Implementing NextGen Weather

Friends/Partners in Aviation Weather Vision Forum

June 27, 2007

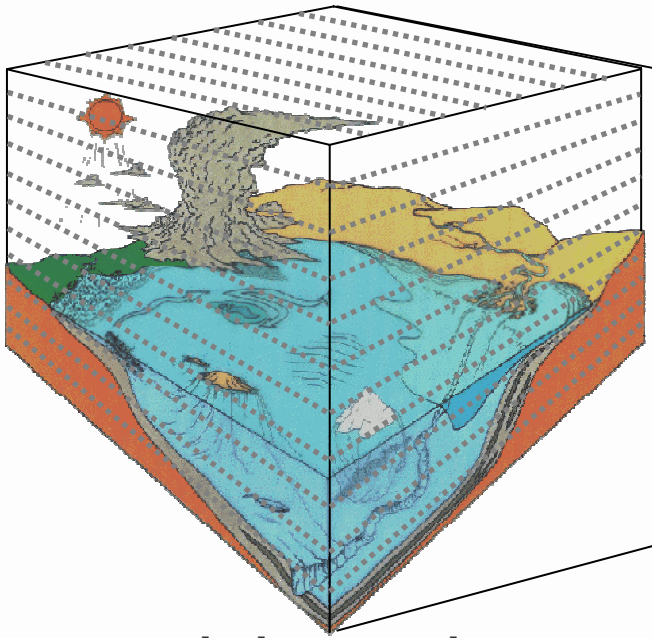
Overview

- Define NextGen Net-Enabled Weather
- Describe agency capabilities and plans - today and tomorrow
- Discuss collaborative efforts

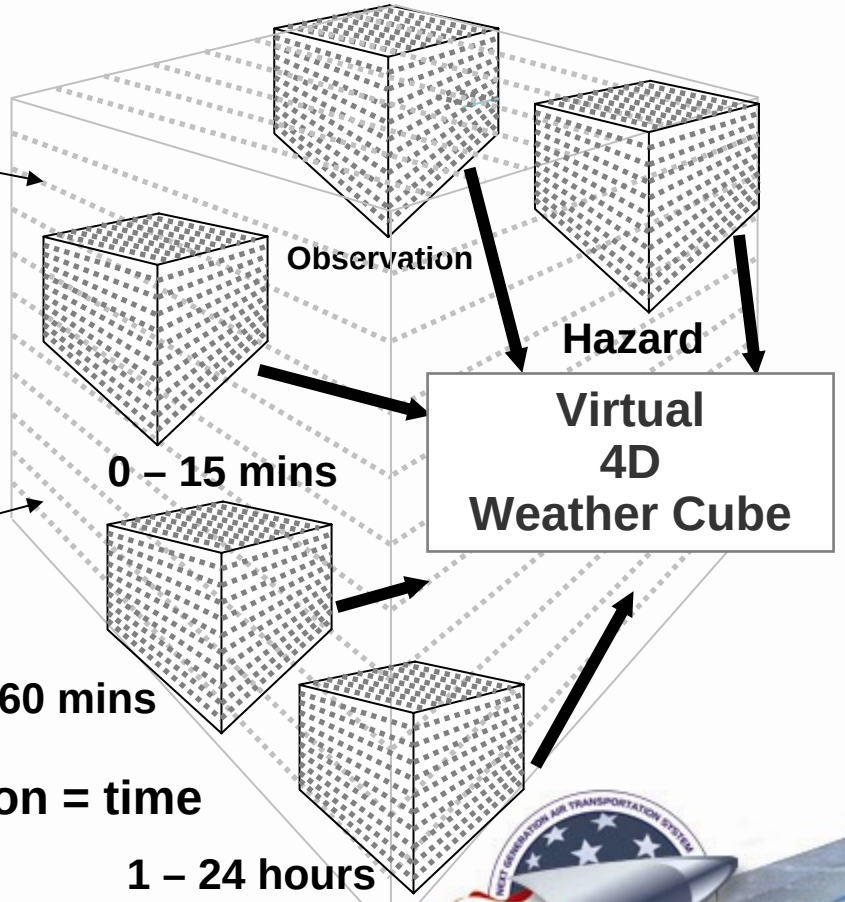
NNEW

- JPDO foundational concept to reduce weather impact
  - Serve as the core of the NextGen weather support services
- Mirrored in FAA budget requests – 4 key elements
  - Observations, Forecasts, Dissemination, Integration
- Fuse global weather observations and sensors into a real time weather information system
- Forecast a common weather picture across the national airspace system
- Utilize a network enabled operations approach to integrate weather into other key components of NextGen
- Support effective use of 4-D cube and NEO capabilities in air transportation decision-making

