Turbulence Prediction and Warning Systems Future Plans

Weather Accident Prevention
Third Annual Review
Nov 20-21, 2002

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Presentation Outline

- Goals and Objectives
- Programmatic Boundaries
- Technical Priority Areas
- FY03-05 Plans

Goals & Objectives

- **Weather Accident Prevention Goal:** Develop enabling technologies to reduce weather-related accident causal factors by 25-50% and turbulence-related injuries by 25-50% by year 2007.

- **WxAP Objective Number 3:** Develop turbulence prediction technologies, hazard metric methods, and mitigation procedures to enable a 25-50% reduction in turbulence-related injuries.

- **TPAWS Goal:** *Develop and augment knowledge of both the turbulence phenomena and the effects of turbulence on aircraft, and develop technologies to detect convective and clear air turbulence and mitigate the effects on aircraft passengers*

- Turbulence is the predominant weather threat for airborne tactical decision making relating to safety of cabin passengers and crew; also has significant operational costs impact

Programmatic Boundaries

- **Budget Guidelines**
  - TPAWS FY03-05 guidelines are intact
  - FY03-05 program support/infrastructure costs continue to increase resulting in less net research funds
  - FY02 was “bottom of v” profile, FY03 greater than FY02

- **Personnel & Flight Assets Allocations**
  - FY03 TPAWS personnel resources are “minimal critical mass” in total numbers, augmentation by new-hires
  - LaRC 757/Service Activity requirements from overall AvSP are maximized; continual trade-off process

Programmatic Boundaries

- **General Economic Conditions**
  - US economy is slow, businesses must control costs
  - TPAWS technologies must show ***total*** overall value; operational spin-offs, savings, benefits
- **Gov't Agency Missions**
  - CAST/JSAT/JSIT activities have not significantly addressed turbulence/weather items
  - Certification specialist resources support may be reduced

Technical Priority Areas

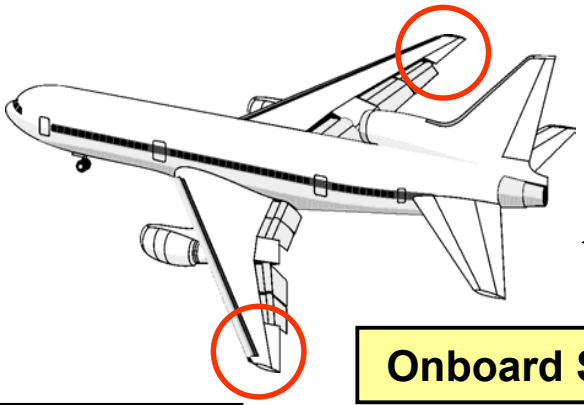
- **Systems-Oriented Process**
  - Get the right turbulence information to/from the right aircraft with sufficient time for necessary decision making; focus on airborne tactical decisions
  - Develop a ConOps document and a Requirements document for Airborne Turbulence Information and Alerting System with inputs by stakeholders and end-users
- **Certification Methods & Tools**
  - Turbulence Modeling and Simulation
  - Final formulation of turbulence safety hazard metric based upon aircraft dependent attributes
  - End-to-end analytical studies for scoring criteria/rules, validation boundaries

Technical Priority Areas

- **Turbulence AutoPIREP Systems**
  - 757/learjet flight experiments
  - Complete systems validation activities
- **Flight Deck Integration**
  - Re-plan activities, clean sheet
- **End User/Customer Collaboration**
  - One-to-one workshops; MOUs, MOAs for transitioning TPAWS items
  - TPAWS website for dissemination of technology status/flight results

