



NOAA NextGen Weather: Development and Implementation

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Overview

- NextGen Need
- NOAA Approach
- 4-D Weather Data Cube
- The Single Authoritative Source
- Example of Improved Contents
- The Roadmap Ahead
- Challenges
- Summary



Need

- Next Generation Air Transportation System (NextGen) is a U.S. *Congressionally-mandated* initiative to modernize the U.S. Air Transportation System in order to:
 - Increase capacity and reliability
 - Improve safety and security
 - Minimize the environmental impact of aviation

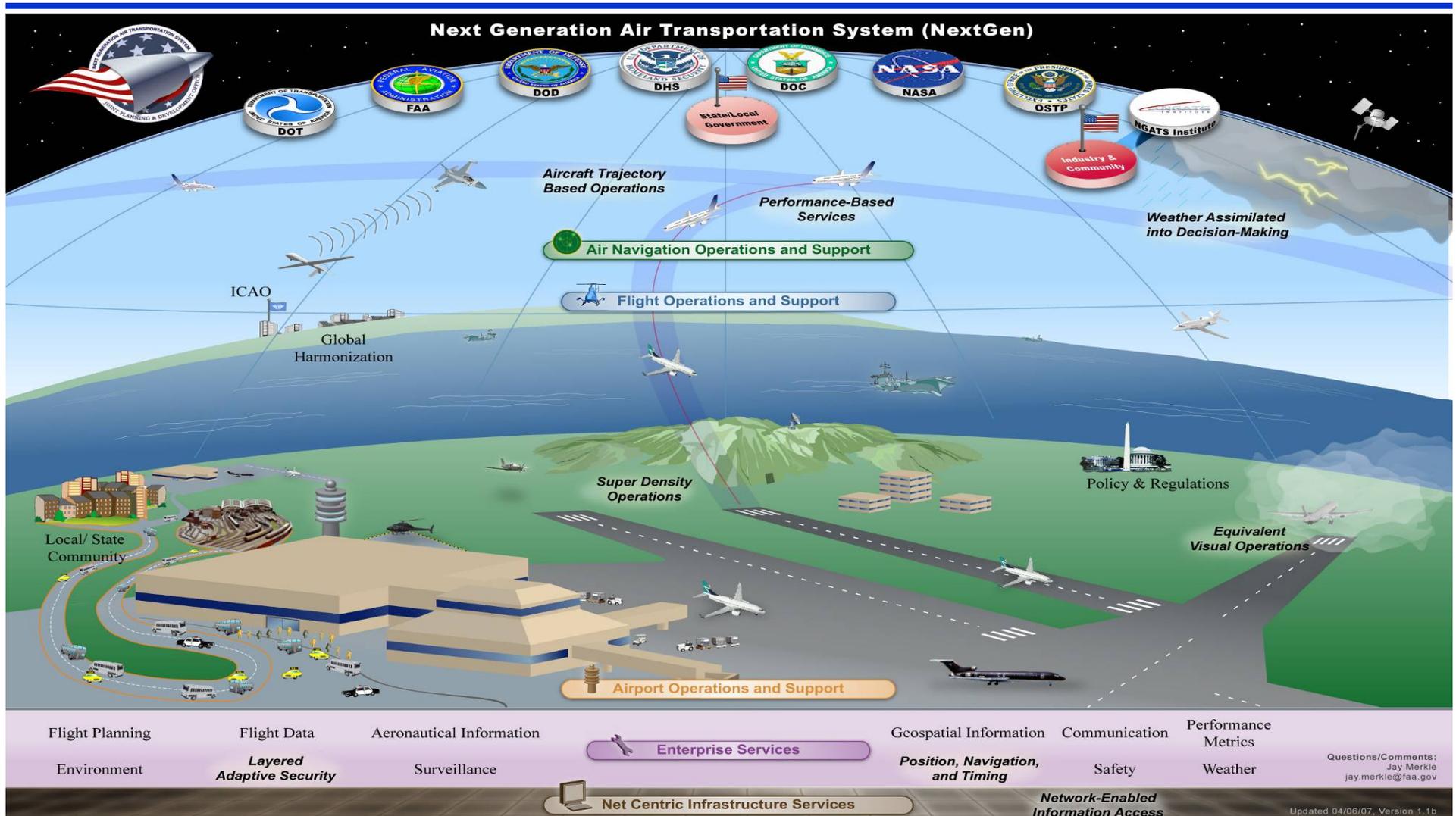


Need

- Improvements to the air transportation system will be achieved by applying:
 - Space-based navigation and integrated surveillance
 - Digital communications
 - Layered adaptive security
 - **Weather integrated into decision-making**
 - Advanced automation of Air Traffic Management
 - Net-centric information access for operations