NNEW and the 4D Cube



Aviation weather information in 3 dimensions (latitude/longitude/height)



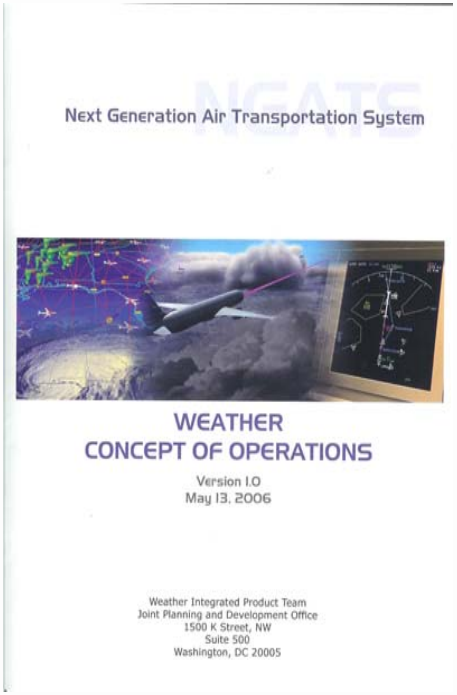
4th dimension = time

Why NNEW

- Leverages ongoing agency weather efforts
- Pools resource to minimize duplicate work
  - Design, Build, Policy and Governance
- Reduces expensive point to point communication
- Promotes common situation awareness
  - Single Authoritative Source Concept