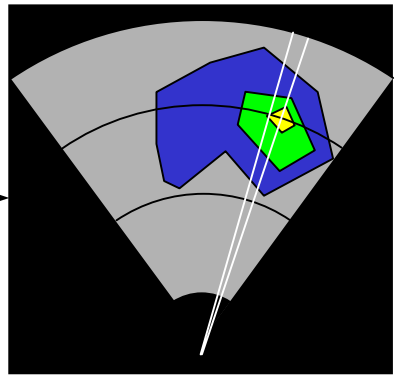
TPAWS Airborne Centric Concept

Flight Management System A/C Controls/Mitigation Schemes



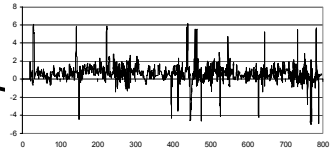
Decision Aids

Presentation to Pilot



Processors

Onboard Sensors



Turbulence Auto-PIREP

Airborne Turbulence Information

Airborne scaling & display of Turbulence Auto-Pirep's information

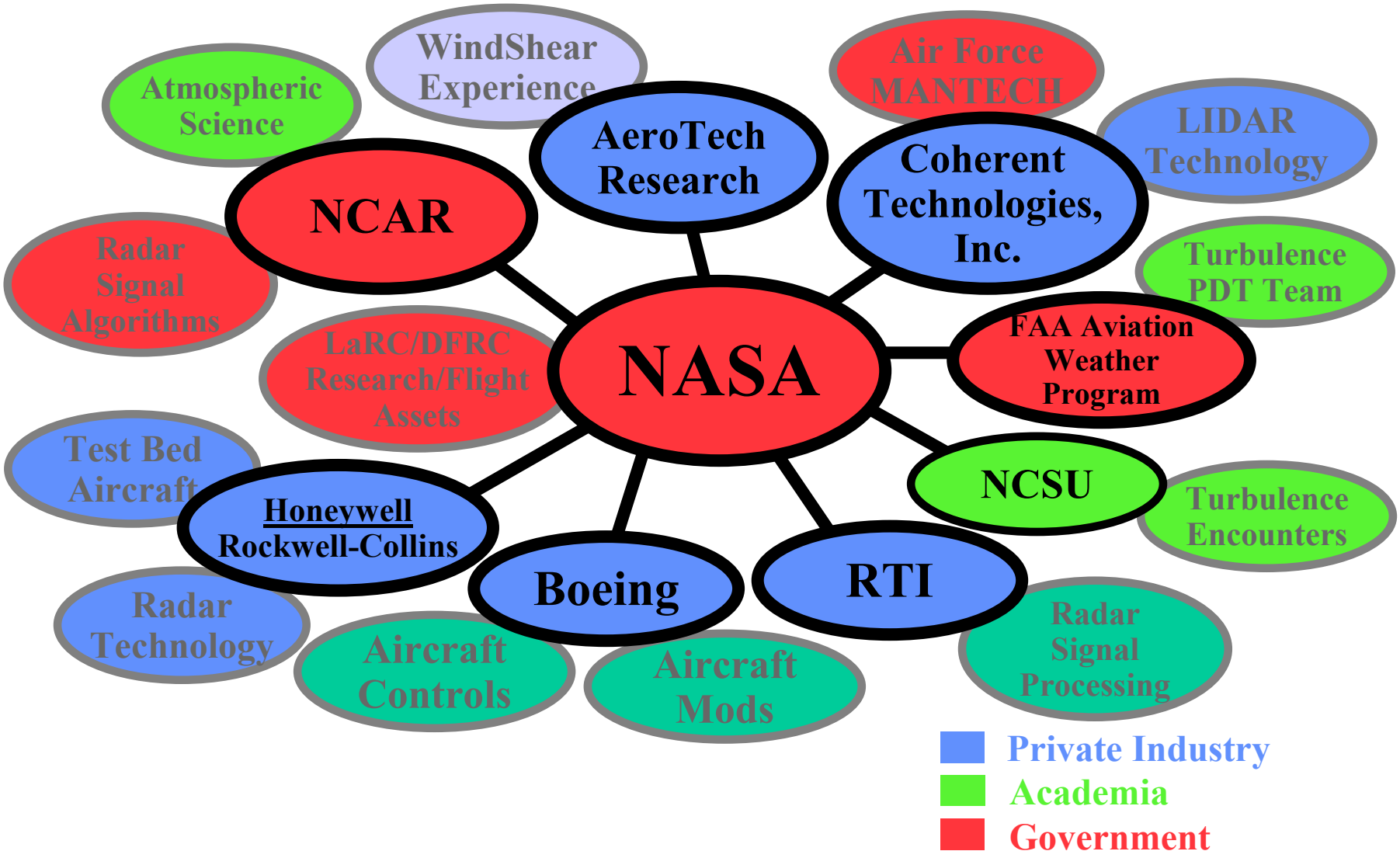
Data Link

Data Link

Ground-based Turbulence Products

Forward-Looking Sensors: Radar and LIDAR

TPAWS Development Team



FY03-05 Plans

- **WxAP Project Plan, TPAWS Element Plan**
  - 11 TPAWS milestones that roll-up into 3 WxAP milestones, developed in 4Q02; FY03 757 Flight window moved from Apr-May to Aug-Sep-03
  - Allocate available resources to TPAWS technologies that have most effective impact on AvSP objectives; continue impact and risk assessment to AvSP accident/injury metrics
  - Mid-year review and reallocate, if necessary, based upon priorities and decision criteria (Independent Review, Annual Mtg, NASA-FAA-Industry Certification Team, end-users collaborations)

- **Foster collaboration for TPAWS technology transfer**
  - realistic and effective MOU/As
  - "partnering/bartering" of interim technology in exchange for acquired data, analyses, and performance metrics

- **Foster collaboration with other Gov't agencies**
  - FAA, NWS related turbulence activities, programs
  - Due to overall personnel shortage, a forum/meeting of key individuals representing each organization

FY03-05 Plans

- **Provide means for potential users to retrieve TPAWS capabilities.**
  - TPAWS web/ftp site with download capability
  - Increased participation at technical forums, conferences, Oshkosh..
- **Provide systems studies for TPAWS sensors, sub-systems for AvSP activities beyond 2007.**
  - Autopilot, FMS
  - Lidar
  - Promising new aircraft controls, actuators, surfaces, etc.
- **TPAWS technologies are based upon enhancements or modifications to existing airborne systems.**
  - General awareness and interim performance capabilities to decision makers needs to be sustained.