Overview





Key Themes

- Data available on demand to users in formats they can understand
 - Information must be secure and usable in real time
 - Information may be pushed to known users and is available to be pulled by others
 - Vision of a “Virtual” repository with no single physical database or computer
 - Conceptually unified source distributed among multiple physical locations and suppliers
- Weather “information” vice “products”
 - Move away from generating “products,” and towards providing weather information focused on decision needs
 - Weather information is translated into operational decision options for human and automated systems



NOAA Approach

- NextGen goals are not achievable without improving integration of weather information into Decision Support Systems
- JPDO/FAA NextGen vision requires:
 - A multiple-user common weather picture
 - Consistent and reliable weather information
 - An improved weather information data storage approach (i.e., the “4-Dimensional Weather Data Cube”)





NOAA Approach

- Develop the 4-D Weather Data Cube
 - Net-Centric using Service Oriented Architecture (SOA)
 - Web-enable existing and proposed data
- Develop Single Authoritative Source (SAS)
 - One point for decision-making weather information
- Improve Weather Information



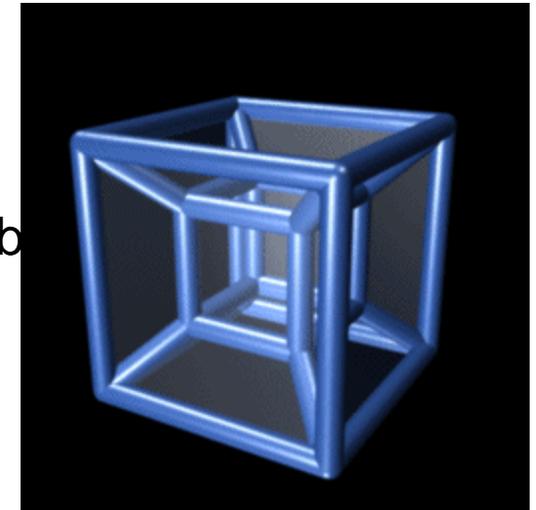
NOAA Approach

- Develop four-dimensional grids of aviation weather information
 - Net-enabled system of systems
 - Leveraging existing and planned capabilities and utilizing national centers
- The 4-D Weather Data Cube will contain constantly updated weather observation and forecast information
 - Delivers the “common weather operational picture” capability described in NextGen Concept of Operations



