

MBSE and Partner Collaboration

Improving Product Development While Protecting Intellectual
Property



Who is Bob Deragisch (a brief bio)

Bob Deragisch is employed by Parker Aerospace (over 35 years), and is currently the Aerospace Group's Director of Engineering and Infrastructure Services. In addition, Bob is the Enterprise Architect for the Group, responsible for acquisition, implementation, deployment and support of all engineering tools and processes, and integration of all business systems, across the \$US 2.3 billion operating segment of Parker-Hannifin.

Bob is also the director of eBusiness initiatives for the Group, with an emphasis on collaboration with customers, suppliers, and partners.

Bob received his Master of Arts in Organizational Leadership from Chapman University in California, after his undergraduate work in Math, Physics, Computer Science, and Organizational Development.

In April, 2014, Bob was elected President of COE, the independent user group of Dassault Systèmes solutions in North America. That same week, Bob was also honored to be awarded membership in the COE College of Fellows.

Bob received the CAD Society "Joe Greco Community Award" in 2015 for ongoing efforts to drive real benefits to the COE organization through interaction with other CAD user communities.

Bob is also a founding member of ASSESS (Analysis, Simulation & System Engineering Software Strategy), focused on "Expanding the use and benefit of Model Based Simulation, Analysis and Systems Engineering". See the ASSESS home on LinkedIn for more information.

Married for over 37 years, Bob and Debbie live approximately 5 miles from the home where Bob grew up in Orange County, California. They have two grown children – an airline pilot and a high school teacher – an incredible grandson and brand new (2 months old) beautiful granddaughter.

Agenda

- Parker Aerospace – an overview
- How does this relate to the subject at hand?
- My “Collaboration-Protection” solution

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Parker Hannifin Corporation



Corporate headquarters • Cleveland, Ohio

Parker Hannifin Corporation



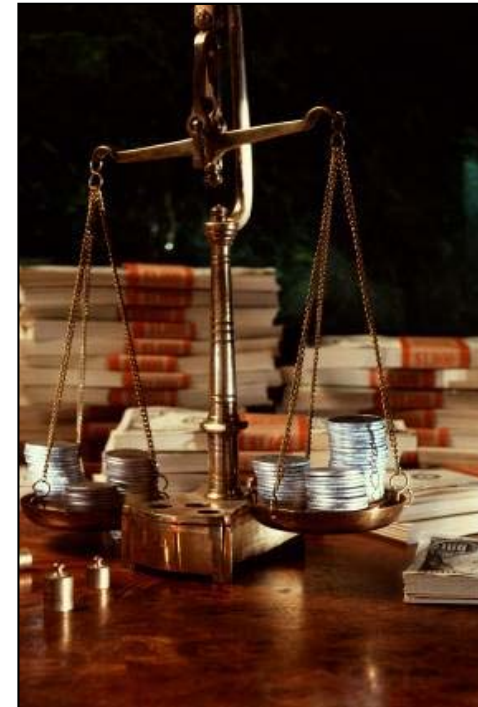
A worldwide, diversified manufacturer of motion and control technologies and systems

- Centrally led, decentralized company
- Broad market exposure
- 323 facilities
- 57,500 employees

Updated 03/23/15

Financial strength

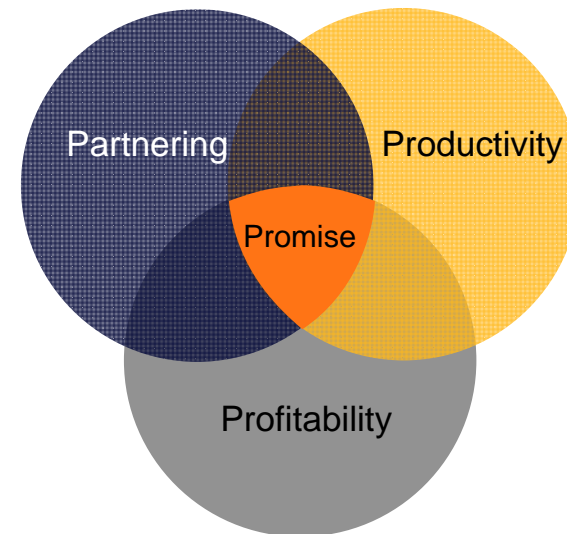
- **Fortune 300**
- **Dividend payout to shareholders increased each year since 1957**



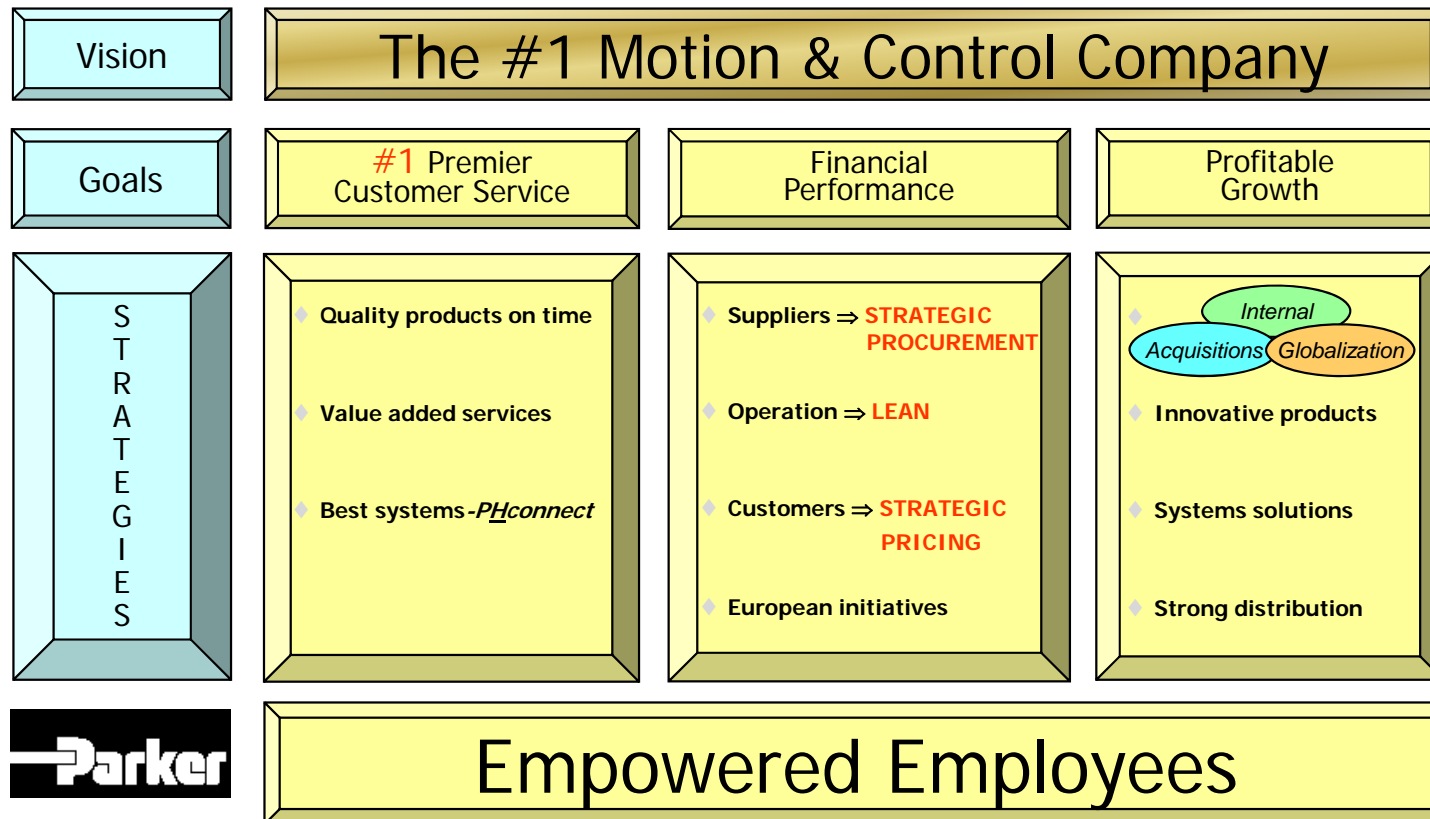
Updated 06/29/15

The Parker brand promise

Parker Hannifin is the global leader in motion and control technologies, partnering with its customers to increase their productivity and profitability.



