Manitoba Advanced Sensor Centre of Excellence (MASCoE)

Winnipeg Workshop

## 27-28 October, 2016

Bottom Line Up Front

- To develop a multi-sectoral, multi-disciplinary, sensor research network proposal – NSERC Strategic Partnership Group – Network (SPG-N)
  - Submission targeted for 01 April 2017

- Requirements
  - Secure industry involvement ✓
  - Establish network - ongoing
  - Identify primary sectors of interest- ongoing
  - Identify research themes for each sector – purpose of this workshop
  - Identify research gaps and projects concepts – beginning in this workshop

WestCanitest R&D Inc (WestCaRD)

- WestCaRD is an NPO that was formed to:

  – Stimulate strategic applied R&D,T&E and commercialization activities in Manitoba and Western Canada;

  – Expand upon unique test and developmental facilities and expertise to address market drivers in aerospace and other market sectors;

  – Support the development of the human capital necessary for growing the aerospace sector in Manitoba; and

  – Be a Manitoba and western Canada commercialization team builder.

Aero-Engine Test and Certification in Manitoba – Aviation R&D Background

GE at Mirabel 2006
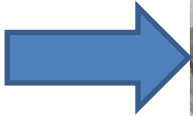
GE TRDC at Winnipeg 2011
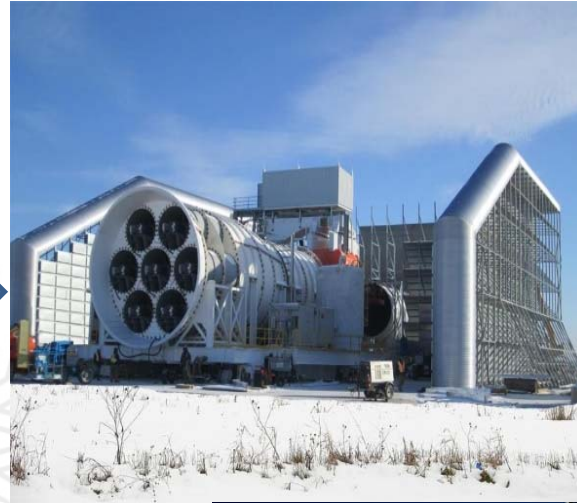
P&W and RR at Thompson 2010

Courtesy – Rolls-Royce plc

WestCaRD

Sensor Network Conceptual Genesis

- Aero-engine research, development, test and certification relies on advanced sensors and analytics
  - GE Aviation with 60+% of world's commercial engine market share employs advanced technologies in all areas
  - NRC is developing critical IP – Ice Crystal Sensing Systems
  - Spawned ongoing sensor collaborative team

- This is the fourth sensor workshop
  - First two were closed aviation developmental phase activities – GE Aviation driven
  - Third workshop was multi-sectoral, multi-party
  - Some future activities may either be closed due to IP sensitivity issues or open as will more generally be the case.

- NRC Factory of the Future initiative/Winnipeg operation opens up a new R&D and commercialization window of opportunities