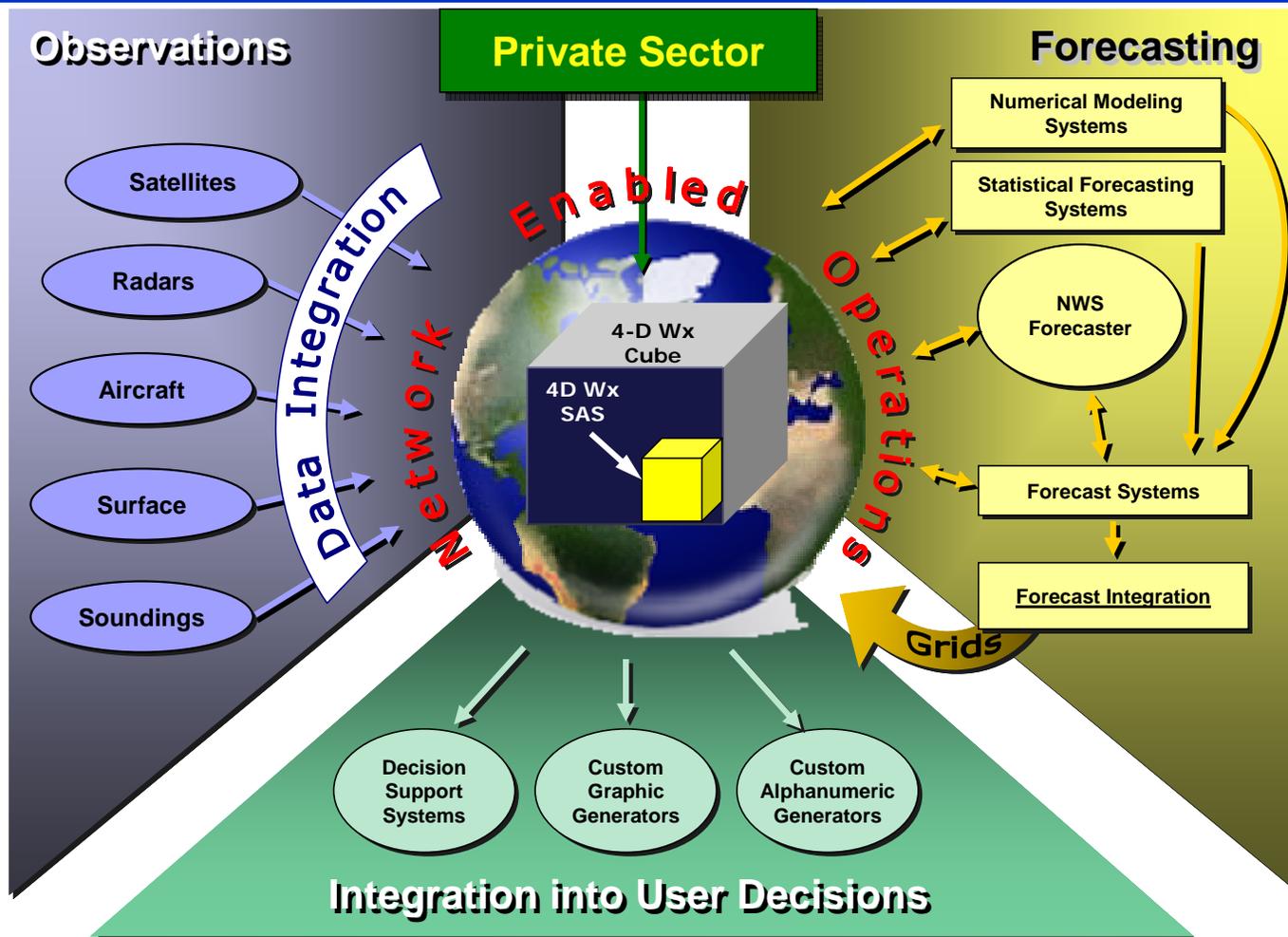
The 4-D Weather Data Cube

- The 4-Dimensional Weather Data Cube will contain:
 - Continuously updated weather observations (surface to low earth orbit, including space weather and ocean parameters)
 - High resolution (space and time) analysis and forecast information (conventional weather parameters from numerical models)
 - Aviation impact parameters for IOC (2013)
 - Turbulence
 - Icing
 - Convection
 - Ceiling and visibility
 - Winds (surface and aloft)
- The 4-D Weather Data Cube will not be a big database but a “system of systems” with metadata tagged, 4-dimensional, gridded weather information
- The 4-D Weather Data Cube of the future will contain “all” weather data, not just aviation parameters