Parker's Win strategy





Parker Aerospace

Parker Aerospace

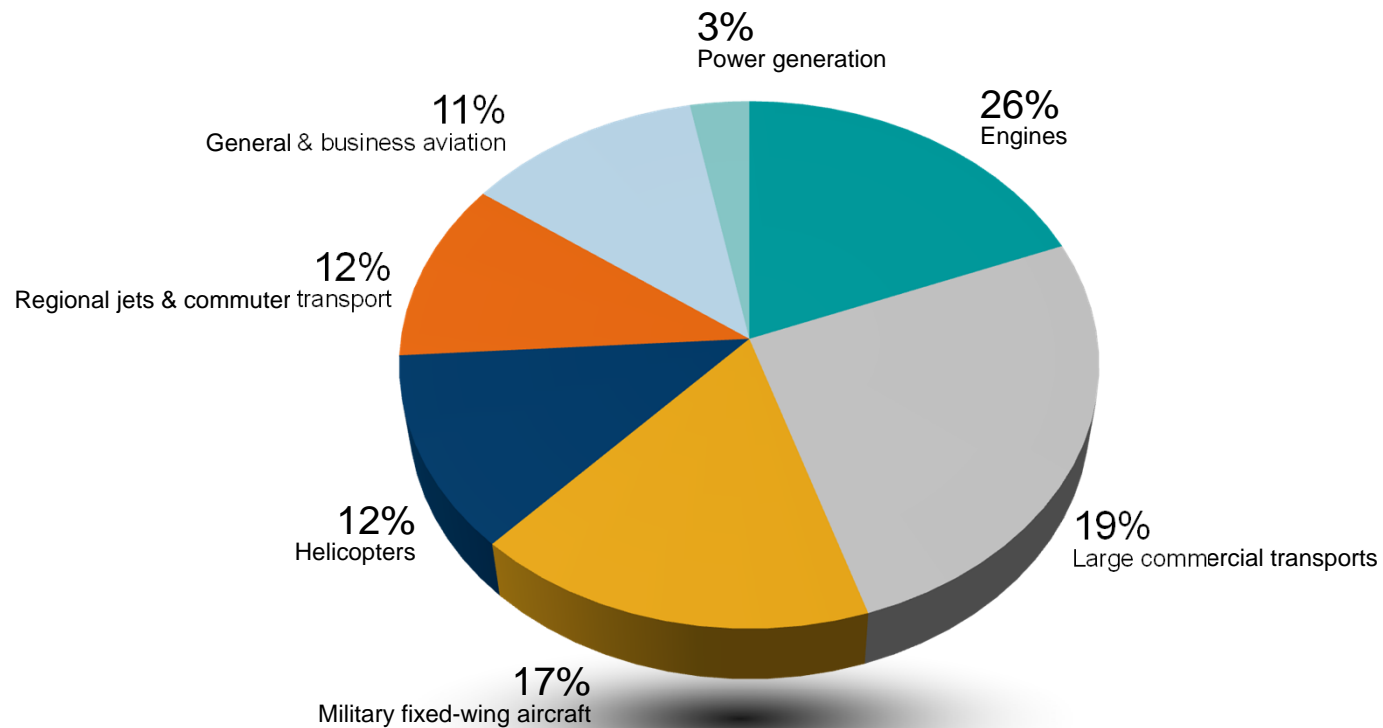


Global leader in flight control, hydraulic, fuel and inerting, fluid conveyance, thermal management, and engine systems and components

- \$2.2 billion in annual sales
- 6,100 employees
- Seven divisions, 46 worldwide locations