- Opportunities for synergies are significant – collaboration is needed

WestCaRD

Industry 4.0 Overview
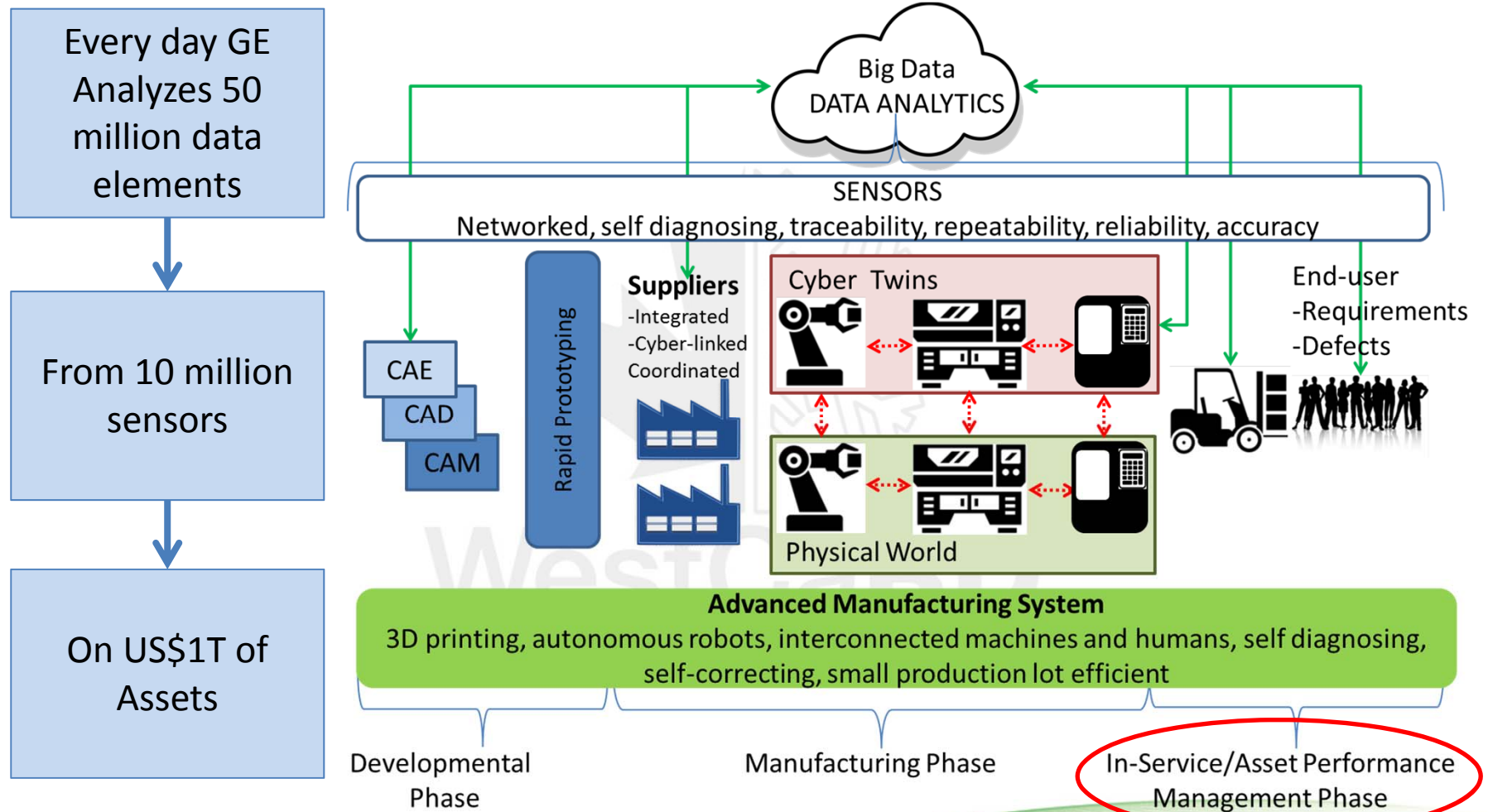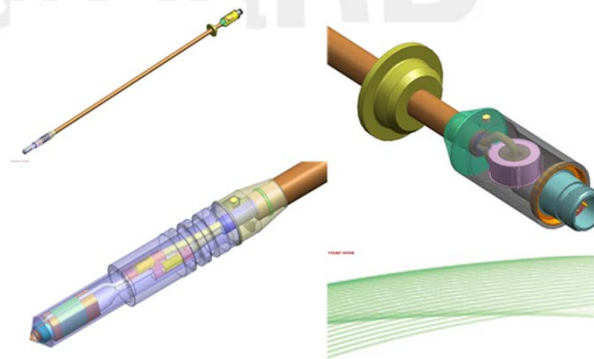
Sensor Environment By Phase

- Developmental Product Phase
  - Large numbers of sensors used for development and technology validation
  - Often very high sample rates
  - Operate in benign to harshest of environments
  - Relatively short life span expectations
  - Where new sensor technologies are often introduced

- Product Manufacturing Phase
    - Relatively small but significant numbers now
    - Sensors more often on machines rather than products
    - Sample rates range from low to high during machining operations
    - Sensors will increasingly remain with the product in-service

Courtesy of Unison

WestCaRD

Sensor Environment By Phase

- Asset Performance Management Phase
  - Focus is more on analytics than sensors
  - Sensors are embedded during manufacturing creating PB of data
  - The challenge is transforming that data into useful and timely information
  - Data security becomes major challenge in asset management/in-service phase
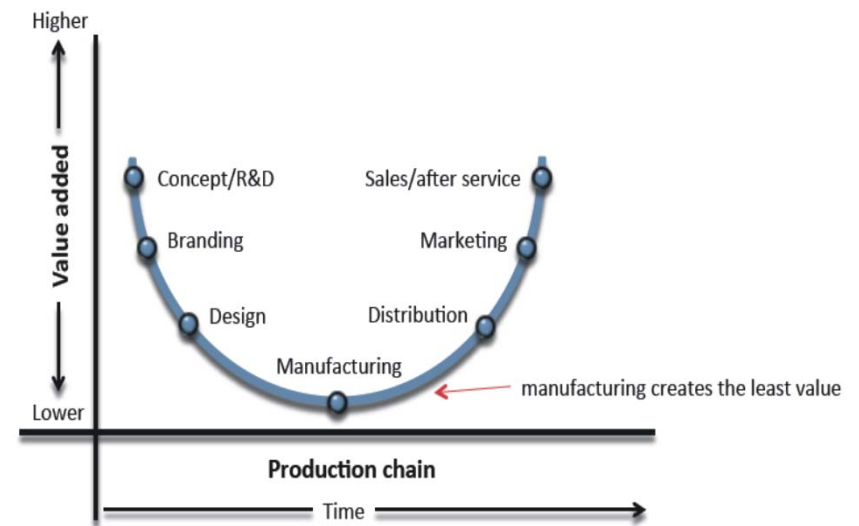
Courtesy of IEC Factory of the Future White Paper

