	Relevant ATM data will be fused for an airspace user's general, tactical and strategic situational awareness and conflict management	Capacity	Inter-Agency SSA	Air System Integration	ICAO	Long Term
		Cost Effectiveness	Dynamic Airspace CM	Network Enabled Operations		
		Efficiency	Cross-Domain Integ	Fast-Time Airspace Modeling		
		Environment	Advanced Flow Management			
		Flexibility	Trajectory-Based Aircraft Operations			
		Community Participation				
2.0-19	Enhance ATC Decision Support by Using Aircraft Derived Data	Safety	Dynamic Airspace CM	Air System Integration	EURO-CONTROL	Long Term
		Efficiency		Network Enabled Operations		
		Global Interoperability		Fast-Time Airspace Modeling		
1.0-6	Further reduce Number of Airspace Categories	Efficiency	Dynamic Airspace CM	Network Enabled Operations	IATA	Long Term
		Flexibility		Fast-Time Airspace Modeling		
		Global Interoperability				
1.0-44	Transition from tactical to strategic flow management	Access & Equity	Dynamic Airspace CM	Network Enabled Operations	JPDO	Long Term
		Capacity	Advanced Flow Management	Fast-Time Airspace Modeling		
		Cost Effectiveness	Trajectory-Based Aircraft Operations	Automated Negotiation		
		Efficiency				
		Community Participation				

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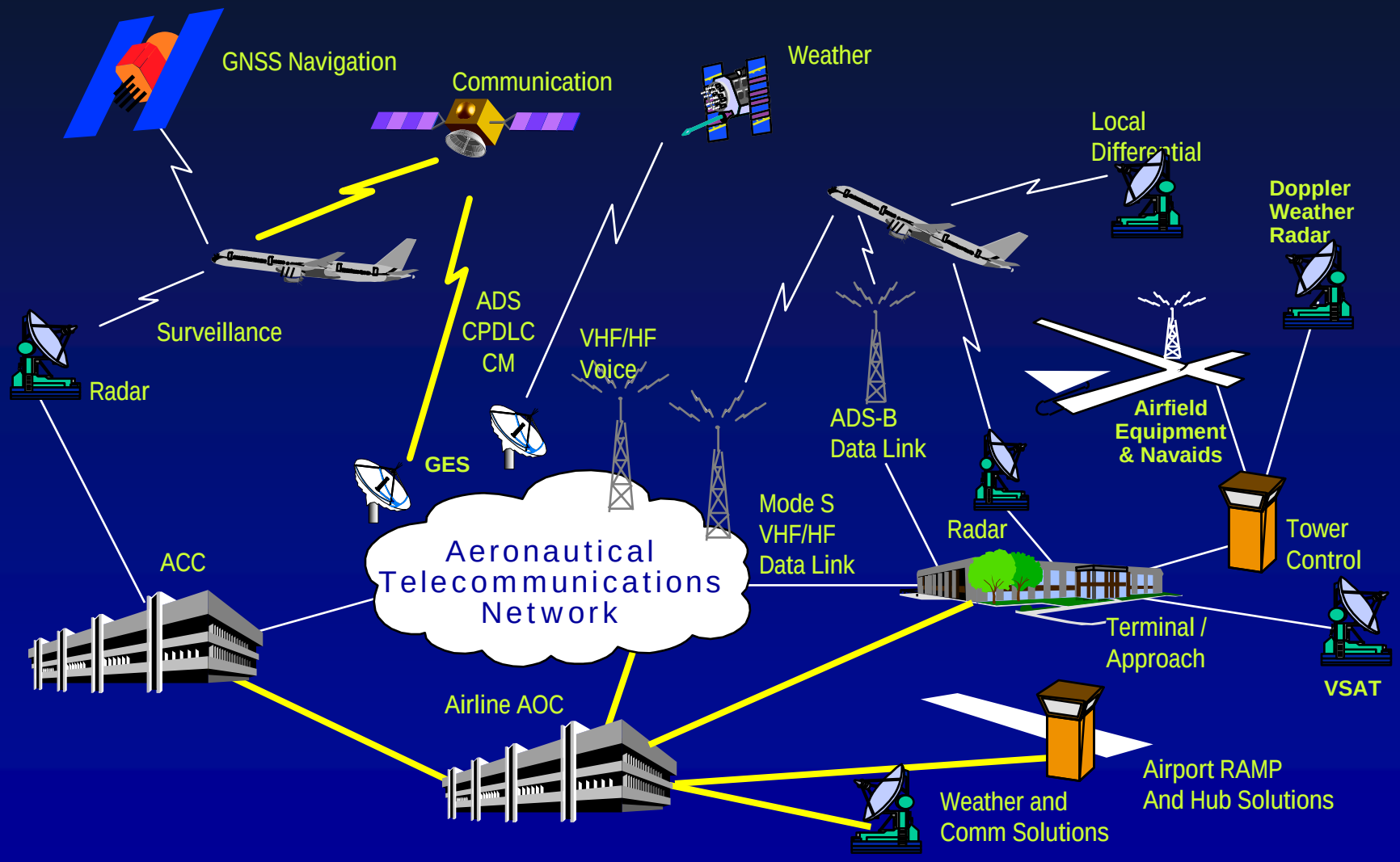
Air Traffic Management System Components