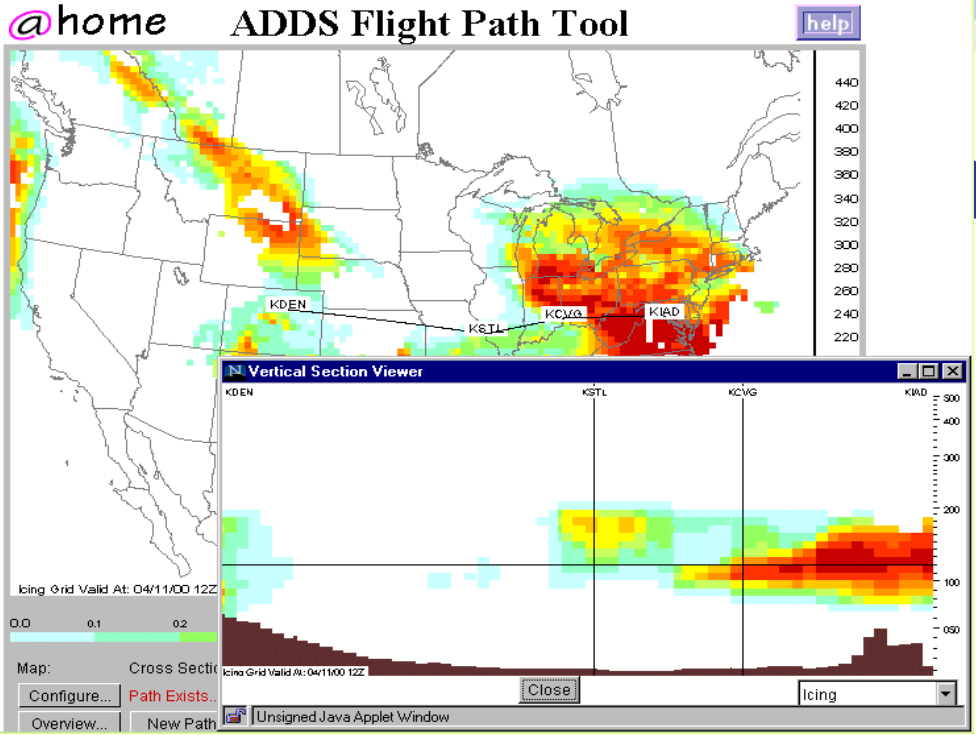
Where We Are Today

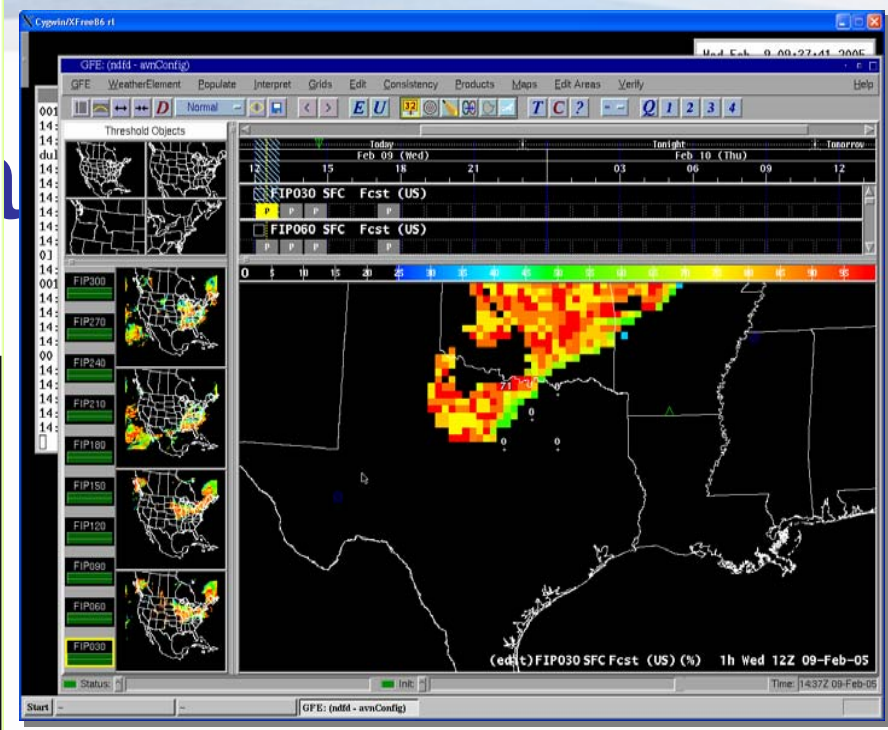
- Developed Weather Conops
- Developed Operational Improvements
- Developed R&D Plan
- Requested agency funding to support JPDO vision
- Identifying policy issues
- Increasing coordination of agency execution activities