Workshop Process

- Presentations are provided to begin populating the research idea pool

- Today's break-out sessions are to identify sensor requirements themes for each sector and identify common themes where they exist

- Tomorrow's break out sessions are to begin to identify gaps and research projects

- Three break-out sessions are organized each day
  - Aero-engine/Aerospace
    - Empress A (Ed Hoffmann, Bob Hastings)
  - Surface Transportation and Manufacturing
    - Ellice A (Nestor Dudych, Kathryn Atamanchuk)
  - Infrastructure and Energy
    - Ellice B (Doug Thomson, Ibrahim Yimer)

Courtesy of Propulsion Instrumentation Working Group
http://www.piwg.org/matrix.html

MEASUREMENT/DRIVER/REQUIREMENT	Enabling/Emerging Technology	HT electronics	HT optical materials	HT optical fibers	HT metal materials	HT ceramic materials	HT dielectric materials and application methods	improved material vibratory capability	Flexible softwire	Overcoating methods	HT attachment methods /ceramic cements	Connectors and transition technology	Thin film coatings; compliant layers and dielectrics	Sensor composition	Electronic circuit design	laser systems maturity	probe sensor head configuration/design	Miniaturization / small package	Data acquisition	Software and algorithms	Data processing	High temperature power source	Signal conditioning	Uncertainty - data quality
ENGINE EMISSIONS																								
ACOUSTIC NOISE EMISSIONS																								
GAS PATH TEMPERATURE																								
DYNAMIC PRESSURE																								
MEMS																								
SURFACE TEMPERATURE																								
SURFACE TEMPERATURE ON TBC																								
STRESS AND STRAIN																								
NSMS, BTT - TIP VIBRATION/DISPLACEMENT																								
TIP CLEARANCE																								
COMPONENT WEAR AND DEGRADATION																								
SLIPRINGS																								
TELEMETRY AND WIRELESS																								

Manitoba Advanced Sensor Centre of Excellence (MASCoE) Workshop 4
Held at the Homewood Suites Conference Facility, 1295 Ellice Avenue, Winnipeg Manitoba
On October 27th and 28th, 2016

Day 1 – October 27th, 2016

Start	Finish	Description	Lead
0700	0800	Breakfast	
0800	0815	Introductory/Welcome/Administration	WestCaRD/ Bob Hastings
0815	0830	MASCoE Introduction- Background of Initiative, its Goals and Objectives	WestCaRD/Bob Hastings
0830	0900	GE Aviation Test and Certification Sensor Research Requirements	GE Aviation/Ed Hoffmann
0900	0930	GE Aviation/University of Manitoba Collaborative Sensor R&D Project – Model Based Clearance Sensor	UoM/GE Aviation
0930	1000	Surface Transportation - Manitoba Vehicle Technology Centre – Technology Framework and Strategic Review – Where do Sensors Fit In	Executive Director Vehicle Technology Centre/Nestor Dudych
1000	1015	Comfort Break/Networking	
1015	1045	SMART Bridges - Innovation in Second Generation Bridge Monitoring with IoT and Enterprise Cloud Computing	Brian J. Westcott
1045	1115	A SME Perspective on Sensors and their Experience with GE Predix	IDERS Incorporated
1115	1145	Designing Sensor Networks for Long-term Deployment and Resilience	Ioanis Nikolaidis University of Alberta
1145	1215	Energy Sector Sensor Presentation	
1215	1330	Lunch/Networking	
1330	1400	Enterprise Machine Intelligence and Machine Learning Initiative	Sightline Innovations
1400	1530	Sector Themes Breakout Sessions – Aero-engine, Surface Transportation/ Manufacturing, Infrastructure & Energy	
1445	1500	Break	
1530	1630	Breakout Session Summary Presentations	
1630	1930	Cash Bar Networking Session	

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Day 2 – October 27th, 2016

Start	Finish	Description	Lead
0730	0830	Breakfast	
0830	0900	Day 1 Outcomes Summary Discussion	WestCaRD/ Bob Hastings
0900	1000	Sector Themes Breakout Sessions – Aero-engine, Surface Transportation/ Manufacturing, Infrastructure & Energy	
1000	1015	Break	
1015	1100	Research Projects Discussion Continues	
1100	1200	Collaborative Projects Summary and Plenary Session	All

Workshop Sponsors