NASA Airborne Science Program

Joint Airborne Science Sensor Integration Working Group (JASSIWG)

Presentation to ICCAGRA

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Goals

Improve Science Investigator access to NASA Airborne Platforms by…

1. Coordinating NASA aircraft instrument integration requirements across Airborne Science platforms.

2. Increase information availability.
   - Instrument design.
   - More demand for aircraft.

3. Generating common data flows across centers.

4. Reducing or eliminating redundant or unnecessary integration requirements.

Study Scope

- Joint Airborne Science Sensor Integration Working Group (JASSIWG) formed.
  - 1st WG team mtg in Oct 07.
  - WG agreed on three initial products (Phase A).
- Phase A:
  - Working Group kick-off, charter, platforms, initial products.
  - Generated initial products.
    - Common Payload Information Form (PIF).
    - Standard Experimenter Handbook format.
    - Platform Performance & Design Characteristics.
- Phase B:
  - Compare instrument design requirements for ASP aircraft categorized by subsystem, rationale, and requirement type.
  - Complete/revise Experimenter Handbooks.
- Phase C:
  - Development of a common design requirements & guidelines document.

Preliminary Requirements Assessment
March 2009

- Reviewed four handbooks (DC-8, P-3, ER-2, WB-57).
  - Over 2700 handbook statements reviewed to identify potential requirements.
- Extracted ‘hard’ requirements statements.
  - Requirements identified based primarily on keyword search, with additional ‘spot-checking’ in the design-related paragraphs.
  - A hard requirement is defined as something a PI (Scientist) would be obligated to do (i.e., non-negotiable) to integrate and fly an instrument on an aircraft.
- These requirements were sub-divided into three preliminary categories:
  - Design.
  - Operations.
  - Safety.
- Design requirements were further decomposed into subsystem/function categories.
  - If a requirement, spanned more the one category, it was counted twice.
- Did not assess heritage or commonality potential at this point.

Example Requirements (DC-8)

#	Title	Requirement	Section	Comments	Subsystem/Type
	Platform: DC-8				
1	Design	Experimenters are cautioned to engineer their equipment to prevent spurious response at these frequencies, and to limit any output from their systems to 100 milliwatts (as in telemetry).	2.1	2 reqmts.	Electrical or Radiation?
2	Design	The cabin floor can withstand a distributed download; however, fore, aft, and lateral forces must be sustained by the seat-support tracks.	3.2		Structural
3	Ops	Only the aircraft crew may operate these doors.	3.3	Refers to additional A/C doors.	
4	Safety	Personnel must wear personal protective gear during in-flight and ground handling of liquid nitrogen.	3.4.3	Similar to C.11.	
5	Ops	Advance notice to the mission manager is required for these types of facilities.	3.4.4	Refers to placement of dry nitrogen cylinders. Applicable to all cylinders?	
6	Ops	Aluminum cylinders are required for all types of gases.	3.4.4	On the plane only?	
7	Ops	Advance notice is required for use of this facility.	3.4.5	Refers to liquid helium container system.	
8	Safety	In-flight handling of liquid helium is not permitted aboard the DC-8.	3.4.5		
9	Ops	All seats must face forward for take-offs and landings.	3.4.6		
10	Design	Advance request of at least three months is required, to allow for approval, design, and fabrication.	4.3	Refers to viewport safety shields.	Mechanical or Sys Engr?
11	Design	Each installation is considered individually and must be discussed with DC-8 engineering staff during the preliminary planning.	4.4		Sys Engr
12	Safety?	Regardless of the source, each optical window (or spare window) that will fly on the DC-8 must be inspected, tested, and approved as airworthy prior to installation.	4.5		
13	Design	Adapter plates must be used for all circular optical materials in order to adapt them to the standard rectangular shape of the aircraft window.	4.5		Mechanical
14	Design	All edges of glass-type materials must be chamfered (Figure 4-6 and Figure 4-7) and scratches, digs, or unsmoothed edge chips may disqualify a window for use.	4.5.1		Mechanical
15	Design	It is mandatory that any window material be isolated from metal inserts or frames by Grade 40 silicone rubber gaskets with sufficient tolerance to prevent strain from thermal and mechanical effects.	4.5.1		Mechanical
16	Design	Optical Windows - Table 4Š2, minimum allowable material thicknesses.	4.5.1, Table 4.2		Structural

Requirements Summary

	DC-8	P-3	ER-2	WB-57
Design	145	158	150	76
Operations	50	90	30	67
Safety	30	14	35	9
TOTAL	**225**	**262**	**210**	**152**

Results by Subsystem

Subsystem	DC-8	P-3	ER-2	WB-57
Structural	49	40	12	21
Mechanical	24	28	43	17
Electrical	33	43	37	1
Materials	15	14	29	7
Thermal	5	3	1	3
Pressure/Hydraulics	5	10	13	2
Safety	16	4	10	19
Radiation	2	1	0	3
Physical Access	2	5	4	4
Sys/Gen Engineering	12	19	10	16
Other	-	-	5	-
TOTAL *	163	167	164	93

* - Some requirements are counted under more than one subsystem.

General Observations & Comments

- Handbooks have differing formats, levels of detail, and ordering/presentation of technical information.
  - To the first order, can't link requirements by 'shall' (etc.) statements, since documents use different wording.
  - Design requirements found outside 'designated' sections.
- Many instances where it was difficult to determine whether a hard requirement or not.
- Not clear if/whether/how requirements are verified or enforced.
- Possible 'missing' requirement(s)?
  - DC-8 & P-3 Exp Handbks only specify requirement to provide MSDSs for batteries and cryogens. Shouldn't this be a requirement for all [hazardous] chemicals and materials?
- Once the comparative analysis across aircraft begins, additional requirements may be added to an aircraft based on similarity (or commonality) to other aircraft.

Study Status & Near-Term Activities

- 2nd WG Mtg, Boulder, Feb 3-4, 09.
- JASSIWG web page set up on ASP site.
  - http://airbornescience.nasa.gov/instrument/JASSIWG.html
  - Post consensus products to ASP web site.
  - Internal site for team analyses, products.
- Center concurrence on Payload Information Form and Experimenter Handbook format.
- 3rd WG Mtg, Palmdale, CA, June 09.
- Revised Experimenter Handbooks - Mar 2010.

ISRSE Poster: Session C3, Wed, May 6.

Back-up Charts

Study Platforms

Platform	Lead Center	POC	Phone
DC-8	DFRC	A. Webster	701-330-7090
ER-2	DFRC	M. Kapitzke	661-276-2575
SIERRA	ARC	M. Fladeland	650-604-3325
G-III	DFRC	M. Holtz	661-276-3934
Global Hawk	DFRC	M. Graham	661-276-3202
WB-57	JSC	J. Alexander	281-244-9870
B-200	LaRC	R. Yasky	757-864-2251
P-3	WFF	M. Cropper	757-824-2140
Learjet 25	GRC	E. Emery	216-433-5694
S-3	GRC	E. Emery	“
Twin Otter (DHC-6)	GRC	E. Emery	“

Standard Experimenter Handbook

1.0 Introduction

2.0 Aircraft Description

3.0 Payload Accommodations

4.0 Environment

5.0 Communications, Navigation, and Data Acquisition & Display

6.0 Payload Design Planning, Engineering, and Integration Processes

7.0 Payload Design and Fabrication Requirements

8.0 Aircraft – Payload Interfaces

9.0 Flight Operations

10.0 Ground Operations

Appendices