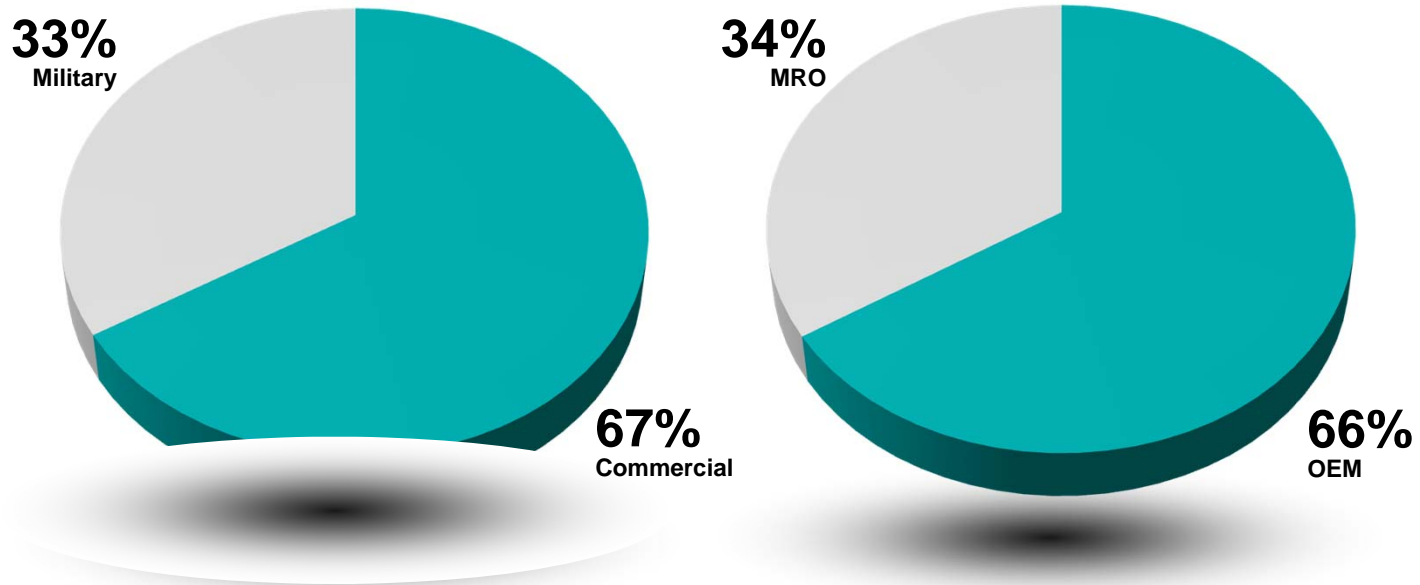
Updated 08/04/15

Our markets, a balanced portfolio



Fiscal year 2014: 07/01/13 – 06/30/14

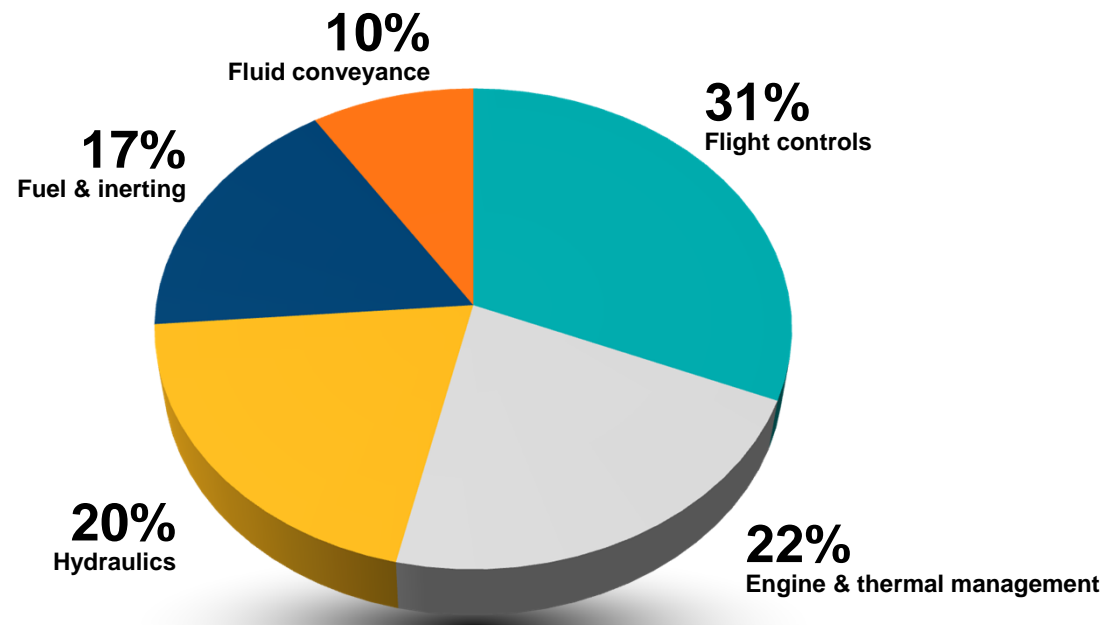
Our business split



Business strength and stability based on a diverse portfolio

Fiscal year 2014: 07/01/13 – 06/30/14

Parker Aerospace: a broad range of system technologies

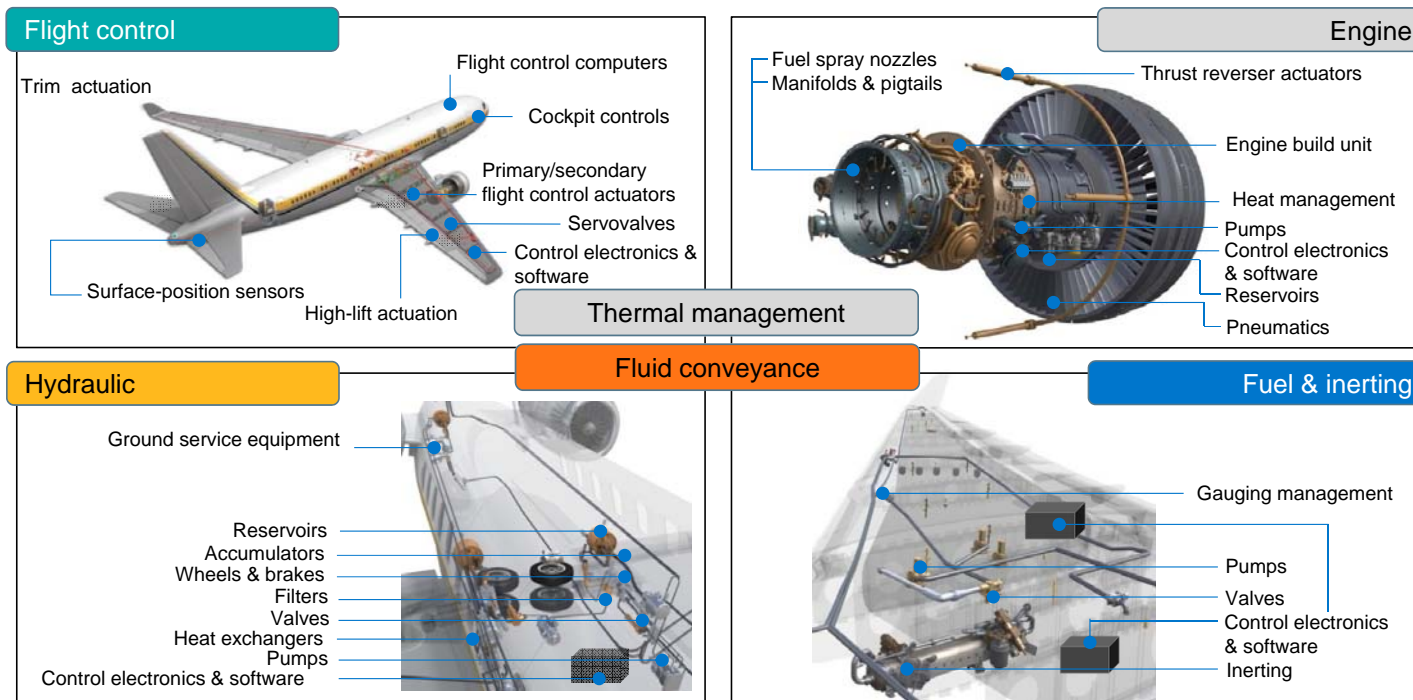


Synergy of technologies, experienced solutions provider

Fiscal year 2014: 07/01/13 – 06/30/14

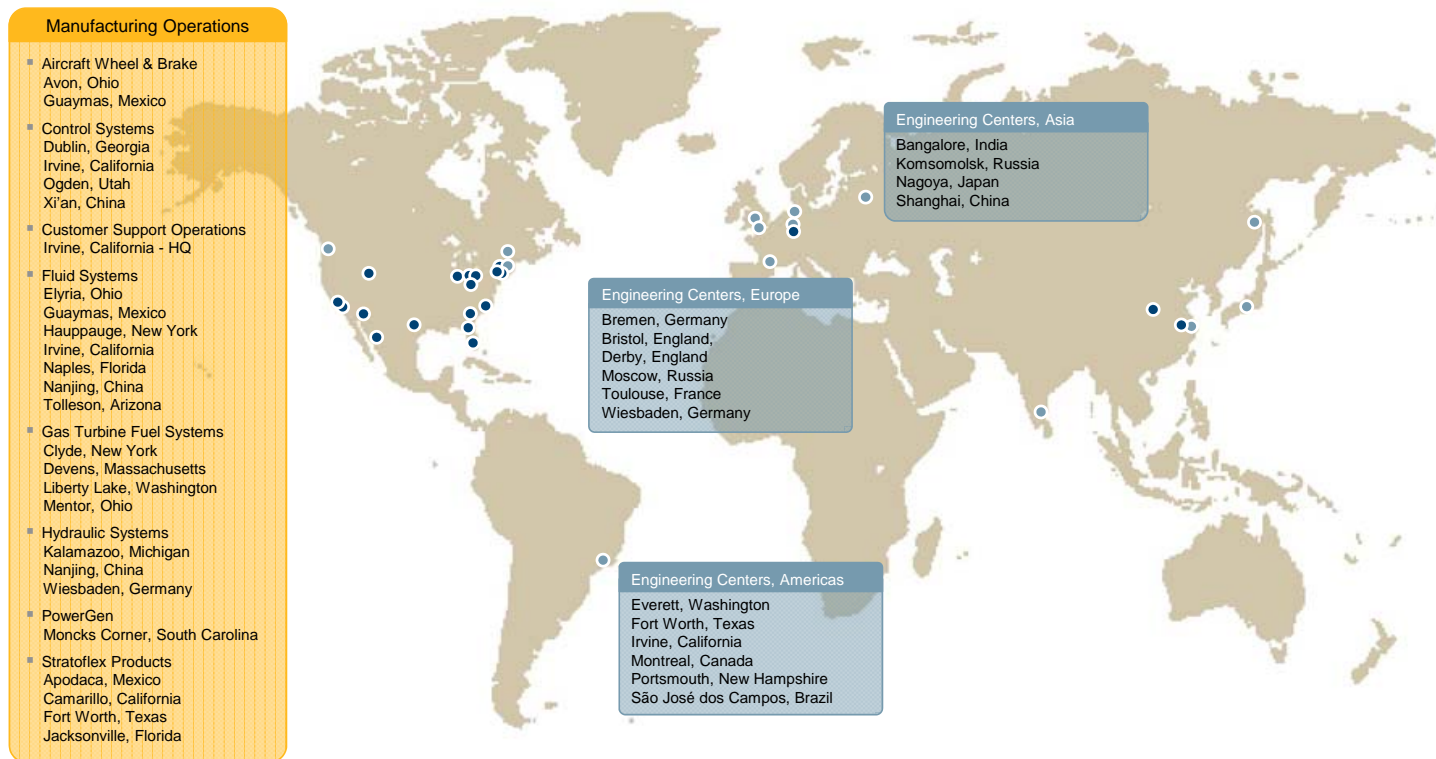
Broad systems knowledge & experience

Sharing best solutions across all platforms



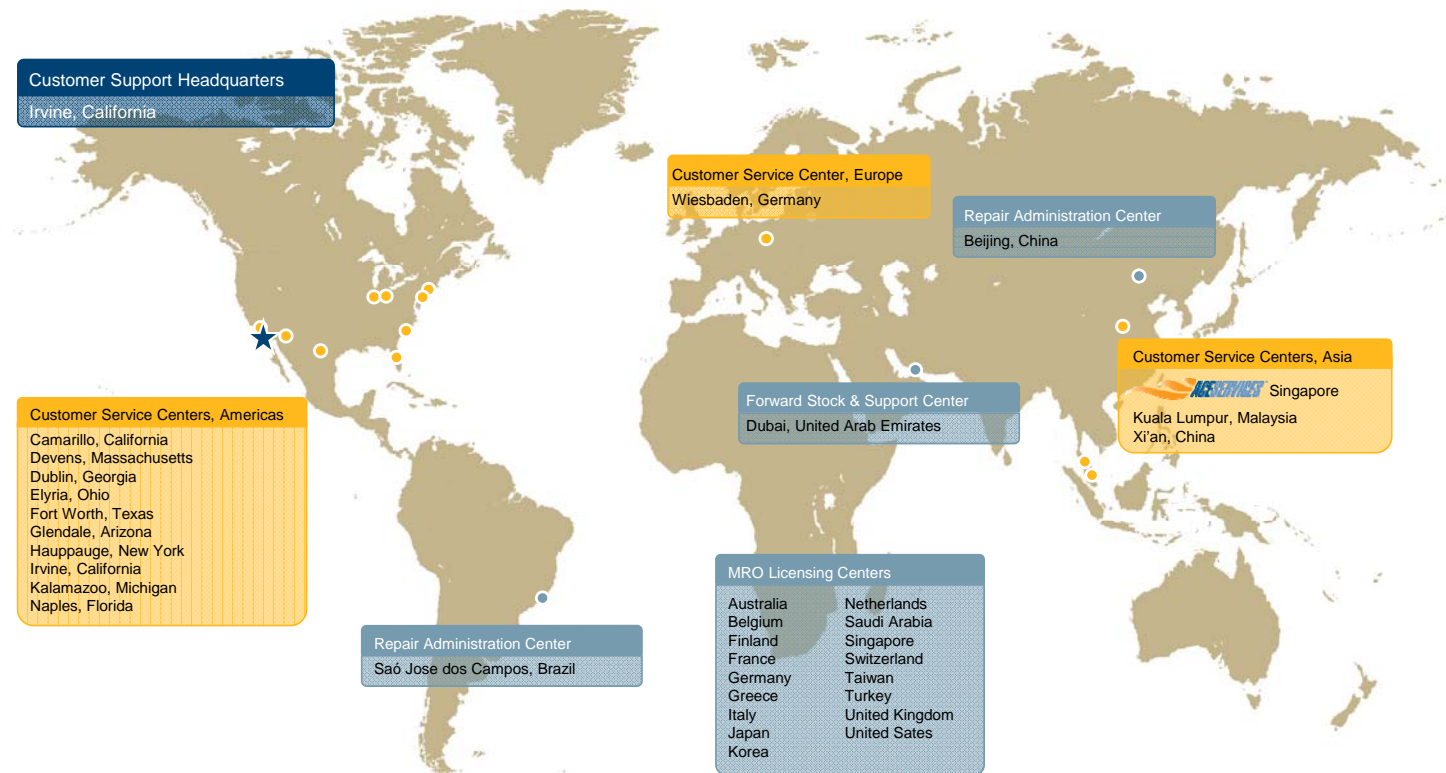
Worldwide divisions and facilities

A global organization



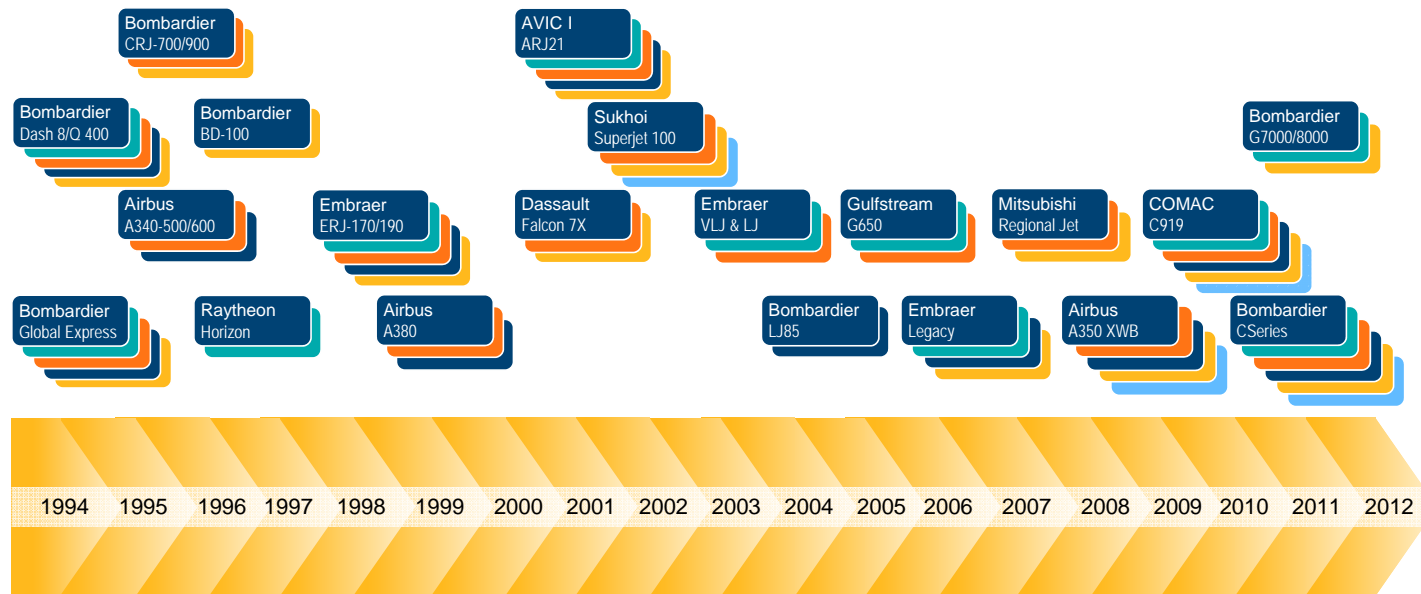
Worldwide customer service centers

Strategic locations for lower cost, faster service

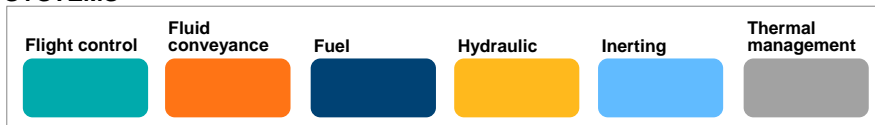


Commercial airframe systems experience

Industry leadership, extensive pedigree



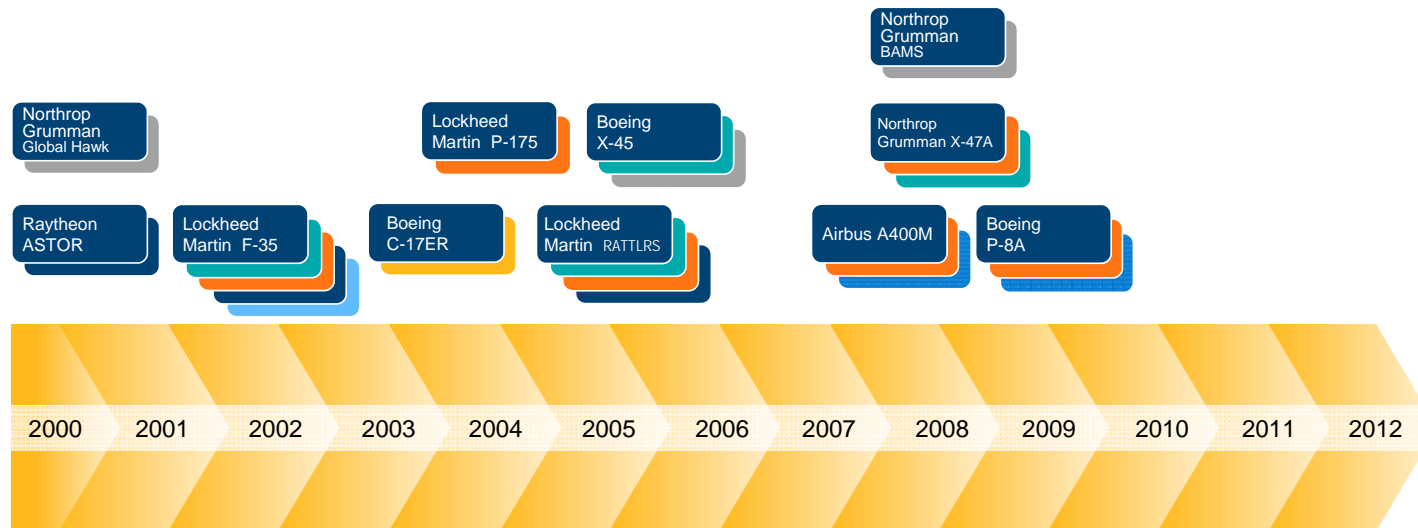
SYSTEMS



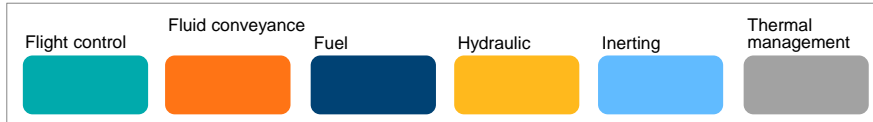
Unmatched pedigree

Military airframe systems experience