4-D Weather Data Cube – Conceptual Model



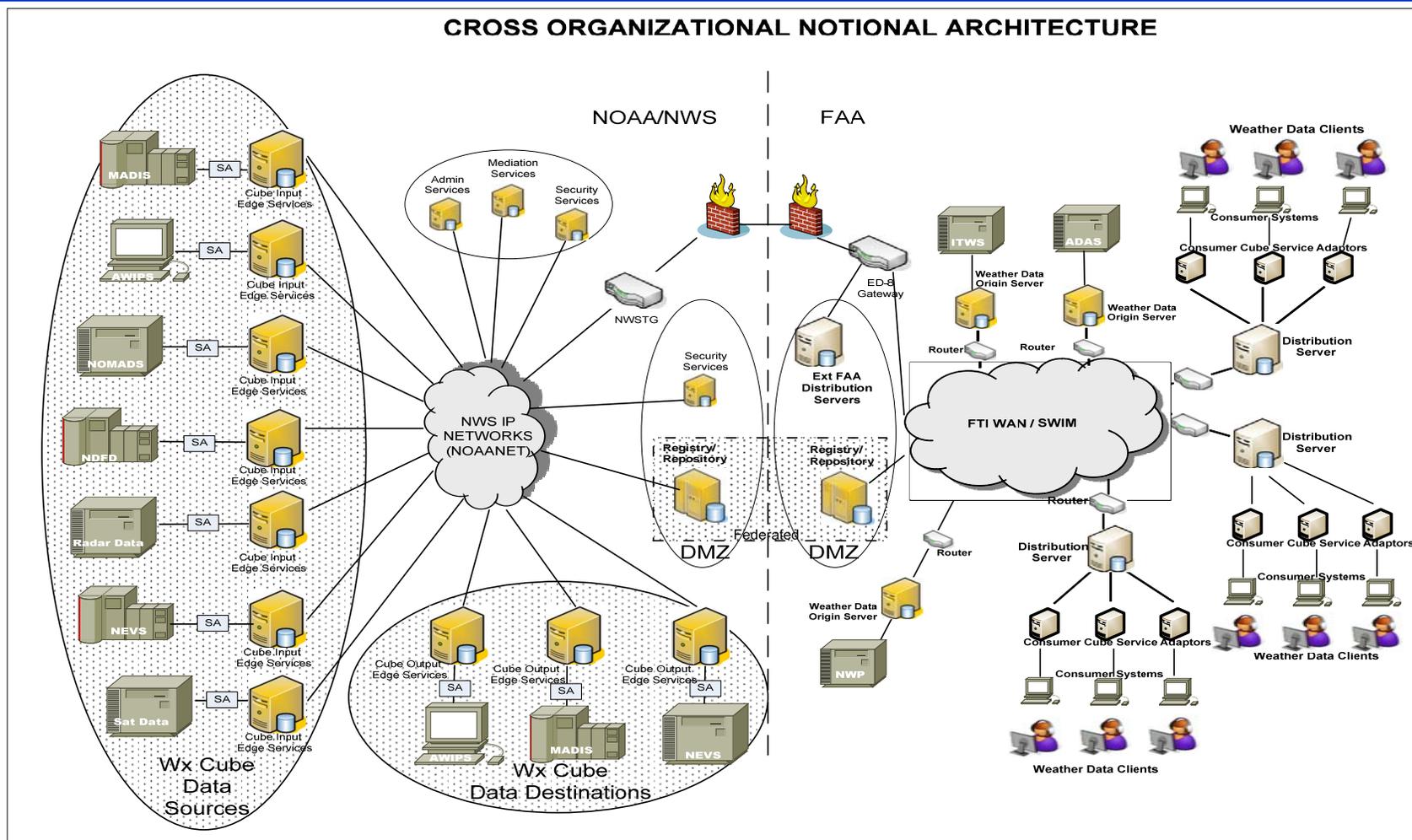


Program Sections

- IT Services include
 - Architecture and design
 - Prototype systems
 - Integrating existing systems
 - Production and deployment of systems
 - Enhancement of NWS infrastructure
- Contents include
 - Forecast process
 - Aviation weather parameter generation (e.g., thunderstorms, icing, turbulence, etc.)
 - Model improvement and development
 - Verification



