



# ***Aviation Safety Program***

## **Weather Accident Prevention (WxAP) Development of WxAP System Architecture And Concepts of Operation**

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# Outline

## *Aviation Safety Program - Weather Accident Prevention*

- Background Information on System Architecture/CONOPS Activity
- Activity Work In Progress
- Anticipated By-Products



## WxAP Project Evolution FY'01

- **Prior Systems Engineering Activities**
  - AvSP LI Product Notebooks
  - Bob Sutton, Pat Corcoran ARI, AvSP LI Systems Engineers
- **Project philosophy/structure towards Product Based Development**
  - Acceptance to modify Level II, III Milestones
  - Define, identify NASA WxAP Products
- **Focus on WxAP technologies, not an optimized NASA WxAP System**
  - AWIN, WINCOMM, TDAM
  - 2/7-8/01 GRC LII/LIII TIM



# Task Origin

## *Aviation Safety Program - Weather Accident Prevention*

- 3/27/01 WxAP LIII Integration Meeting at LaRC
- Scope:
  - To create a NASA WxAP System Architecture and associated Concept of Operations Document.
  - Demonstrate a system implementation that includes AWIN, WINCOMM, and TDAM technologies for Commercial Transport and GA (where applicable).
  - Systems may not fully utilize the full scope of capabilities that are available from any one of the WxAP LIII elements.
  - System will be the WxAP Level II and Level III's vision of potential applications of these technologies.



# Task Origin (cont.)

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- **Justification:**

- To date, WxAP Level III development has been largely a bottoms-up effort with limited systems guidance from WxAP Level II due in large part to the maturity level of the LIII technologies.

- The Level III Elements are moving into a more critical period of technology development and demonstration and the need for a WxAP System Architecture is evident.

- The products of this activity will allow the WxAP Level III elements to refine their development activities and to accommodate WxAP system level requirements in their technologies.

- Anticipated by-products of this activity include WxAP '02 (and '04) Flight Requirements.



# Modified WxAP Products

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**Weather Accident Prevention  
(WxAP)**  
*Shari-Beth Nadell, GRC*

**Aviation Weather  
Information**  
*Paul Stough, LaRC*

**Weather Information  
Communications**  
*Gus Martzaklis,  
GRC*

**Turbulence  
Detection &  
Mitigation**  
*Rod Bogue, DFRC*

**Products**

**AWIN System**  
*Cockpit Weather Display Technologies,  
Pilot Decision Support Tools,  
Ground-to-Air Datalink Technologies*

**AutoMET System**  
*Airborne Weather Reporting Sensor Technologies,  
Air-to-Ground, Air-to-Air Datalink Technologies*

*Wx Products  
(external source)*

**Turbulence  
Sensor Technologies**

**Turbulence  
Mitigation  
Procedures**

**Turbulence  
Characterization**



## Architecture Task Goal:

### Map WxAP Products on System Architecture

## WxAP Proposed Products:

- Cockpit Weather Display Technologies and Pilot Decision Support Tools
- Airborne Weather Reporting Sensor Technologies
- Weather Information Datalink Systems Technologies for Ground-to-Air Dissemination
- Weather Information Datalink Technologies for Air-to-Ground and Air-to-Air Dissemination
- Turbulence Characterization Technologies
- Forward-looking Turbulence Sensor Technologies
- Turbulence Mitigation Procedures



## 5/10-11/01 WxAP LII/LIII SE Meeting at LaRC

### Attendees:

Dave Grantier/GRC	WxAP LII SE
Dwayne Kiefer/GRC/QSS	WxAP LII SE
John Bowen/GRC/ZIN	WxAP LII SE
Ed Johnson/LaRC	AWIN LIII SE
Tom Tanger/GRC/CMST	WINCOMM SE
Dale Force/GRC	WINCOMM SE
Jim Watson/LaRC	TDAM SE (acting)
Pat Corcoran/ARI	AvSP LI SE

### Meeting Summary:

The objective of this meeting was to familiarize each of the WxAP, AWIN, WINCOMM and TDAM personnel with each other, and to uncover the basic composition of each element. The meeting consisted of the WxAP LII System Engineers presenting their understanding gleaned from the available Level III documentation. The presentations were then supplemented and where necessary, corrected by the Level III System Engineers. The overall result of the meeting laid the informational and personal groundwork for future collaborations within the groups, and a starting point for the genesis of a NASA WxAP System Architecture.