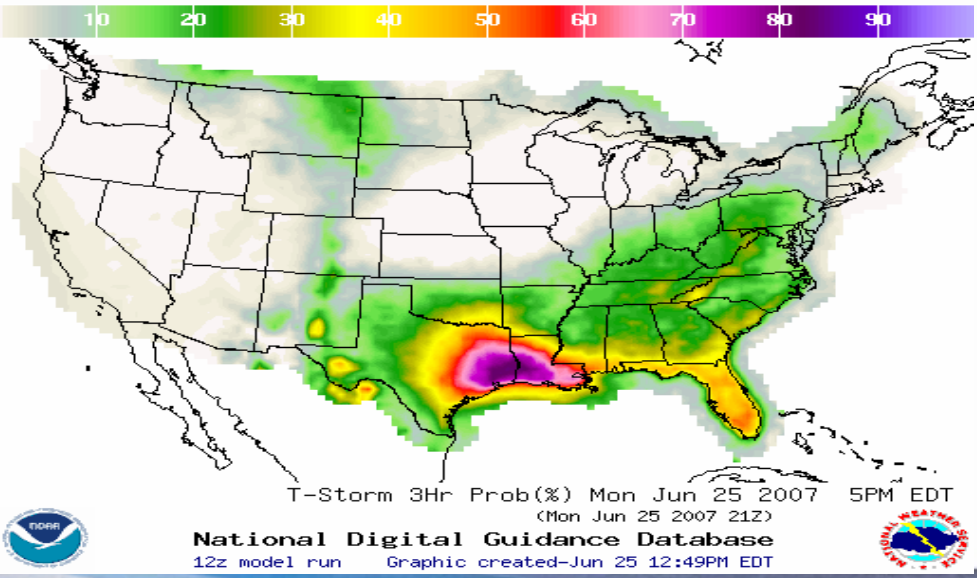


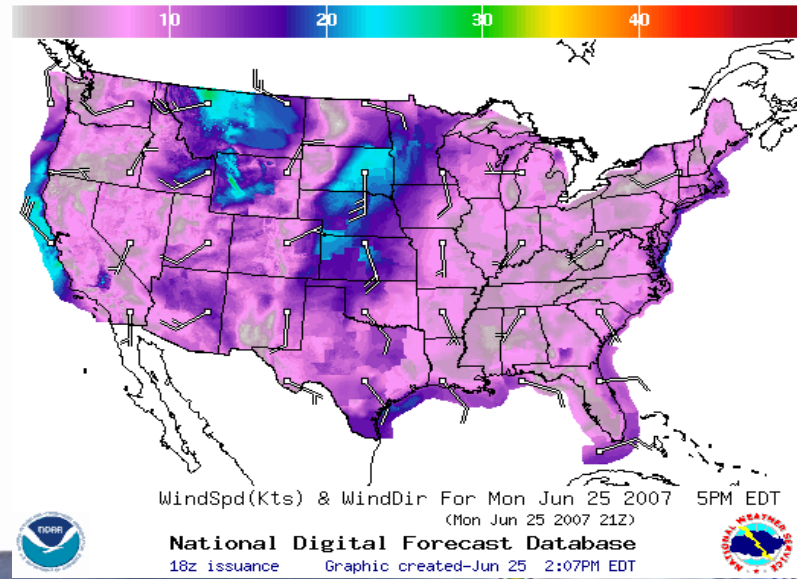
NOAA/NWS

- Integrated with JPDO Weather IPT
- Transitioning FAA R&D into operations
- Some information exists that supports 4-D Concept
- Developing capability to have meteorologists “over-the-loop”
  - Interactive Collaborative in 4 Dimensions (IC4D)


@home
ADDS Flight Path Tool
help
KDEN
KSTL
KCVG
KIAD
Vertical Section Viewer
Icing Grid Valid At: 04/11/00 12Z
Map:
Cross Sectio
Configure...
Path Exists.
Overview...
New Path
Close
Icing
Unsigned Java Applet Window


GFE: (ndfd - avnConfig)
FIP030 SFC Fcst (US)
FIP060 SFC Fcst (US)
(edit)FIP030 SFC Fcst (US) (%) 1h Wed 12Z 09-Feb-05


10 20 30 40 50 60 70 80 90
T-Storm 3Hr Prob(%) Mon Jun 25 2007 5PM EDT
(Mon Jun 25 2007 21Z)
National Digital Guidance Database
12z model run
Graphic created-Jun 25 12:49PM EDT