Fundamental ATM Activities of today still visible in NGATS

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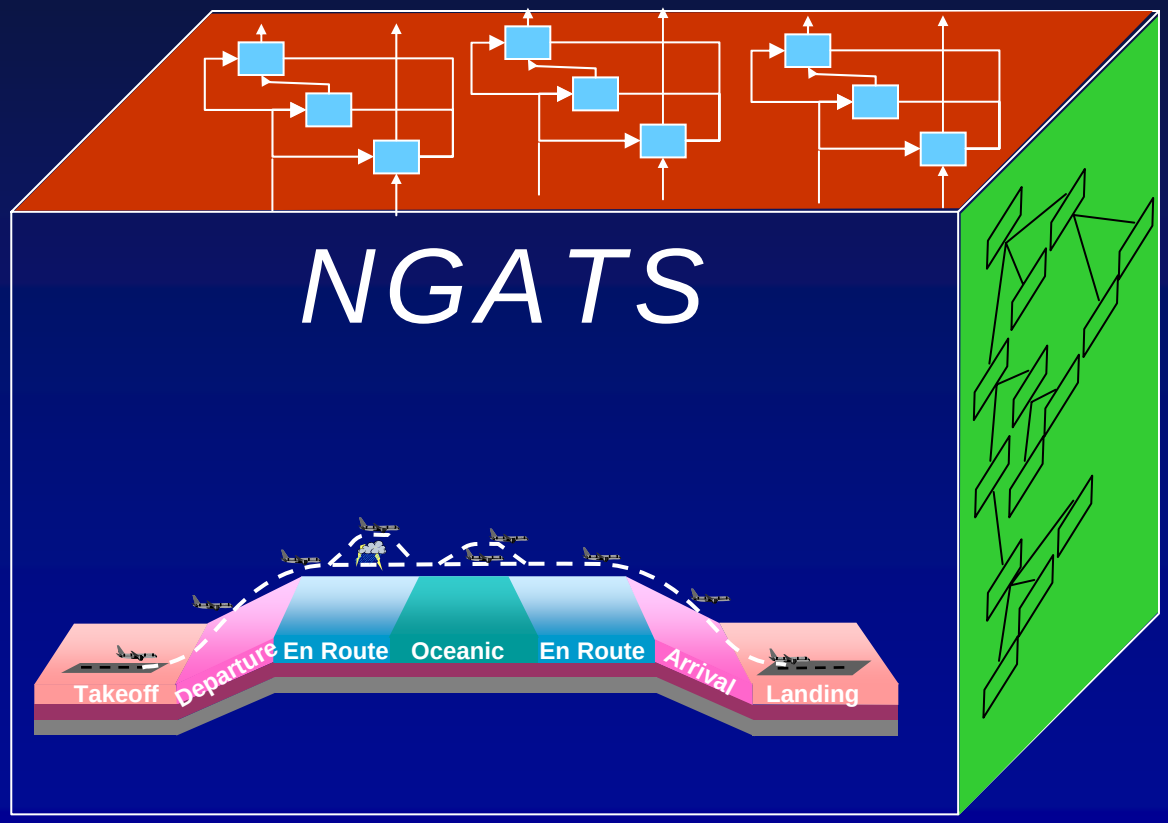
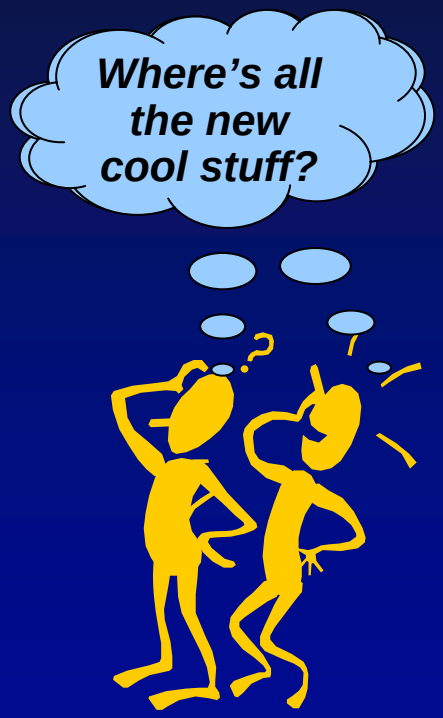
NGATS Enterprise Architecture Development