Partnered with industry leaders

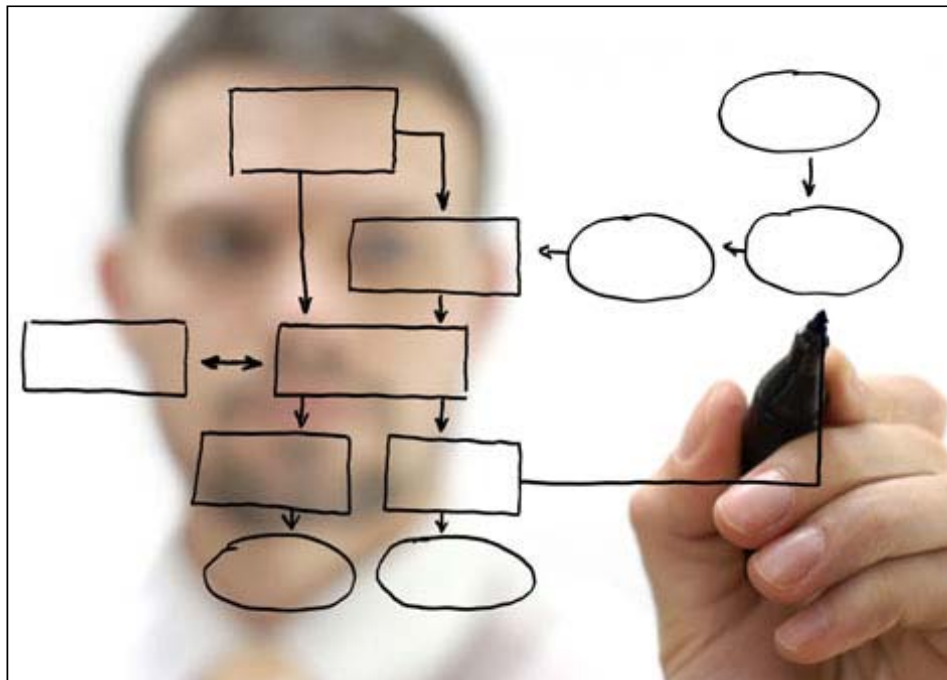


SYSTEMS



*Systems experience,
affordability, reliability*

Common, standardized, model-driven processes and functions

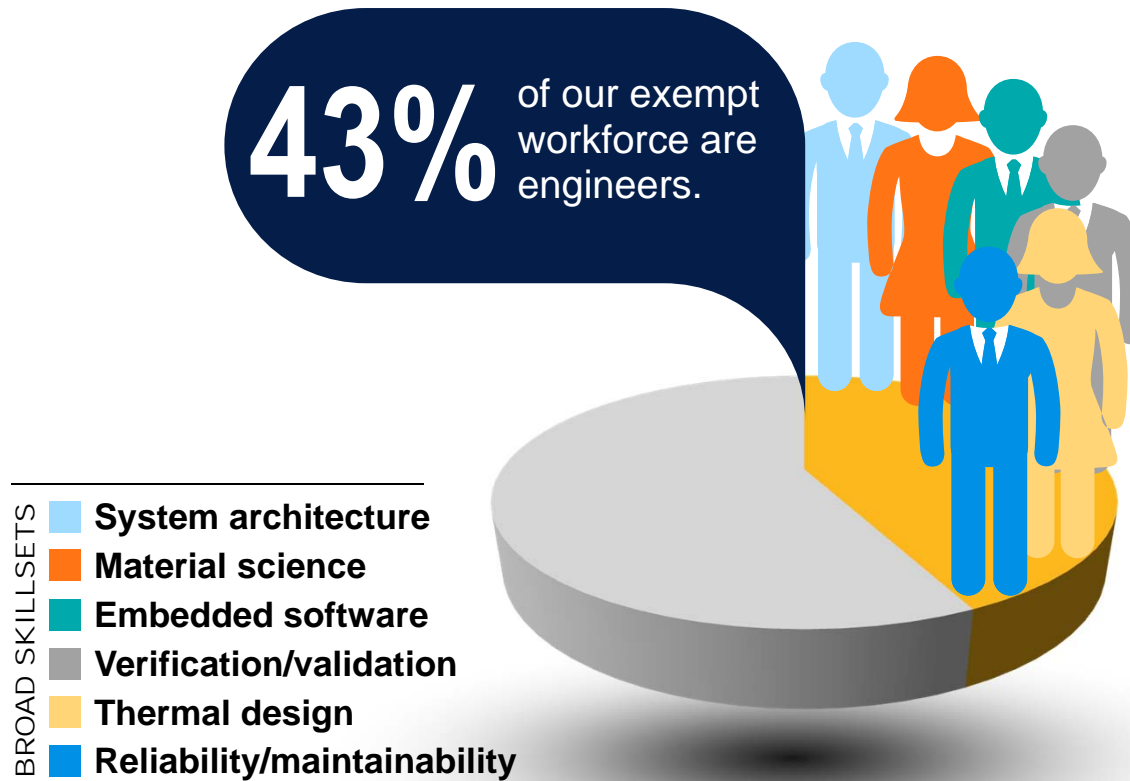


- Program management
- Engineering
- Supply chain management
- Quality

All on a foundation of LEAN

Parker Aerospace engineers

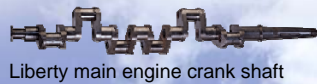
Engineering is a core competency



Engineering highlights

A brief history of Parker Aerospace's engineering accomplishments

1920s & '30s
The growing
aerospace industry



Ram air turbine
pump for
Curtis NC-4



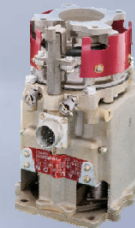
Fuel
primer



DC-3
deicer pump



Lycoming VO
engine gerotor



B-52 level
control valve



1920

1930

1940

1950

1927
The Spirit of St. Louis



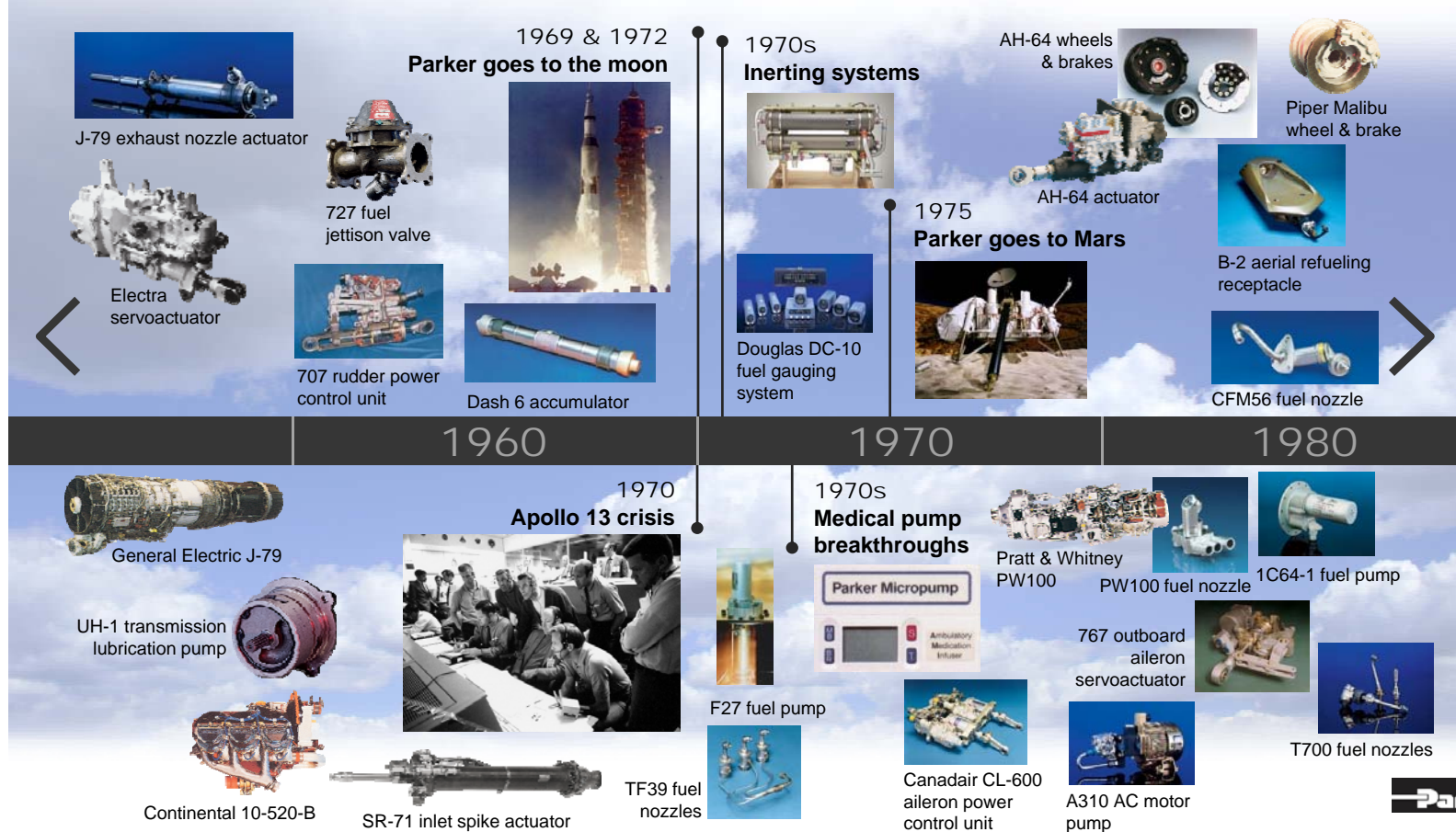
Army/Navy standard fitting



GE1-16 oil pump

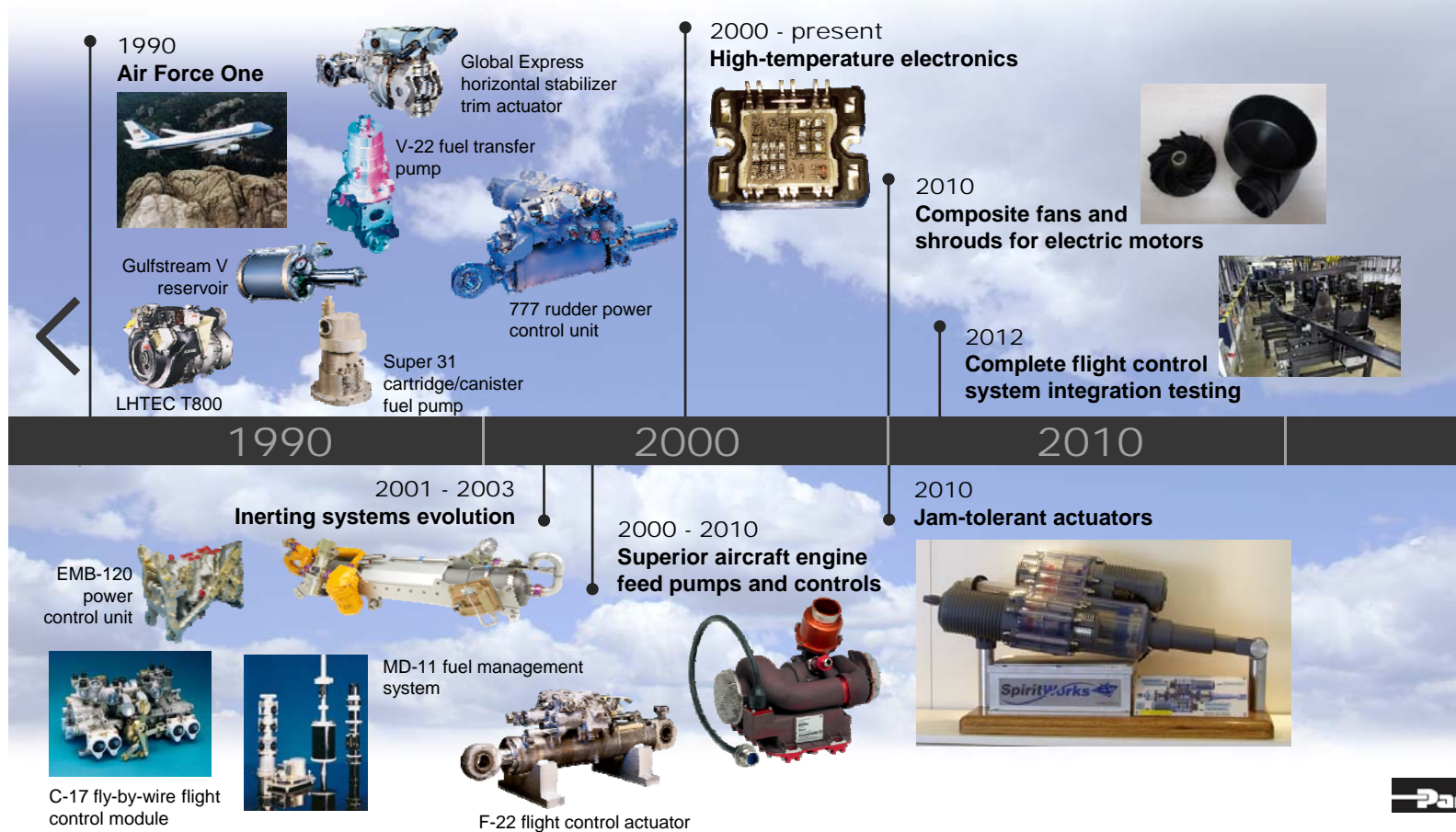
Engineering highlights

A brief history of Parker Aerospace's engineering accomplishments



Engineering highlights

A brief history of Parker Aerospace's engineering accomplishments



Lean Product Development (LPD)



Meeting Customers' Needs through Innovation



- **More electric aircraft**
- **Flight control systems**
- **Fuel cell systems**
- **Fuel tank inerting systems**
- **Hydraulic systems**
- **Thermal management systems**

Growing trends impacting aerospace



Fly-by-wire flight control systems

Latest control systems electronics technologies

Inceptor interface modules (IIMs)

- Central hydraulic power
- Data concentrator
- Flight deck to PFCC interface

Remote electronics units (REUs)

- Single REU for each primary actuator or
- Dual-channel REU plus motor controller circuits

Motor control electronics (MCEs)

- Flaps control
- HSTA control
- EBHA control

Alternate flight control unit (AFCU)

Provides independent “stick to surface” control path

- Controls all primary surfaces
- Contains simplified control laws
- Allows for trimming in each axis



Number-one supplier in the market

Flight Control Systems Integration Labs

Only Supplier to Offer this Capability

Features

- Fly-by-wire, stick-to-surface
- Fully integrated
- First supplier in history to provide aircraft flight control integration