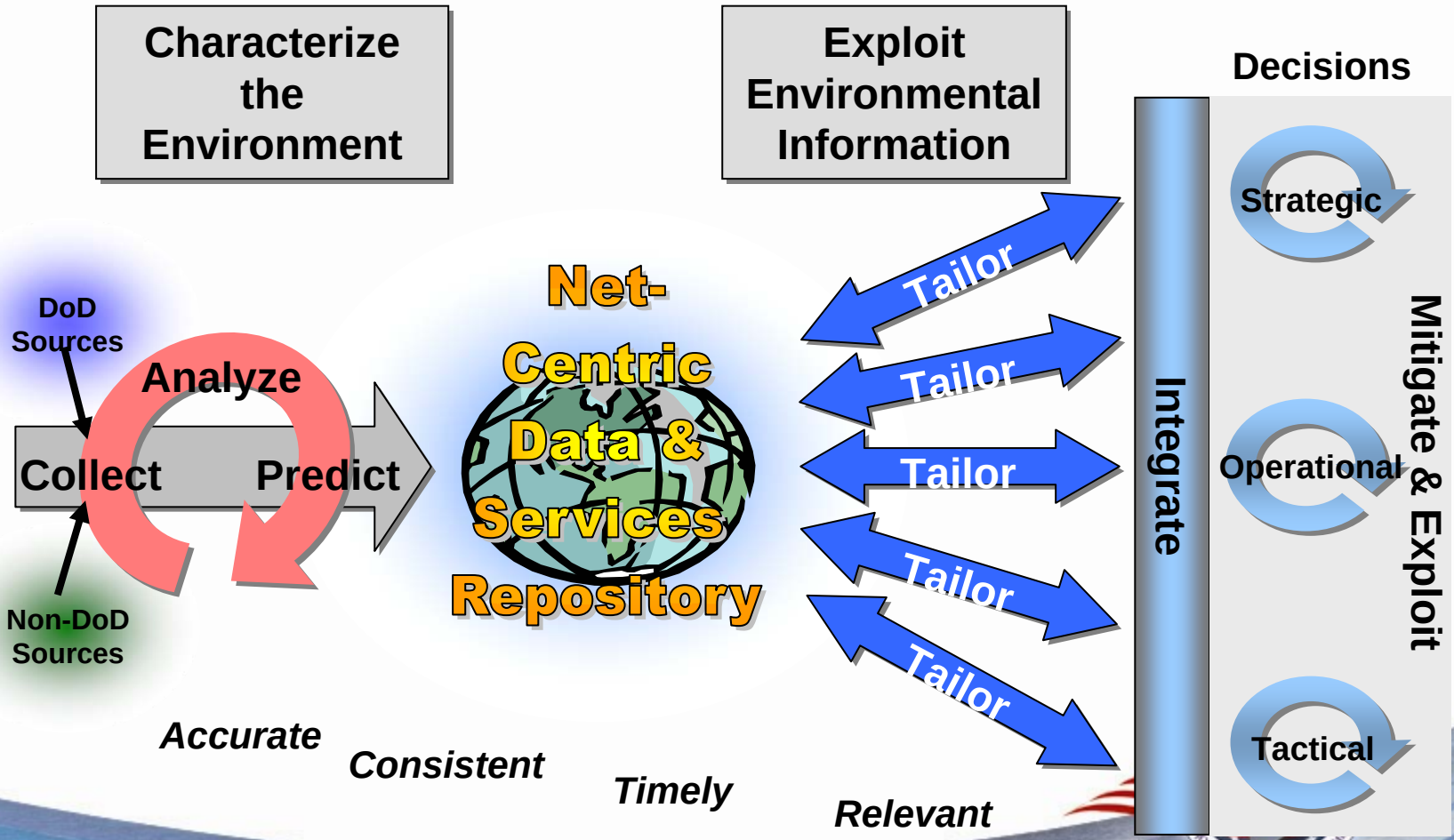

10 20 30 40
WindSpd(Kts) & WindDir For Mon Jun 25 2007 5PM EDT
(Mon Jun 25 2007 21Z)
National Digital Forecast Database
18z issuance
Graphic created-Jun 25 2:07PM EDT

NOAA/NWS

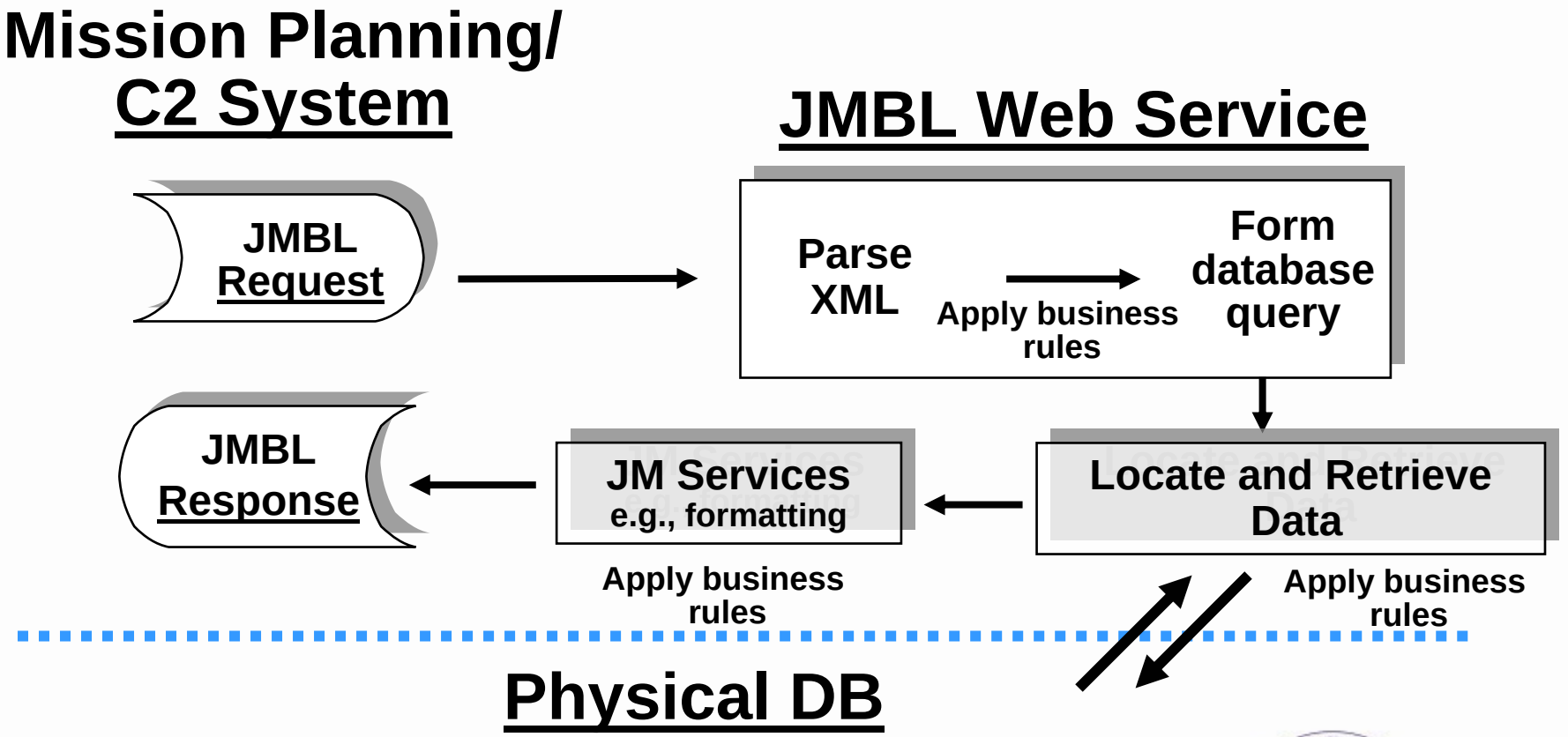
- Building NOAA's programmatic requirements in support of NextGen for FY10-14
  - Numerical Models/Probabilistic ensemble methods
  - Network enabled observations
- Key participant with Study Team to determine 4-D cube functional requirements
- Demonstrate IC4D capability
  - Process in place to determine human value added