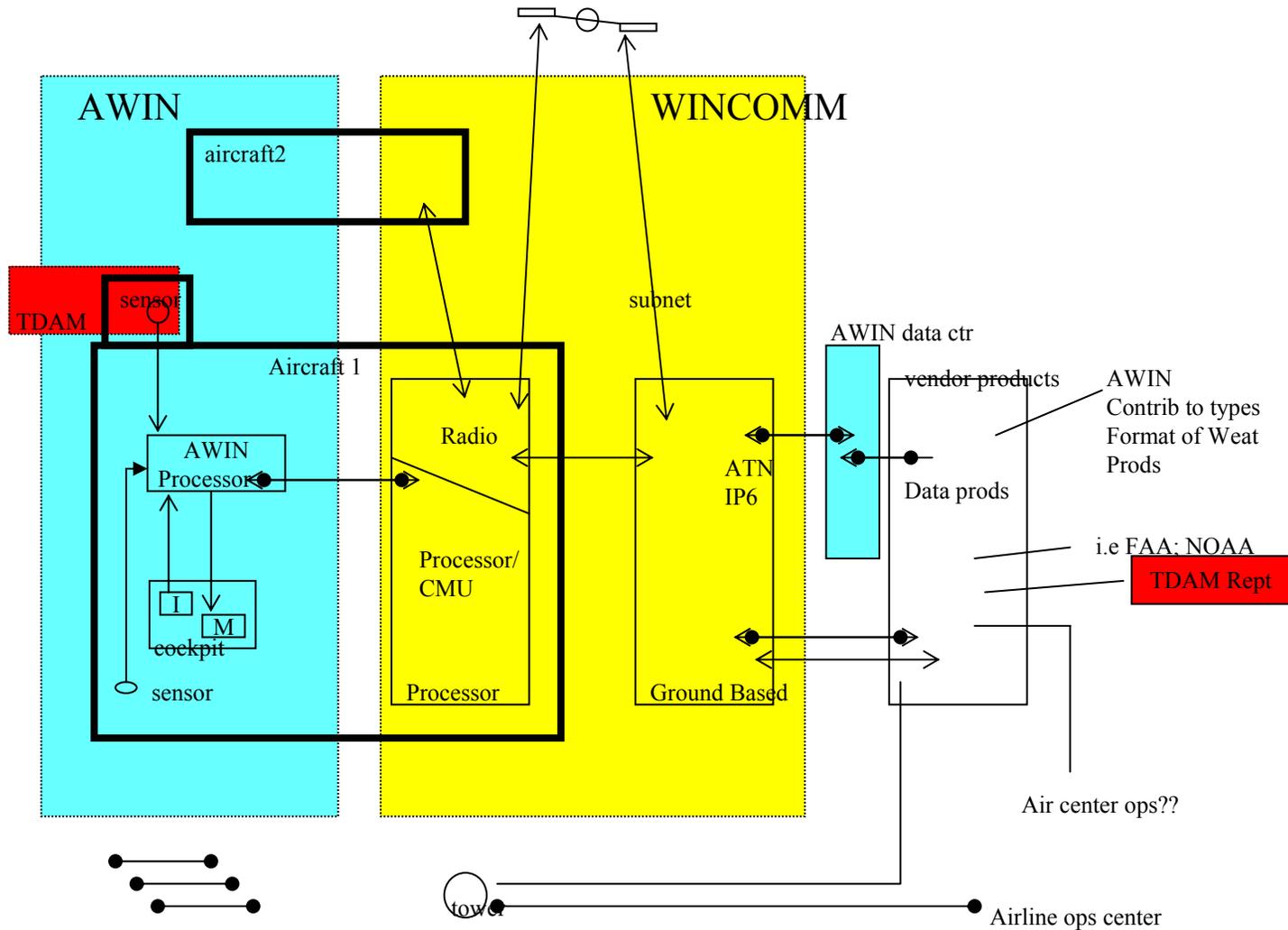


## NASA WxAP CONOPS Issues Currently Identified

(5/11-12/01 WxAP SE TIM at LaRC)

