28th Annual **INCOSE**
international symposium

Washington, DC, USA
July 7 - 12, 2018

Model-Facilitated Collaboration by Regulators, Technical Societies, Customers, and Suppliers

Accelerating Innovation Effectiveness

www.incose.org/symp2018

COLLABORATION WITH REGULATORS

- SAE INTERNATIONAL SUPPORTS THE FAA THROUGH A STANDARDS TASKING REQUEST PROCESS

U.S. Department of Transportation

Federal Aviation Administration

800 Independence Avenue, S.W.
Washington, DC 20591

Mr. Logen Johnson
Director, Washington Operations, Aerospace
SAE International
1200 G. Street NW, Suite 800
Washington, DC 20005

Dear Mr. Johnson:

The FAA requests SAE form a committee to develop industry standards to update AC 20-135, *Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards and Criteria.* The committee should work with the aerospace industry and the FAA's William J. Hughes Technical Center, if possible. The FAA plans to work closely with SAE, industry, and other certification authorities to support development of this document.

SAE Integrated Vehicle Health Management

- FAA and EASA supported activity

- The SAE HM-1 Integrated Vehicle Health Management committee addresses the integration of health management systems at both the platform and fleet levels and provide technical standardization to support, guide and advance the realization of Integrated Vehicle Health Management – through common definitions, parameters and taxonomy

SAE IVHM

- *This Aer*ARP6904 Data Interoperability for IVHM

- ARP6887 Verification & Validation of Integrated Vehicle Health Management Systems and Software

- JA6268 Design & Run-Time Information Exchange for Health-Ready Components

  - *The intent is to provide an IVHM system that can robustly report the degradation of a given component before it reaches the point where it goes outside its operational performance envelope by providing sufficient advance notice to deal with the issue.*

SAE Digital & Data Steering Group

- FAA and EASA supported activity

- The DDSG will strategically identify emerging technologies, and coordinate standardization activities such as data interoperability, ownership, sharing, and security necessary to support D&D technologies at the system, subsystem, and component levels, as well as within the supporting organizational infrastructure.
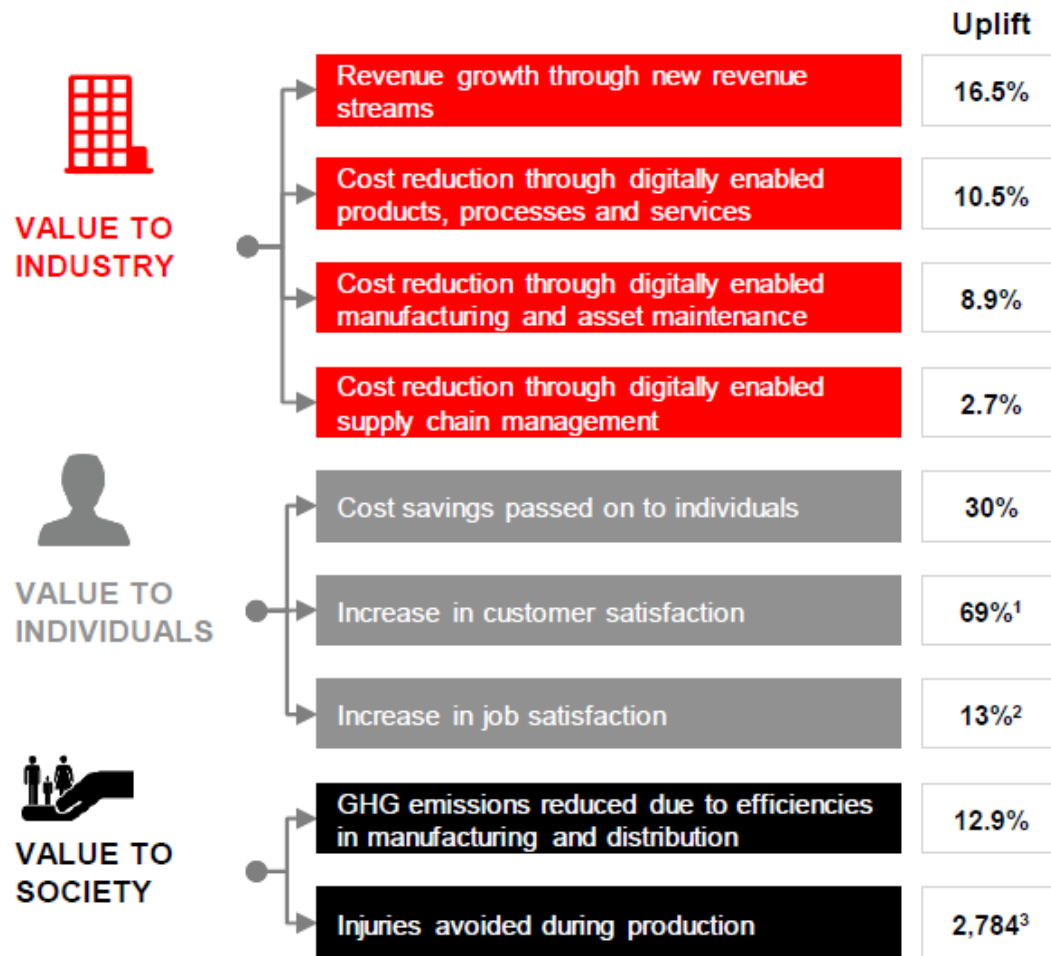
SAE Digital & Data Steering Group