DOD – Air Force

Global Predictive Environmental Awareness



DOD – Air Force



DOD – Air Force

- Joint Environmental Toolkit (JET) is the future AF forecaster's kit bag
  - Initial Fielding in ~ 9 months to field units
  - Subsequent increment aimed at regional forecasting hubs
  - Built for net-centric operations
- AF working with FAA's WJHTC to integrate JET into the SWIM Development Ops Center
  - Demonstrate initial capability in net-enabled weather operations—first steps to NextGen 4-D weather cube
  - Build understanding of net-enabled weather processes, challenges, and break down barriers
  - Engineering version of software loaded on FAA hardware and we have exchanged data
  - Developing demo scenarios

FAA

- Leading research in aviation weather products and services
- History of domain oriented systems to address aviation customer needs
- Aligning aviation weather planning activity to advance JPDO vision

FAA

- Coordinating FAA and NextGen aviation weather requirements
- Developing a transformational roadmap and strategy for aviation weather
- Building FAA components of the 4-D cube
- Integrating weather information via network enabled operations
- Working collaboratively with SWIM through the Weather Community of Interest, domestically and internationally

Data Standards

- Agency coordination on data exchange models and formats
  - Eurocontrol meeting in May
  - Interagency meeting at OFCM in June
  - Energize Joint Action Group for XML and Committee for Environmental Information Systems and Communications
  - Joint Environmental Toolkit integration and demo at FAA's WJHTC, with NWS