- NASA WxAP Implementation Time Phasing
  - ✓ Past, Present, 2007, beyond 2007
- NASA WxAP Flight Phase
  - ✓ Preflight, Take-off, Enroute, Landing, Postflight
- Aircraft Classifications
  - ✓ GA, Transport, Other?
- Communications Protocols
  - ✓ VDL-2,3, UAT, Mode S, SatCom
- Aircraft Hardware
  - ✓ Radio, Processors, Sensors, Cockpit Displays
- Aircraft Services
  - ✓ Other AvSP technologies, other Wx information on plane
- Ground Communications Network
  - ✓ IP-6, ATN

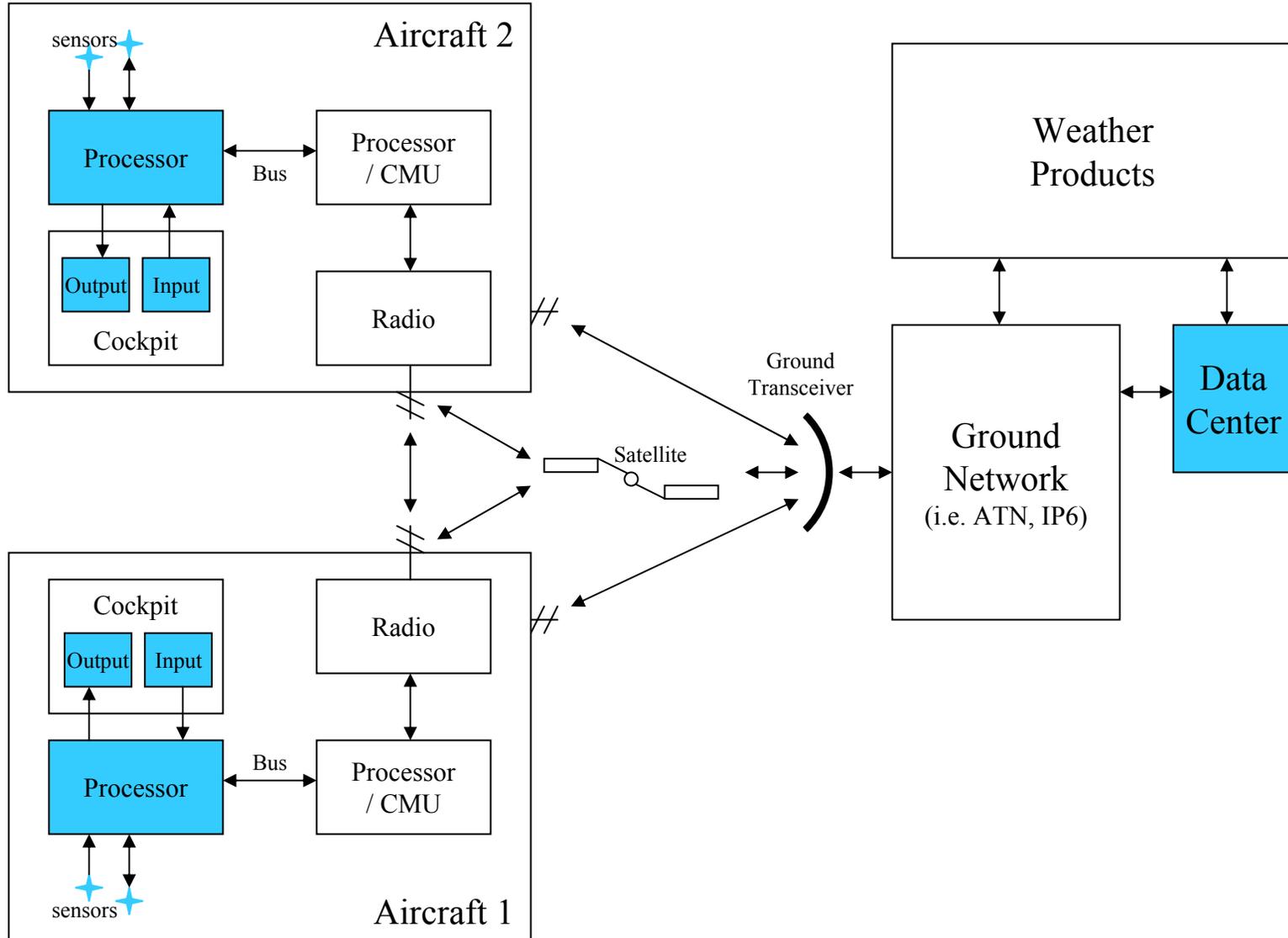
# Examples of WxAP System Architecture sketches from WxAP SE working group meeting (5/11-12/01 LaRC)