What you see depends on your "View"

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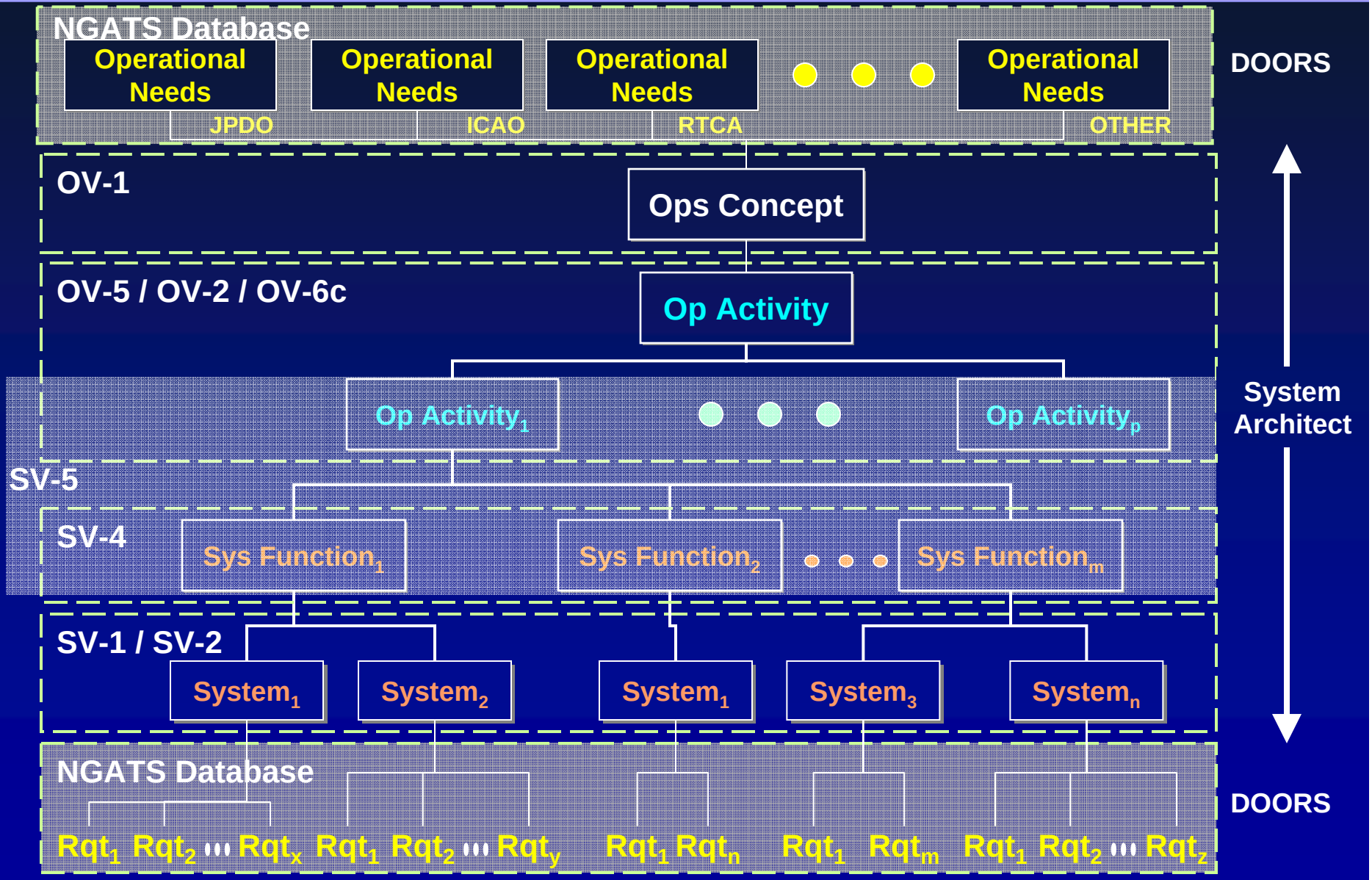
NGATS Enterprise Architecture Development

Activity, Function, System & Requirements



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Summary

- **Continue development of NGATS operational capabilities database to identify duplications, redundancies, gaps or shortfalls in the many ATM stakeholder visions for NGATS**
- **Begin the effort by concentrating on ICAO, JPDO and RTCA identified operational needs for dynamic airspace management as a pathfinder**
- **Develop and evolve transition architectures that realize the NGATS vision compliant with the DoDAF framework**

Fully engage and collaborate with NGATS JPDO IPTs to evolve the NGATS architecture and identify the transition implementation requirements

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