Multi-Agency Data Repository for Sharing Sensor Related Research and Potential System Applications

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Joint Sensors Database

- Who are JHU-CPIAC & JANNAF?
- Joint Sensors Database History
- Goals
- Development Plan
- Status
- Needs

Who is CPIAC?

Johns Hopkins University – Chemical Propulsion Information Analysis Center

- Part of Whiting School of Engineering
- Center has existed under various names since 1946
- Currently a DoD Information Analysis Center (IAC) under contract with the Defense Technical Information Center (DTIC)
  - Serve as the national repository for information related to propulsion and energetic systems
- Serve as the administrative and technical advisors to the Joint Army Navy NASA Air Force (JANNAF) Interagency Propulsion Committee

What is JANNAF?

Joint Army Navy NASA Air Force (JANNAF) Interagency Propulsion Committee

- Led by an Executive Committee with 2 members from each service and NASA
- Exists as a means of technical interchange and collaboration between the DoD and NASA in the areas of propulsion and energetics
- Holds two conferences a year
  - Difference subcommittees meet at each conference
  - Subcommittee Technical Steering Groups and Panels exist to facilitate collaboration and work problems

Joint Sensors Database

History:

- c2007, Joint Army-Navy-NASA-Air Force (JANNAF) propulsion interagency committee identified need for community accessible sensor knowledgebase
- After a number of workshops JANNAF coalesced around creating a database of available sensors
- DoE National Energy Technology Laboratory (NETL) desires a similar database to identify sensor technology gaps

- May 2010 DoE NETL and JANNAF Integrated Health Management (IHM) and Engine Health Management (EHM) panels agreed to cooperate on a Joint Sensors Database

Goals

Goal (out of May 2010 meeting):

- An online database for information on sensors with aerospace applications
- Collaborative data collection (users provide sensor information)
- Secure – For US Government and their US contractors
- Searchable based on criteria of interest
- Generation of side-by-side comparisons

- Data to include:
  - Specifications – one set of specifications for a single sensor
  - Applications – unlimited sets of user provided application specific notes (ex: environments a sensor has been successfully used)

Benefits

Benefits (out of May 2010 meeting):

- Identify available sensors and successful implementations
- Identify gaps in sensing technology
- Leverage knowledge across agencies and industry on available sensors
- Cross-pollination of sensor success from propulsion systems to energy generation and vice versa
- Identify & update TRL for particular sensors

Access

CPIAC and JANNAF operate in a limited distribution environment

- ITAR restricted information
- Distribution limitations (not for public release)

- Baseline plan is to control access to the DoD Distribution C level – for U.S. Government and their U.S. Contractors only
- Possibility for public interaction?
  - Some data may be publicly releasable
  - Data entry could be open to public

Development Plan

1. Develop a framework for data on health management sensors
    - Types of sensors
        - Standardized categories / labels
    - Information to collect
        - Standardized units for values to enable direct comparisons
        - What information is required, what is not?
    - Tracking sources
        - Who provided the data, when? Was is modified? etc.
        - Has the data been reviewed by an admin? Has is been flagged by community for possible erroneous data?
    - Search fields
    - Fields for comparisons

Development Plan

2. Implement and Test
    - CPIAC is the Defense Technical Information Center (DTIC) IAC responsible for maintaining national knowledgebase for propulsion
        - Multiple database are maintained by CPIAC for this purpose
        - A new layer of complexity: user generated records
        - Within the experience base and charter of CPIAC
    - Funding agencies and select JANNAF panel members to oversee development.
        - Most work has been accomplished under the joint MSS IHM and LPS EHM panels, we would welcome S&MBS participation
    - Invited users to test data population

Development Plan

3. Documentation
    - Sensors database framework document will guide development of database
    - User's guide will be generated to aid community efforts to utilize database
    - Project briefing slides will be generated to aid community to inform others about the database

Funding

- Funding Team Members – NASA MSFC & GRC, AFRL EAFB, and DOE/NETL
- NASA & AFRL provided majority of funding
- DoE NETL contract approved March 25th through Ames National Laboratory

- As of this date the project is fully funded and we have ATP.