# Example WxAP Architecture Sketch

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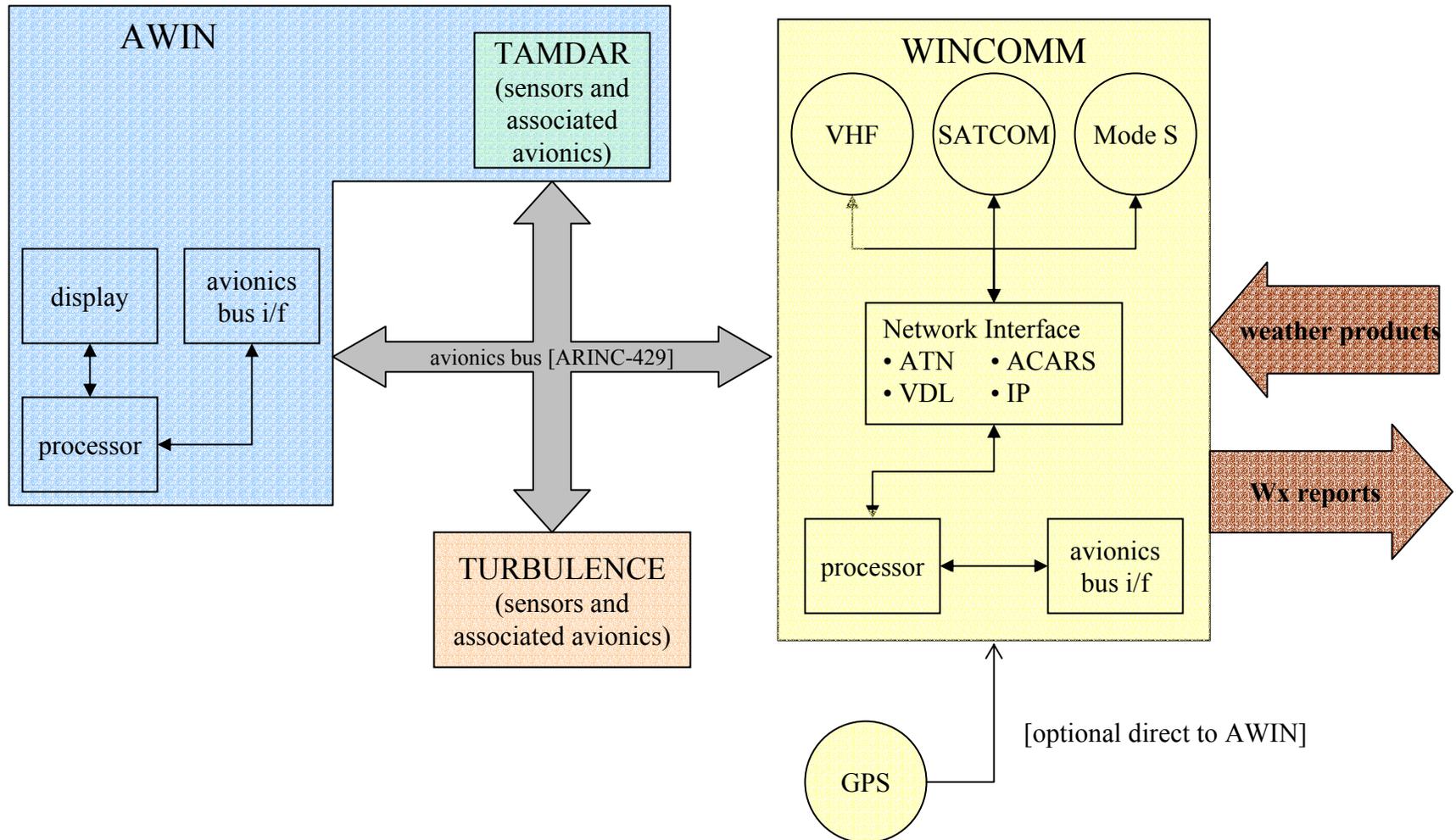