International Connections

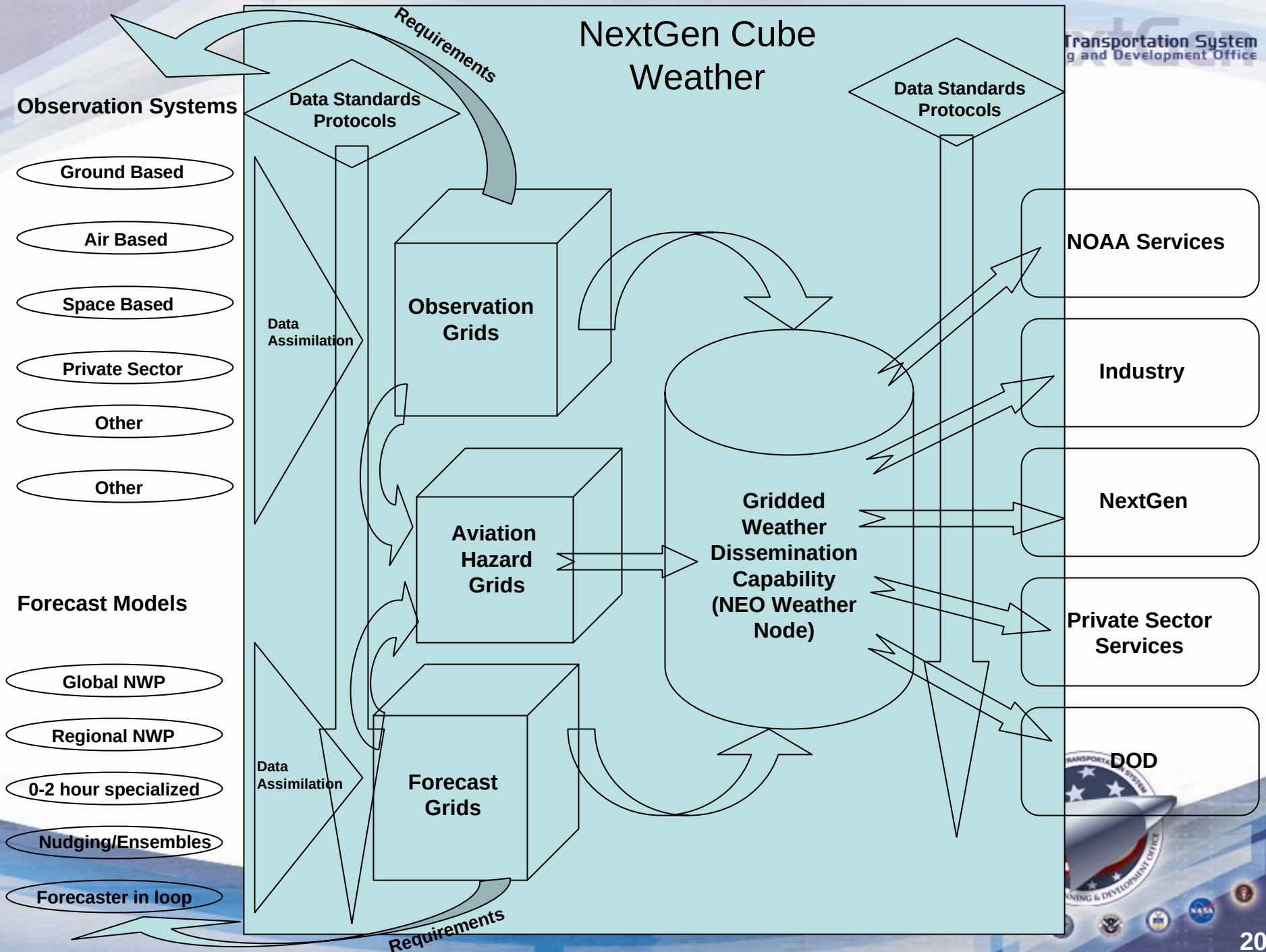
- US – Eurocontrol Meetings
  - Brussels, May 2007
  - Washington, August 2007 (planned)
- Data exchange models, XML schema
- Coordinated way ahead via Eurocontrol Annex
- Future standard-setting via ICAO and WMO

Summary

- NNEW – a JPDO and agency commitment
- Planning today – and applying resources to build capability
- Blending the information technology and weather communities
- A global approach to meet user needs

QUESTIONS?

BACKUP SLIDES


NextGen Cube
Weather
Requirements
Data Standards
Protocols
Data Standards
Protocols
Observation Systems
Ground Based
Air Based
Space Based
Private Sector
Other
Other
Data
Assimilation
Observation
Grids
Aviation
Hazard
Grids
Gridded
Weather
Dissemination
Capability
(NEO Weather
Node)
NOAA Services
Industry
NextGen
Private Sector
Services
DOD
Forecast Models
Global NWP
Regional NWP
0-2 hour specialized
Nudging/Ensembles
Forecaster in loop
Data
Assimilation
Forecast
Grids
Requirements

Joint METOC Database

Segments of the Physical Database

- JMCAT: Catalog of Weather data & products resident in a physical instantiation of the JMDB. Identification of user subscribers, points of contact.
- JMPLAT: Platforms. Weather stations, both fixed and mobile.
- JMOBS: "Conventional" observations--low to moderate volume
- JMR-SOB: Remote-sensed observations--high volume
- JMSESS: Space Environment and Solar Segment
- JMSEC/ JMCOM: Security and Common tables
- JMGRID: Weather data / models in gridded format.
- JME: Weather effects (on military missions, weapon systems, …)
- JMSAT: Meteorological Satellite data.
- JMIM: Finished imagery.
- JMAN: Alphanumeric messages, bulletins.
- JMCLIM: Climatology products.