- A prime area for regulatory involvement is managing the certification phase of Connected Aviation. Essentially, regulators will need to work with airframe manufactures and suppliers to ensure that aircraft, when delivered to operators, meet the standards defined by the regulator.

- For connected aviation to succeed, suppliers and operators alike must partner with regulators to help drive standards. The partnership enables a broad range of opportunities, including digital twin, the Internet of Things and big data analytics to drive productivity, quality and cost improvements throughout the product lifecycle.

SAE DDSG

	Uplift
VALUE TO INDUSTRY	
Revenue growth through new revenue streams	16.5%
Cost reduction through digitally enabled products, processes and services	10.5%
Cost reduction through digitally enabled manufacturing and asset maintenance	8.9%
Cost reduction through digitally enabled supply chain management	2.7%
VALUE TO INDIVIDUALS	
Cost savings passed on to individuals	30%
Increase in customer satisfaction	69%[1]
Increase in job satisfaction	13%[2]
VALUE TO SOCIETY	
GHG emissions reduced due to efficiencies in manufacturing and distribution	12.9%
Injuries avoided during production	2,784[3]

Reference: Industrial Digitalisation UK benefits analysis, Accenture Strategy 2017

Connected Devices (IoT)
- Real-time operational prognostics
- Intelligent data and capacity management
- Interoperability (new and legacy systems)

Big Data Analytics
- Mining data - Informing the product life cycle
- Improved product/situational awareness
- Validation and Provence of data

Digital thread/ Digital twin
- Integration and validation of products and processes through data
- Fundamental to all aspects of aerospace