# Example WxAP Architecture Sketch



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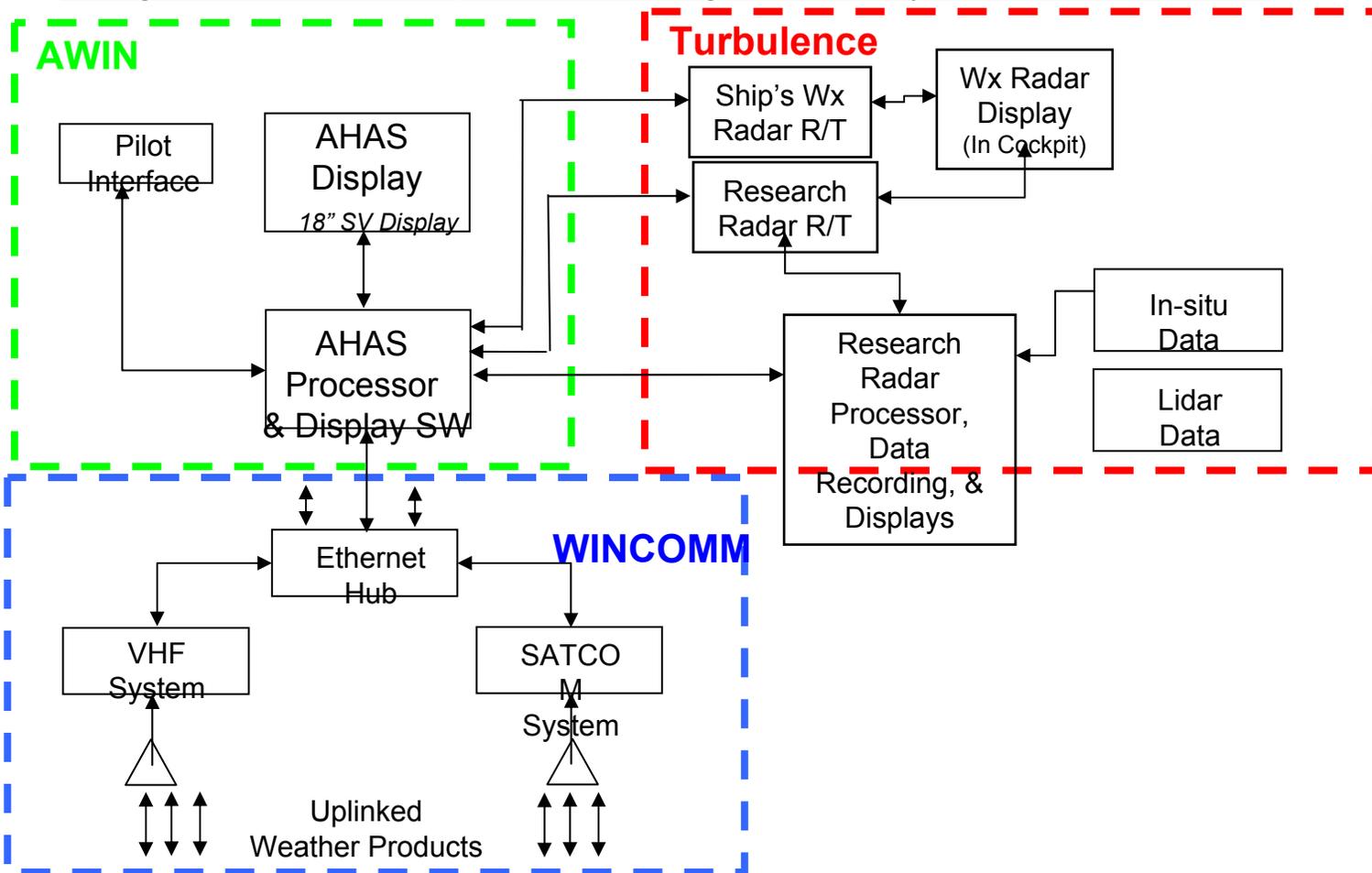
## Revised Architecture