Benefits

- Reduces cost
- Reduces development time
- Reduces overall risk



Integrating cockpit controls, electronics, and actuation

Multi-function Fuel Cell System



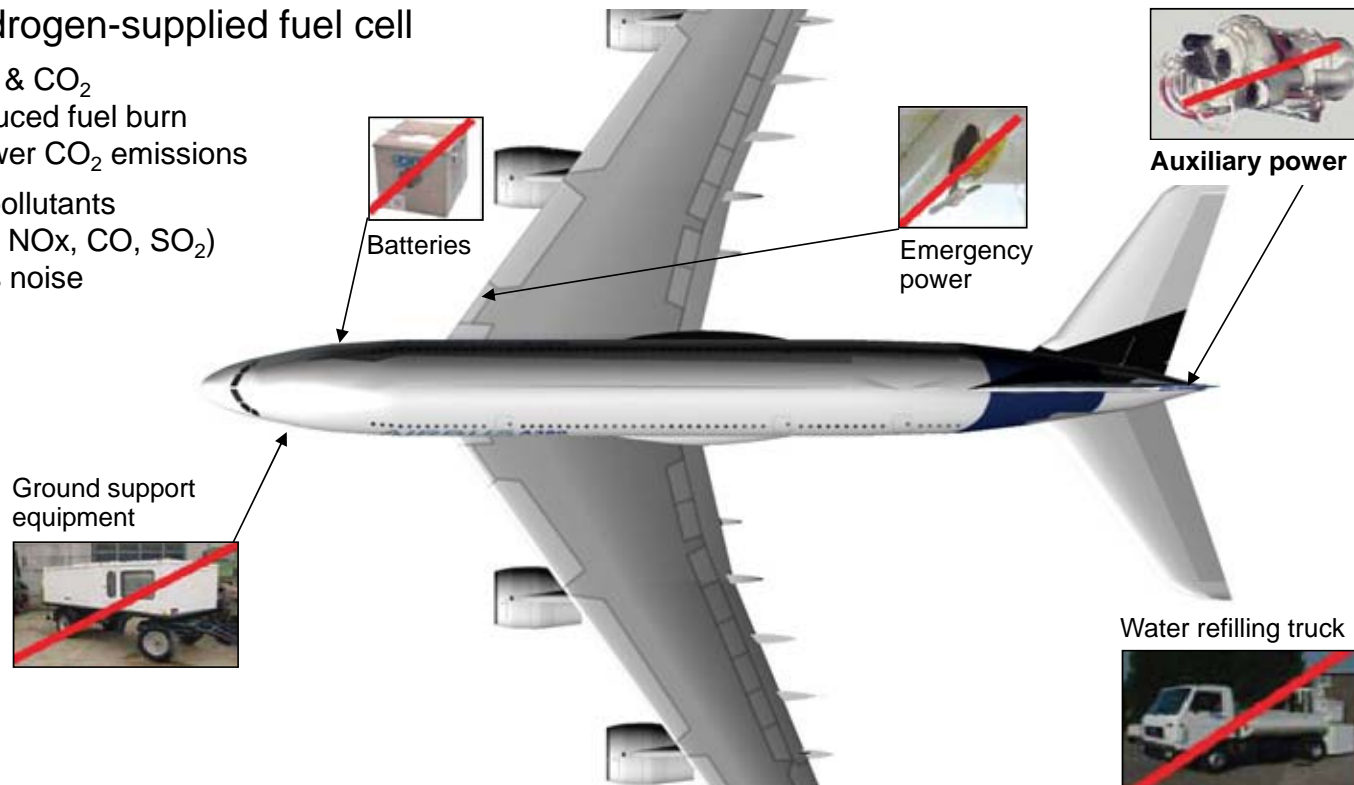
*Advisory Council for Aeronautics Research in Europe

Multi-function fuel cell system

Replaces and supports multiple functions

Hydrogen-supplied fuel cell

Fuel & CO₂
Reduced fuel burn
= lower CO₂ emissions
No pollutants
(HC, NO_x, CO, SO₂)
Less noise



Serving the world's aerospace leaders



Customers are central

Our customers

- Are the most important people in our business.
- Are not dependent on us—we are dependent on them.
- Are not interruptions of our work—they are the purpose of it.
- Do us a favor when they call—we are not doing them a favor by serving them.
- Are a part of our business—not outsiders.
- Are not cold statistics—they are flesh-and-blood human beings with feelings and emotions like our own.
- Are not there to argue or match wits with.
- Bring us their wants—it is our job to fulfill those wants.
- Are deserving of the most courteous and attentive treatment we can give them.
- Are the lifeblood of our business.





Parker Aerospace

**We do not make aircraft,
we just make them fly!**

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- Parker Aerospace – an overview
- How does this relate to the subject at hand?
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Leveraging partnerships

- Up and down the supply chain
- None of us can do it alone
- MBSE is how we communicate



How to collaborate – one opinion

- In a word...

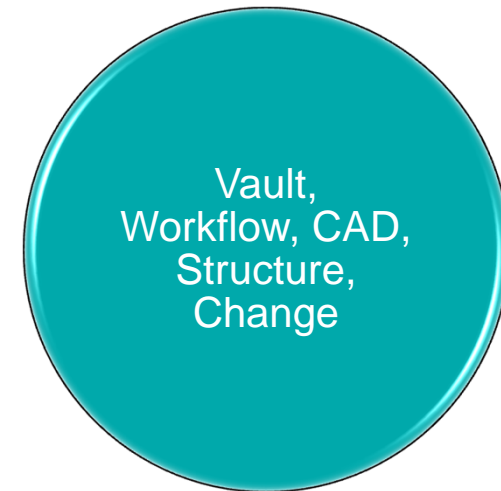


STANDARDS

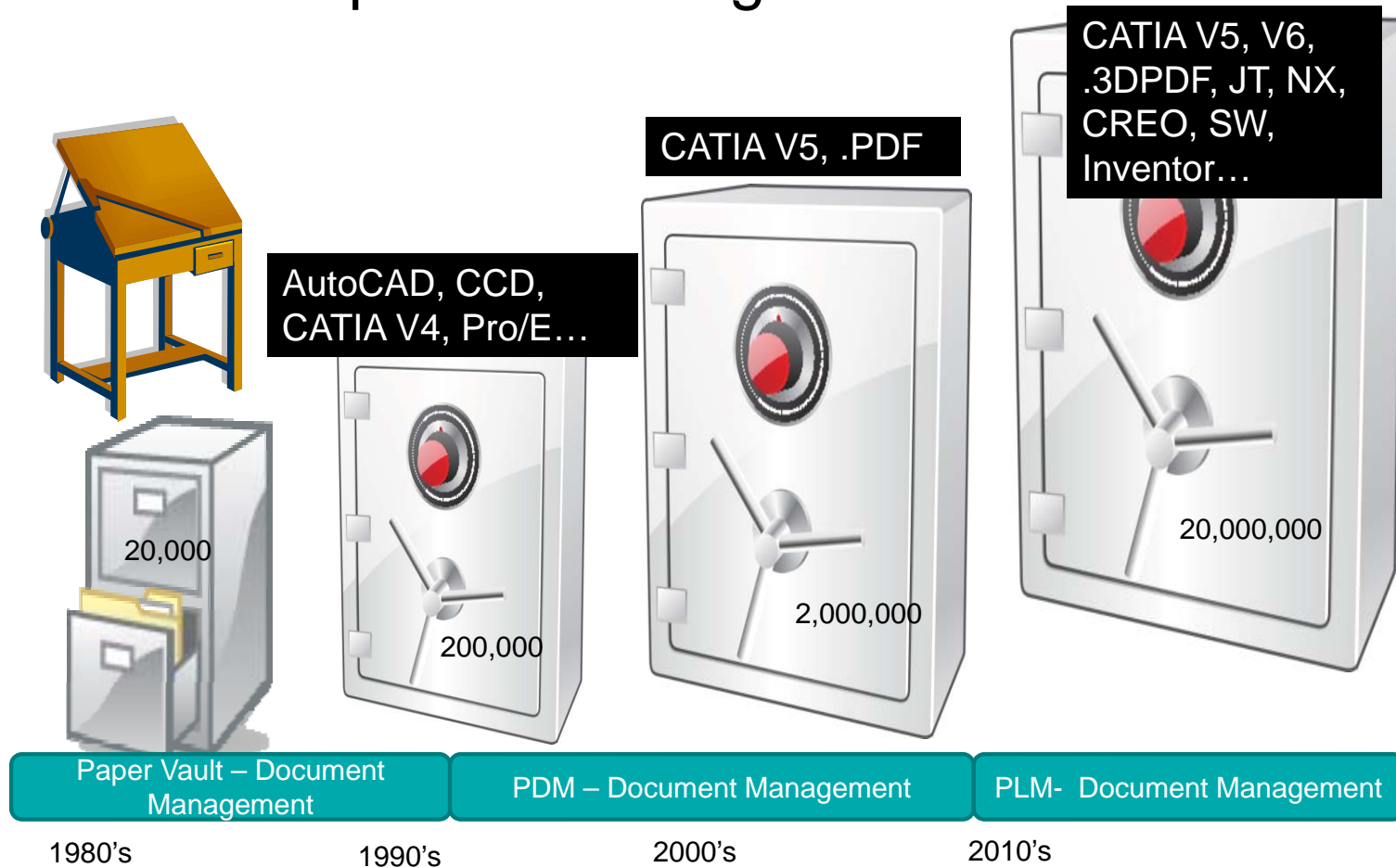


Standards – our way forward

- Where we have come – the foundation
 - Document management
 - CAD management
 - Workflow
 - BOM management
 - Change management

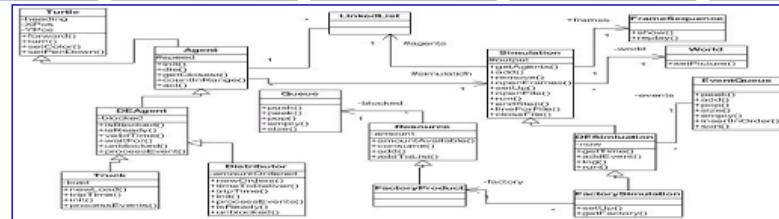


One example of evolving standards...



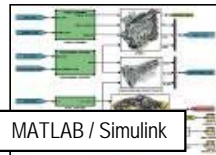
Model Driven Development – Today's Challenge, Tomorrow's Opportunity

Tools and data are distributed across the extended enterprise in many different systems



Integration: Processes and workflow management
Alignment: with Engineering, Manufacturing and Service After Sales

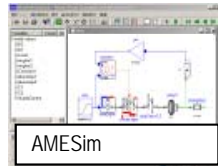
Dynamic System Modeling



VR Simulation?