Current Capability

Partial Capability

NextGen Weather

- Weather significantly impacts the national airspace system
- NextGen goals are not achievable without improving integration of weather information into decision support systems
- NextGen weather vision (a major paradigm shift) is focused on:
  - Providing a multiple user common weather picture
  - Consistent and reliable weather information
  - An improved weather information and dissemination approach containing observation and forecast data (i.e., the “4 Dimension* Weather Cube”)
  - Leveraging JPDO agency 4D Cube capabilities
    - NOAA’s National Digital Forecast Database
    - Navy’s 4D Metoc Cube
    - Air Force Weather Cube
    - FAA’s implementation of weather within System Wide Information Management (SWIM) capability
- Weather Working Group has made significant progress

*** 4 dimensions are 3D space and time**

NextGen Weather Today/NextGen Weather Information Attributes

Today

- Stovepiped Application(s)
- Inconsistent/Conflicting
- Low resolution (for aviation decision making purposes)
- Often delayed to user by 30 minutes or more
- Updated by schedule (hours)
- Rigid product formats (graphic or text)

NextGen

- Totally integrated into decision support systems
- Nationally consistent
- High resolution
- Communicated to users within seconds
- Updated by events (seconds/minutes)
- 100% digital gridded data supports unlimited formats

Weather Problem Statement

- 4D Cube is needed early in NextGen overall implementation schedule (2012 – initial capability)
- 4D Cube cost, schedule, and performance requirements need much more definition
  - NextGen concepts just now reaching maturity level where 4D Cube plans can be made
- There is not an interagency agreement to work towards a NextGen level weather capability

Recommended Action

- JPDO Weather Working Group **proposes a study team be created for a period of six months**, made of up of JPDO agency SME's (those involved in agency 4D cube efforts), **with the following deliverables due Jan 1, 2008** to support a Spring 2008 SPC decision on implementation:
  - A set of common NextGen 4D Cube functional requirements [defined for short (2012), mid (2015), and long (2018+) time frames] -- 2012 requirements highest team priority
  - Document containing higher level 4D Cube definition (including cost/schedule/ performance information) than proposed for the initial baseline of the JPDO Integrated Work Plan)
  - Working jointly with the JPDO System Evaluations and Analysis Division, deliver improved cost-benefit analyses

Benefit/Cost

- Annual benefits of Improved Weather Capability
  - Reduces $1.2 Billion in economic loss due to delay
  - Increased overall system safety
- 4D Cube 10 year implementation costs ($300M - $500M)
- Integration of weather into NextGen decision support systems ($1B - $1.5B) over 10 years

Phases of NextGen Weather

2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025

NextGen Weather Information Concepts

Align Agency Policy and Resources

- Identify and align weather research and acquisition programs (FAA,NASA,DOC,DOD)
- Redirect research programs towards the implementation of a national weather information collection and dissemination capability (FAA, NASA, DOC, DOD)
- Stand up an interagency "4D" weather program office (FAA, DOC, DOD)
- Publish an update to the weather operational policies (FAA)

Direct & implement agency-wide policy, governance, standards and solutions for NextGen Weather Information

NextGen Weather Information Initial Capability

Build Initial 4D Weather System

- Establish and implement weather information protocols and standards (FAA, DOC, DOD)
- Develop and Deploy 4D Weather Infrastructure technologies (FAA, DOC, DOD)
- Complete development of the 4D Weather making it the "Single Authoritative Source" (FAA,DOC, DOD)

Synchronize existing and planned future agency and industry efforts

NextGen Weather Decision Support Tools And Proactive Weather Decision Making

Optimize/Integrate

- Integrate weather Information into decision tools to enable a layered, risk-based operations approach (FAA, NASA)
- Weather Event Information management provides well defined sharing across organizational / agency boundaries (FAA, NASA, DOC, DOD)
- Improved4D trajectory predictions and agreements are enabled through the use of integrated weather information (FAA,NASA)

Transform operational system weather decision making processes

Full Integration of Weather Information into NextGen Operational Decisions

Manage/Enable

- Common situational awareness for all users of the NextGen System, promoting both improved system capacity and safety (FAA, DOC, DOD)
- Streamlined weather information architecture reduces operations and maintenance costs for both government and users (FAA, DOC, DOD)
- Direct integration of weather information and decision support tools ensure NextGen is supported by both NextGen relevant weather data and "weather savvy" decision support automation (FAA, NASA, DOD)
- Informs decision makers of options, assists in the automated identification of potential decision risks, and poses suggested operational solutions along with projections of NextGen impacts (FAA, NASA, DOD)

Risk based decision making, supported by information sharing measures with continuous feedback loops