Virtual Certification
- Consistency of data architecture
- Fidelity of data to achieve virtual certification
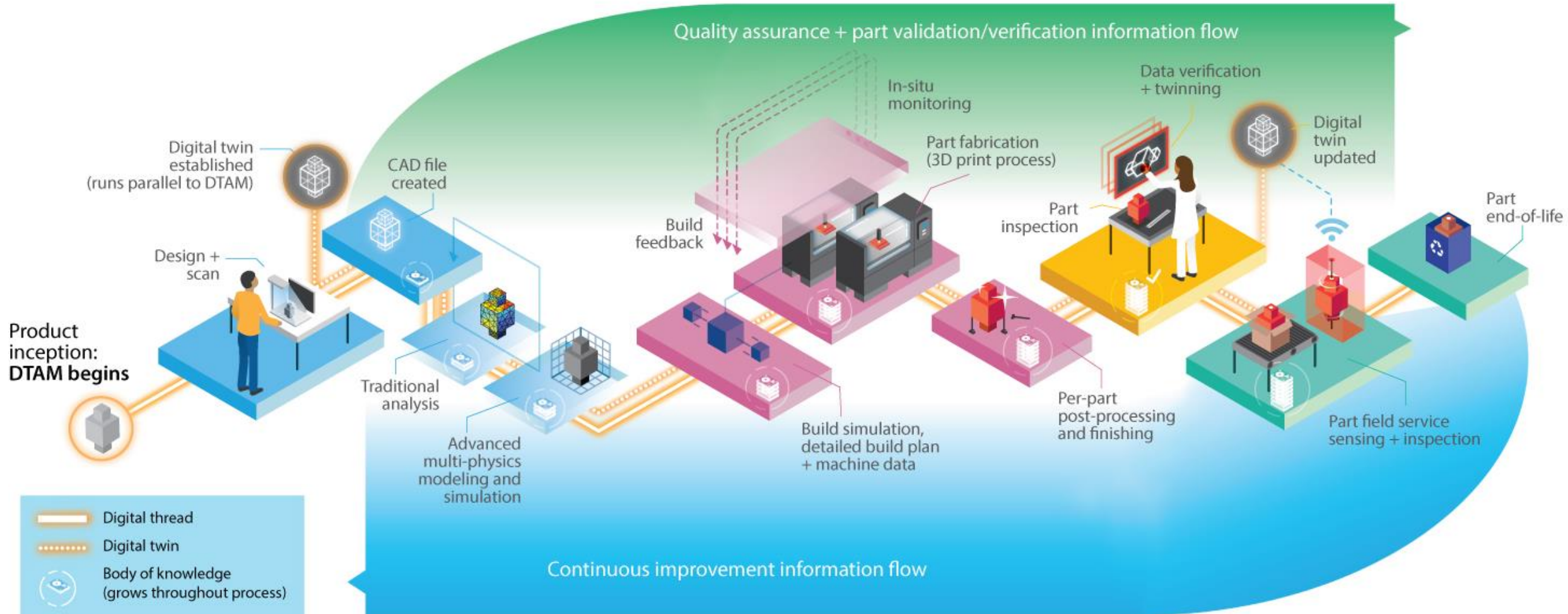- Probabilistic quantification methods

SCAN/DESIGN + ANALYZE
BUILD + MONITOR
TEST + VALIDATE
DELIVER + MANAGE

Quality assurance + part validation/verification information flow

Data verification + twinning

In-situ monitoring

Part fabrication (3D print process)

Digital twin established (runs parallel to DTAM)

CAD file created

Digital twin updated

Part end-of-life

Part inspection

Build feedback

Design + scan

Product inception: **DTAM begins**

Traditional analysis

Advanced multi-physics modeling and simulation

Build simulation, detailed build plan + machine data

Per-part post-processing and finishing

Part field service sensing + inspection

Digital thread

Digital twin

Body of knowledge (grows throughout process)

Continuous improvement information flow

CONCLUSION

While the cooperation is not inherent in the highly competitive aviation industry, the adoption of standards in essential. Connected aviation will likely drive many opportunities for industry to adopt common development practices and policies including:

- Data Formatting
- Application programs interfaces (APIs)
- Cybersecurity standards
- Communication protocols
- Requirements for availability, latency and redundancy
- Data policies
- Network Segregation
- Predictive Maintenance
- Virtual Certification