Notional Architecture



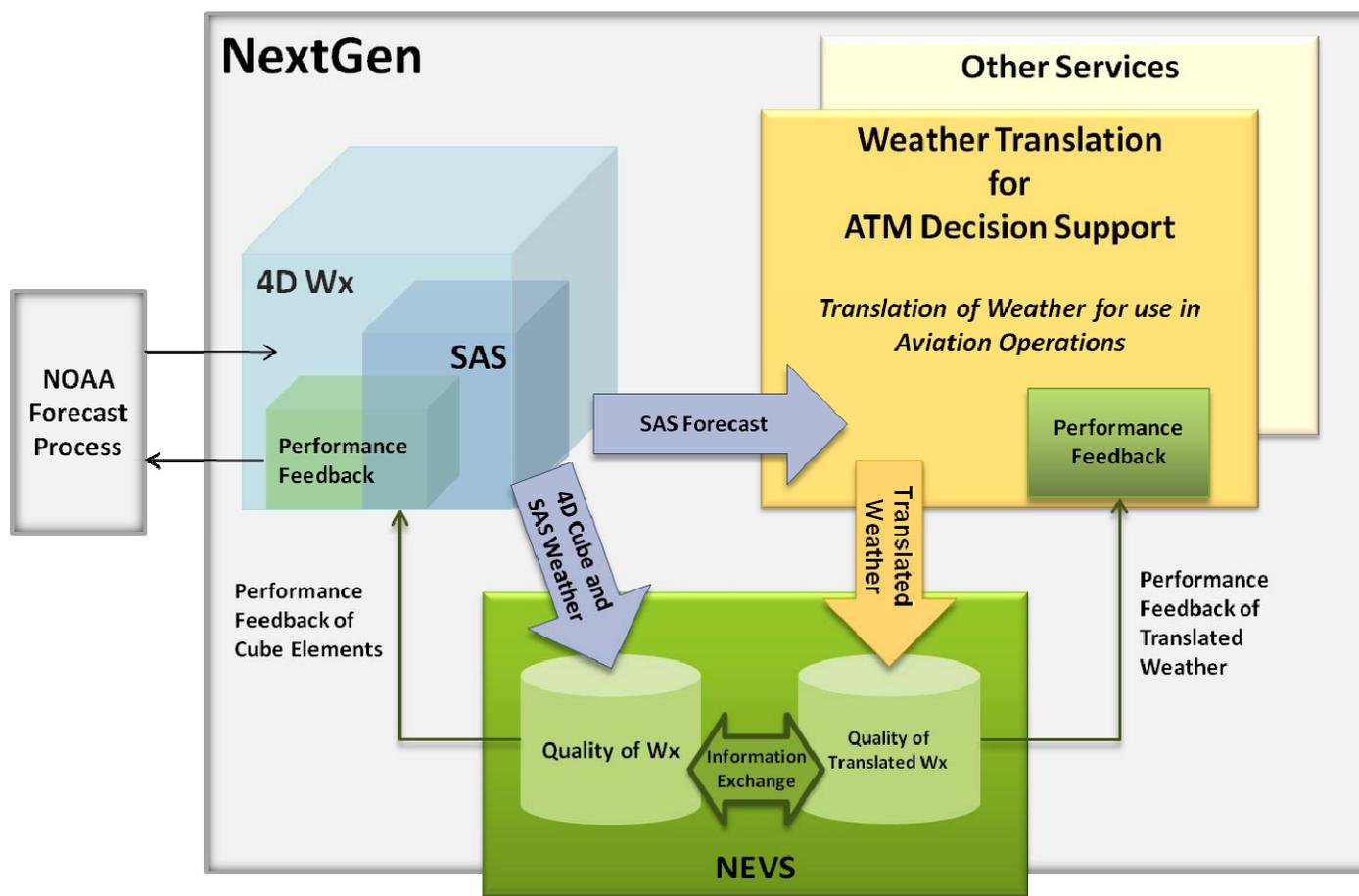


Contents Example - Convection

- Aviation requirements are demanding higher resolution models
- Convection in the short term time frame (0-2 or 4 hours) is key
- Resolution requirements based on:
 - Terminal – within 100km radius of an airport, a.k.a. Super Density Operations (SDO)
 - Enroute – within the National Airspace System (NAS), aka Trajectory Based Operations (TBO)
 - Global – outside the NAS



Contents Example - Verification

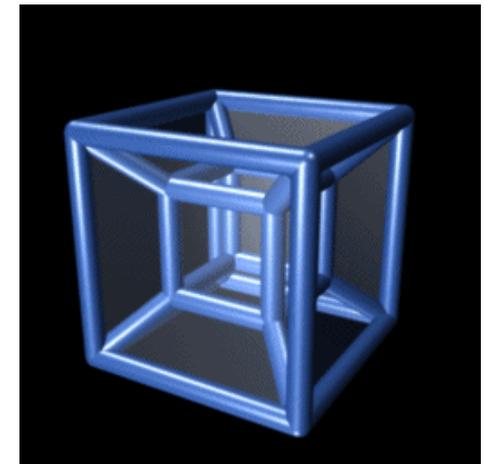


Net-enabled Verification System



Single Authoritative Source

- The Single Authoritative Source (SAS):
 - Is only a portion of the 4-D Weather Data Cube
 - Provides a common weather picture for National Air Space (NAS) participants (Airlines, DoD, FAA, etc.)
 - Is the basis for all aviation decisions by Air Traffic Management (ATM) in the FAA
 - Is formed by merger of model data, automated gridded algorithms, climatology and observational data, and meteorologist input/data manipulation to ensure consistency and accuracy
- NWS is the arbiter for the science and contents of the SAS





Challenges

- ***Infuse current operational systems into future IT architecture***
- Develop advanced high resolution models and algorithms to meet NextGen accuracy and spatial requirements
- Develop capabilities to accurately predict the development, evolution and dissipation of thunderstorms at airports or along flight routes
- Develop forecaster tools to interact with data within NextGen's rapid refresh paradigm



Challenges

- Encapsulating R&D efforts from all agencies that pertain to aviation forecasting
- Need for continuous international collaboration to ensure seamless weather information for air transportation including:
 - Harmonized weather data and impact exchange
 - Agreed upon governance structure



Summary

- NextGen requires significant changes in weather information production and dissemination
- NextGen means weather information is integrated directly into decision support tools and the decision making process
- The development of the 4-D Weather Data Cube is key for program success!