Status

- 4th draft of data fields to collect has been created using JANNAF workshop inputs
  - Provided to Wireless Avionics Community of Practice
  - Provided to Aeronautical Sensors Working Group
  - Can email out to group if you would like to provide feedback

- Foundational IT systems currently under development at CPIAC
  - Leveraging existing CPIAC experience in online databases

Draft Data Fields

Sensor Information (1/3):

4	**Sensor Information**		Individual who created database entry on a particular sensor will be saved. Last person to update sensor in			
5	**Field**	**Units**	**Required?**	**Searchable?**	**Field-type**	**Description**
6	Manufacturer	-	yes	yes	Text	Free Entry. Existing entries are available for selection.
7	Sensor Model Number	-	yes	yes	Text	Free Entry.
8	Website Link (manufacturer)	-			Url	
9	Website Link (sensor, datasheet)	-			Url	Different than uploading a copy of the datahseet, idea is ability
10	Unit Cost	$			Text	Free Entry.
11	Sensor Image	-				Option to upload an image of sensor if available.
12	Availability	-	yes	yes	Drop-down list	Development, Historical, Commercially Available
13	Date - last update to sensor infor	date	yes		date	date the sensor was last updated in the database, can be autom
14	**Measurement Information (may need to be duplicated if we're allowing multi-parametric sensors)**					
15	Measurement Type	-	yes	yes	Drop-down list	
16	Sensor Type	-	yes	yes	Drop-down list	Depends on Measurement Type
17	Sensor Output		yes	yes	Drop-down list	Depends on Sensor Type
18	Measurement Range (low)			yes	Text (numerical)	Lowest possible reading, Units depend on measurement type
19	Measurement Range (high)			yes	Text (numerical)	Highest possible reading, Units depend on measurement type
20	Sensitivity				Text	curve fit?
21	Linearity			yes	Drop-down list	Linear, Logrithmic, Exponential, etc.
22	Uncertainty (+/-)			yes	Text (numerical)	+/- some quantity. Units depend on Measurement Type
23	Error			yes	Text (numerical)	+/- some quantity. Units depend on Measurement Type
24	Accuracy			yes	Text (numerical)	+/- some quantity. Units depend on Measurement Type
25	Selectivity			yes		
26	Resolution			yes	Text (numerical)	Units depend on Measurement Type (sensor property)
27	Date - last update to section	date	yes		date	date this section of sensor information was last updated, autom

Draft Data Fields

Sensor Information (2/3):

28	**General Information**					
29	Footprint (length)	mm		yes	Text (numerical)	Size of the sensors attachment face, length
30	Footprint (width)	mm		yes	Text (numerical)	Size of the sensors attachment face, width
31	Volume	mm^3		yes	Text (numerical)	volume of the sensor
32	Non-intrusive?			yes	Radio button	yes/no, the sensor does not physically disturb the measuremer
33	Mass	grams		yes	Text (numerical)	
34	Method of attachment			yes	Drop-down list	Need a pre-populated list
35	Sensor Output Range (low)			yes	Text (numerical)	Lowest possible reading, Units depend on sensor type
36	Sensor Output Range (high)			yes	Text (numerical)	Highest possible reading, Units depend on sensor type
37	Op. Env. Temp. Range (low)	K		yes	Text (numerical)	
38	Op. Env. Temp. Range (high)	K		yes	Text (numerical)	
39	Op. Env. Max Vibration Frq.	Hz		yes	Text (numerical)	
40	Op. Env. Max Vibration Amp.	g (accel)		yes	Text (numerical)	
41	Op. Env. Pressure Range (low)	kPa		yes	Text (numerical)	
42	Op. Env. Pressure Range (high)	kPa		yes	Text (numerical)	
43	Op. Env. Max Humidity	%rel		yes	Text (numerical)	
44	Storage Env. Temp. Range (low)	K		yes	Text (numerical)	
45	Storage Env. Temp. Range (high)	K		yes	Text (numerical)	
46	Storage Env. Max Vibration Frq.	Hz		yes	Text (numerical)	
47	Storage Env. Max Vibration Amp.	g (accel)		yes	Text (numerical)	
48	Storage Env. Pressure Range (lov	kPa		yes	Text (numerical)	
49	Storage Env. Pressure Range (hig	kPa		yes	Text (numerical)	
50	Storage Env. Max Humidity	%rel		yes	Text (numerical)	
51	Storage Time Limit	months		yes	Text (numerical)	
52	EMI/EMC compatibility	-			Text	Free Entry for any comments related to EMI/EMC for the sensor