Dynamic System Modeling



Digital Mockup



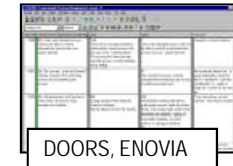
Digital Manufacturing



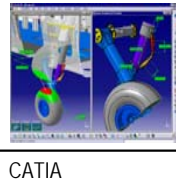
Visualization Modelling



Requirements Modelling



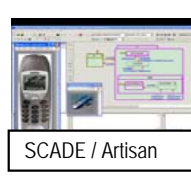
Kinematic Modelling & Simulation



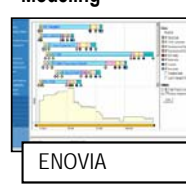
Finite Element Analysis



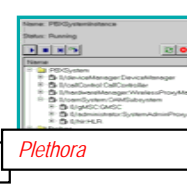
SW / FW Modelling



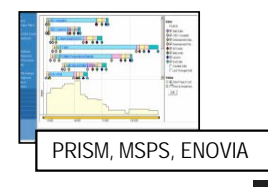
Product / Portfolio Modeling



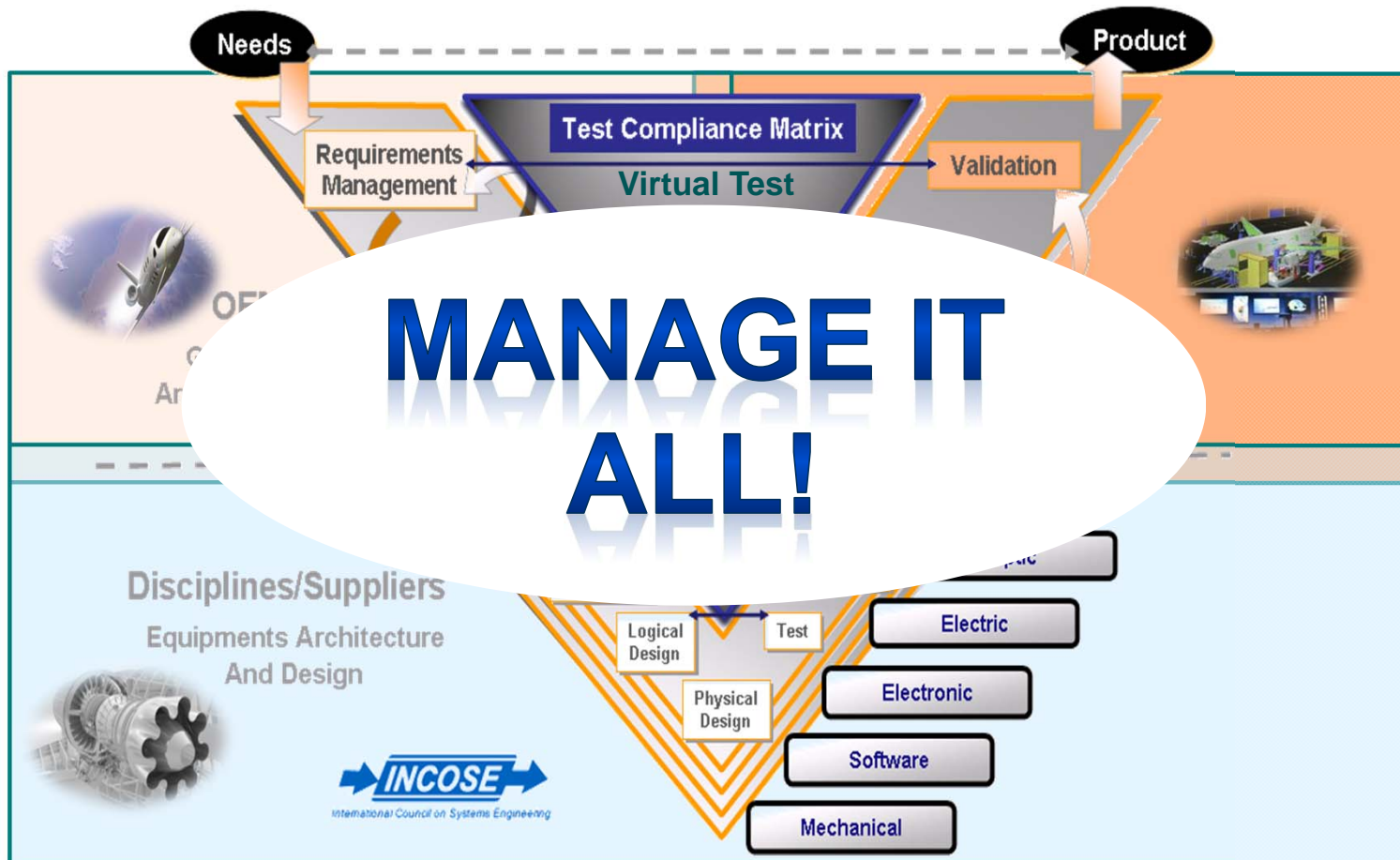
Validation & Verification



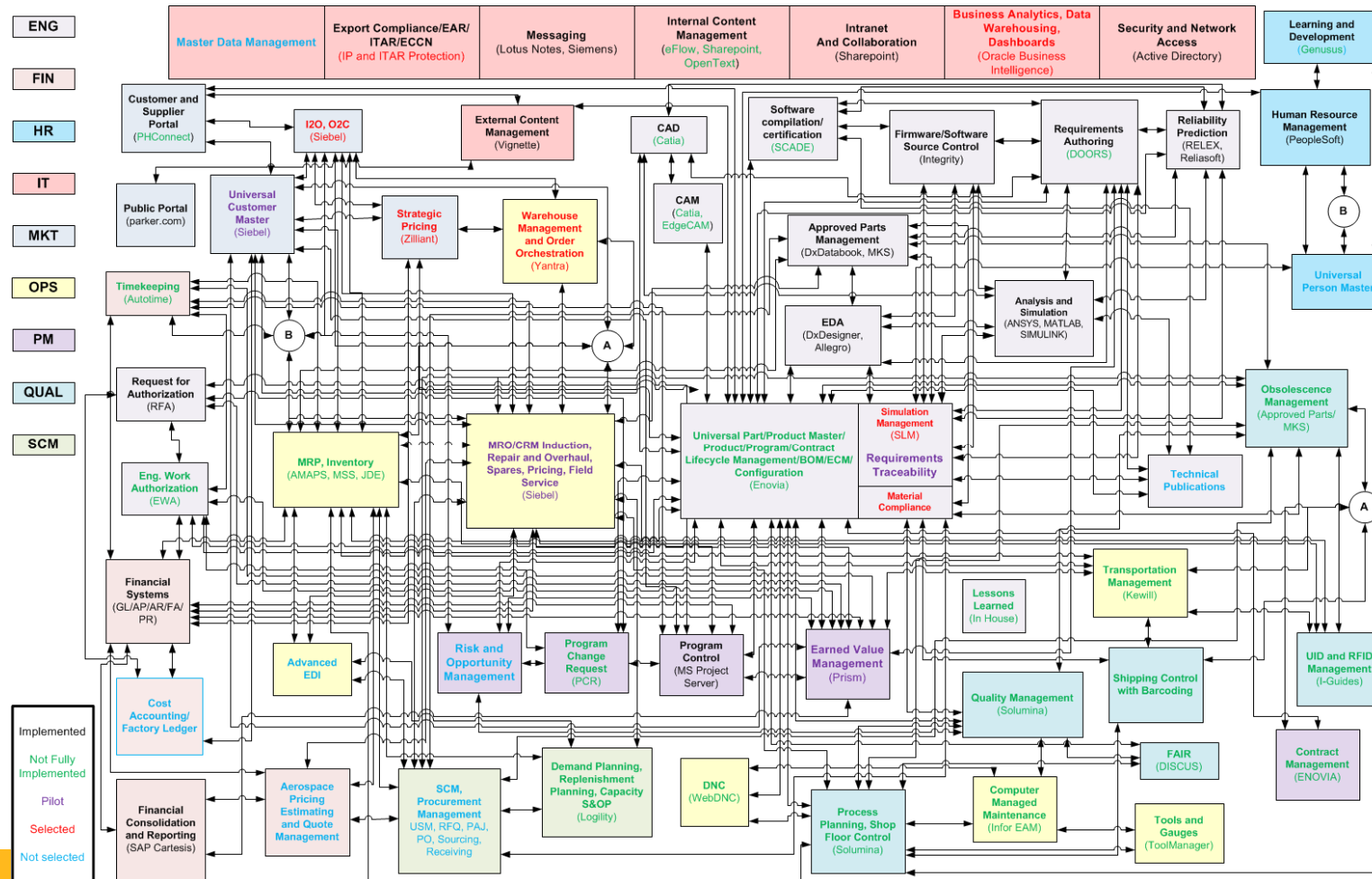
Program Management



MBSE | Objectives

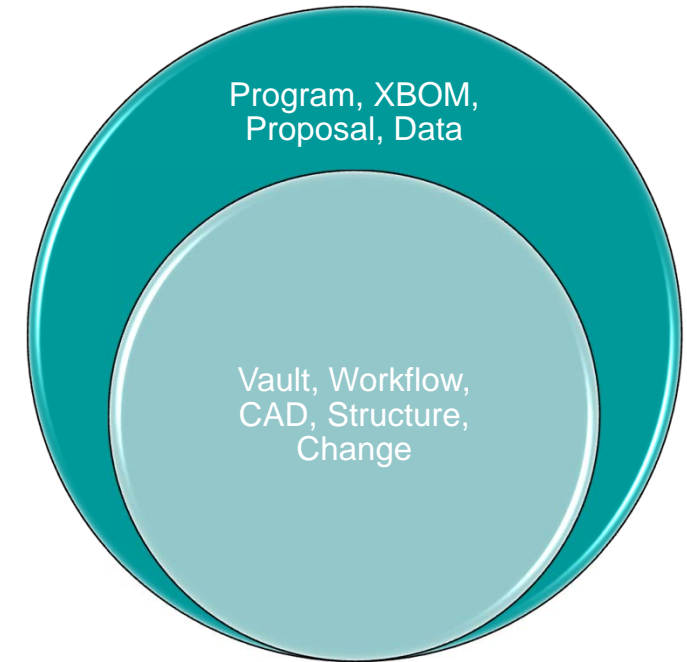


Without a Roadmap, with no standards, this led to....