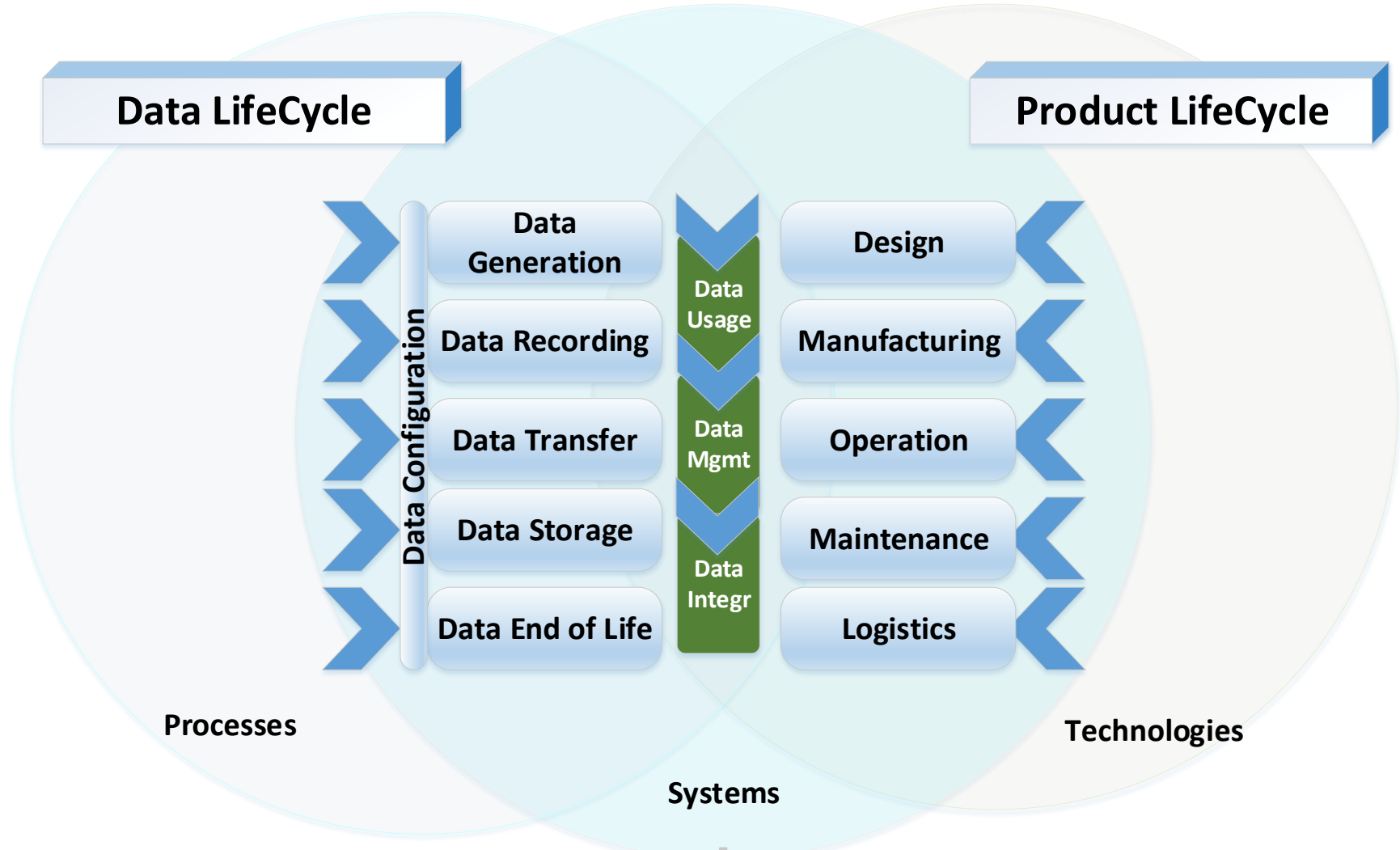**28**th Annual **INCOSE**
international symposium

Washington, DC, USA

July 7 - 12, 2018

www.incose.org/symp2018

Appendix

Data LifeCycle

Product LifeCycle

Data Configuration

Data Generation
Data Recording
Data Transfer
Data Storage
Data End of Life

Data Usage
Data Mgmt
Data Integr

Design
Manufacturing
Operation
Maintenance
Logistics

Processes

Systems

Technologies

Common Data Attributes

Data Security
- Classification
- Confidentiality
- Integrity
- Availability

Regulatory/Legal
- ITAR/Export
- IP
- Data Ownership
- Regional Laws

Data Authenticity
Data Safety

Data Schemas (New/Old)
Data Format