Draft Data Fields

Sensor Information (3/3):

53	Reliability (MTBF)	hours		yes	Text (numerical)	
54	Date - last update to section	date	yes		date	date this section of sensor information was last updated, auto
55	**Data Interface**					
56	Calibration Capability	-		yes	Drop-down list	in-situ, on bench
57	Sample Rate	Hz		yes	Text (numerical)	
58	Bus Protocol	-		yes	Drop-down list	
59	Bus Connection	-		yes	Drop-down list	wired, induction (wireless), radio frequency (wireless)
60	Power requirement	mW		yes	Text (numerical)	sensor power draw
61	Power source	-		yes	Drop-down list	battery, wire, wireless
62	Self-diagnostic Capability	-		yes	Radio button	yes/no
63	Smart sensor software maturity	-			Text	Free Entry. Comments on software maturity for smart sensors.
64	ITAR/EAR Restricted (hardware)	-	yes	yes	Radio button	yes/no/TBD
65	Man. POC Name	-			Text	Free Entry.
66	Man. POC E-mail	-			Text	Free Entry.
67	Man. POC Phone	-			Text	Free Entry.
68	Supporting Documentation	-	yes			At least one piece of documentation required to be uploaded the database. Multiple documents can be uploaded. Documen description is required. Document distribution level required. Documentation will be available to all users to download.
69	General Sensor Notes	-			Text	Free entry for any comments. Editable wiki-style (track change by user) to update information on a sensor
70	Date - last update to section	date	yes		date	date this section of sensor information was last updated, auto

Draft Data Fields

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Application Information:

73	**Sensor Application Information**		Multiple sensor application entries can be made per sensor.			
74	**Field**	**Units**	**Required?**	**Searchable?**	**Field-type**	**Description**
75	Company	-	yes		Text	Free Entry. Existing entries are available for selection.
76	Project	-	yes		Text	Free Entry.
77	Application area	-			Text	Free Entry.
78	Contract number	-			Text	Free Entry.
79	POC Name	-	yes		Text	Free Entry.
80	POC E-mail	-			Text	Free Entry.
81	POC Phone	-			Text	Free Entry.
82	TRL	-		yes	Drop-down list	1 to 9
83	Sample Rate	Hz			Text (numerical)	
84	End-to-End uncertainty				Text (numerical)	
85	Qual. Op. Env. Temp. Range (low	K		yes	Text (numerical)	
86	Qual. Op. Env. Temp. Range (high	K		yes	Text (numerical)	
87	Qual. Op. Env. Max Vibration Frq	Hz		yes	Text (numerical)	
88	Qual. Op. Env. Max Vibration Am	g (accel)		yes	Text (numerical)	
89	Qual. Op. Env. Pressure Range (l	kPa		yes	Text (numerical)	
90	Qual. Op. Env. Pressure Range (h	kPa		yes	Text (numerical)	
91	Qual. Op. Env. Max Humidity	%rel		yes	Text (numerical)	
92	Application Description	-	yes		Text	Free entry for any comments. Editable wiki-style (track change by user) to update information on a sensor application
93	Supporting Documentation	-				Optional? Multiple documents can be uploaded. Document description is required. Document distribution level required. Documentation will be available to all users to download.
94	Date - last update to section	date	yes		date	date this section of sensor information was last updated, autor

Next Steps

- Questions for the ISA Passive Wireless Sensors Workshop
  - Discuss possible collaboration on gathering sensor data
  - What data can be shared without running afoul of ITAR and other distribution limitations?
  - Does a 1-way exchange of data (public data entry, but not access to data) have any value?

- Seeking feedback on data collection fields to ensure compatibility with key specifications for passive wireless sensors

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