# Example of WxAP initial System Architecture from FY'01 B-757 ARIES Flight Test Requirements Document (S. Rickard/LaRC)

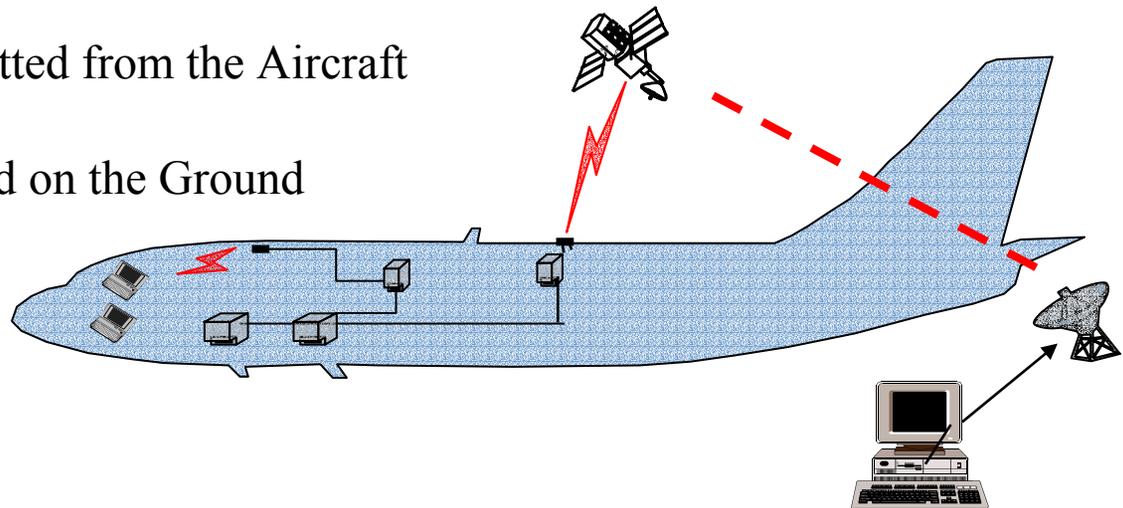
## Integrated WxAP Experiments High-Level System Architecture



## NASA W<sub>x</sub>AP Elementary CONOPS

### The “Building Blocks” of a W<sub>x</sub>AP CONOPS:

- ✓ Data is Transferred to Aircraft
- ✓ Data is Received by the Aircraft
- ✓ Data is Displayed to the Pilot
- ✓ Data is Collected on the Aircraft
- ✓ Data is Transmitted from the Aircraft
- ✓ Data is Received on the Ground





## Anticipated By-Products of Architecture/CONOPS Activity

- WxAP LII Requirements Document
- Formulation of WxAP FY'02 and '04 Flight Requirements
- More efficient evaluation of potential WxAP integration with other AvSP LII projects
- More efficient participation in AvSP LI Systems Engineering activities
- WxAP LII and LIII Project Management tool