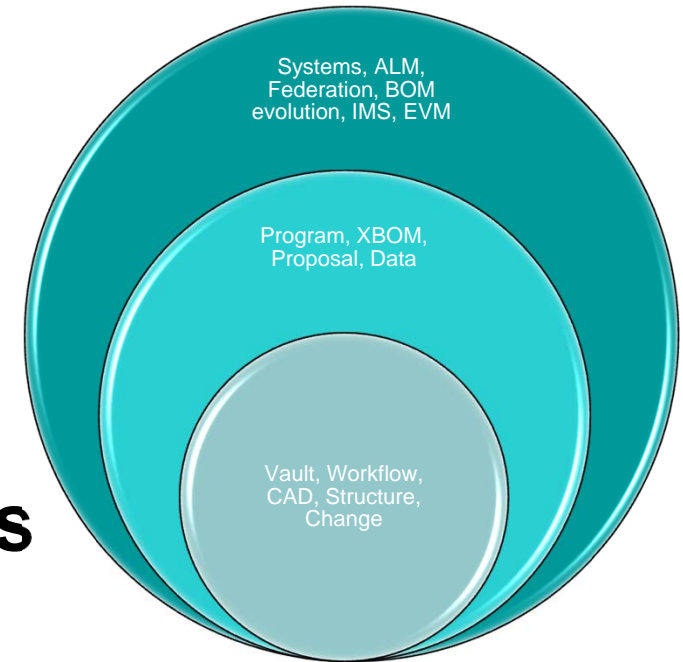
Where we are now

- Program management
- xBOM management
- Proposal management
- Loosely coupled
- Data management



Where we 'NEED TO GO'

- Systems management
- ALM
- Federated between companies**
- BOM *evolution* management
- BOS – Bill of Substance
- Resource loaded schedules
- Earned value management



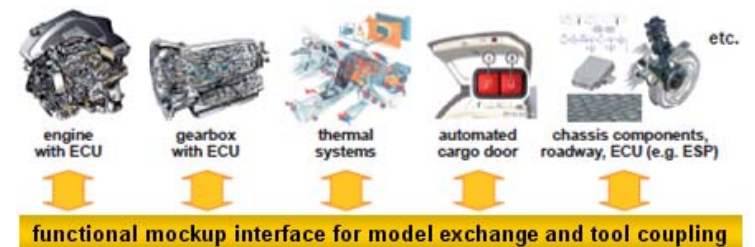
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In a word (okay, an acronym)

FMI

Functional Mockup Interface



FMI – Why it matters

Special thanks to

Dr. John Batteh

Vice President - Engineering Services, Modelon Inc.

Mr. Edward Ladzinski

Owner, Ladzinski Consulting

For educating ME on FMI!

Coexistence



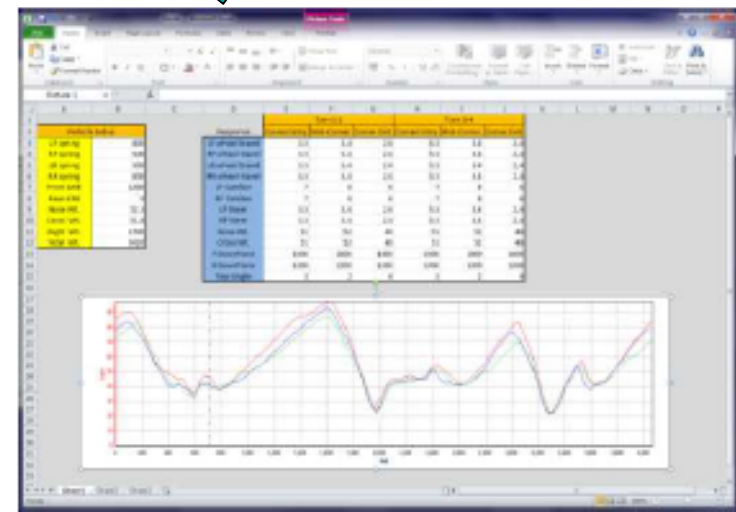
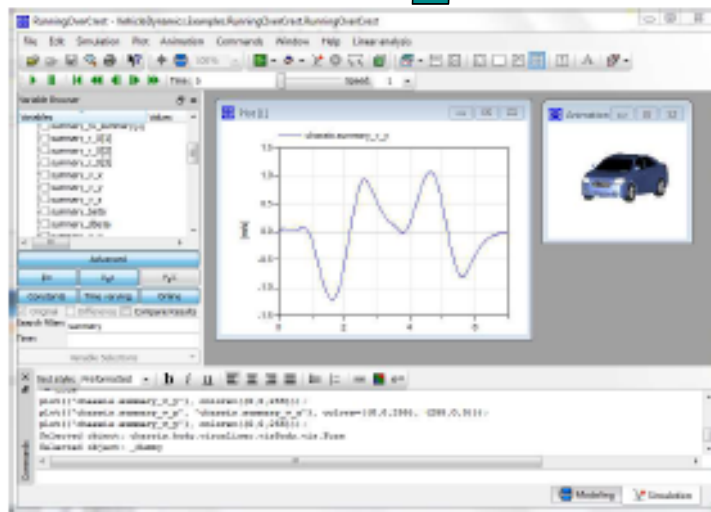
- Multiple tools are a reality
- Standards-based modeling (Modelica, SysML) and toolchain (FMI) bring value to end user and to the business
 - More models
 - More users
 - **NOT** more budget
- FMI enables new MBSE workflows
 - Couple models in new ways
 - Deploy models across multiple platforms
- It's NOT about translation to a neutral format (STEP)!

FMI can help us get there

MBSE – a Perspective

Creating models
CAE tool knowledge

Engineers using models
Non-specialist knowledge



Excel



Why FMI?

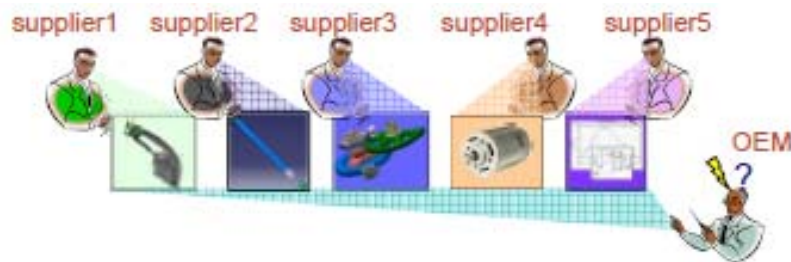


- Due to **different applications**, models of a system often have to be developed using **different programs** (modeling and simulation environments).
 - In order to simulate the system, the different programs must somehow interact with each other.
- The **system integrator** must cope with simulation environments from many suppliers.
- This makes **model exchange** a necessity. No current standardized interface.
- Even though Modelica & SysML are “tool independent”
 - These cannot be used as a standardized interface for model exchange
 - Not all tools use as the same language!

Proposed solution

- FMI!

As a universal solution to this problem, the Functional Mockup Interface (FMI) was developed by MODELISAR, and is now maintained by the Modelica Association



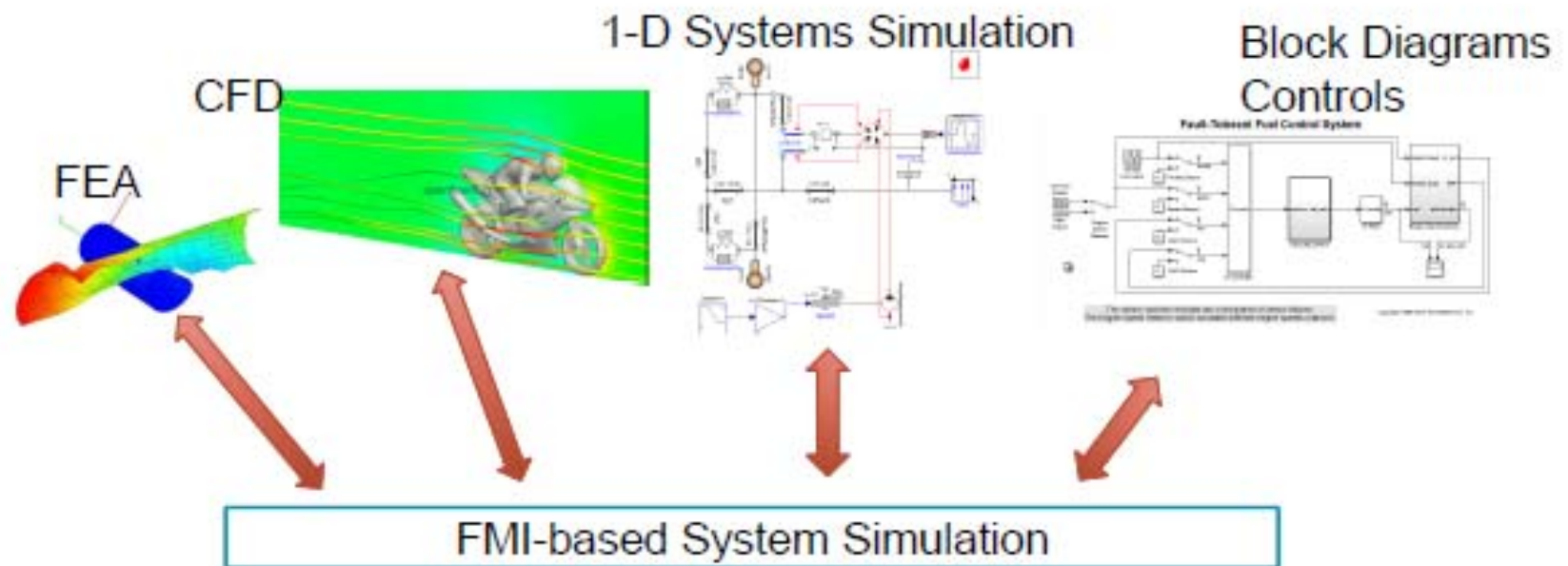
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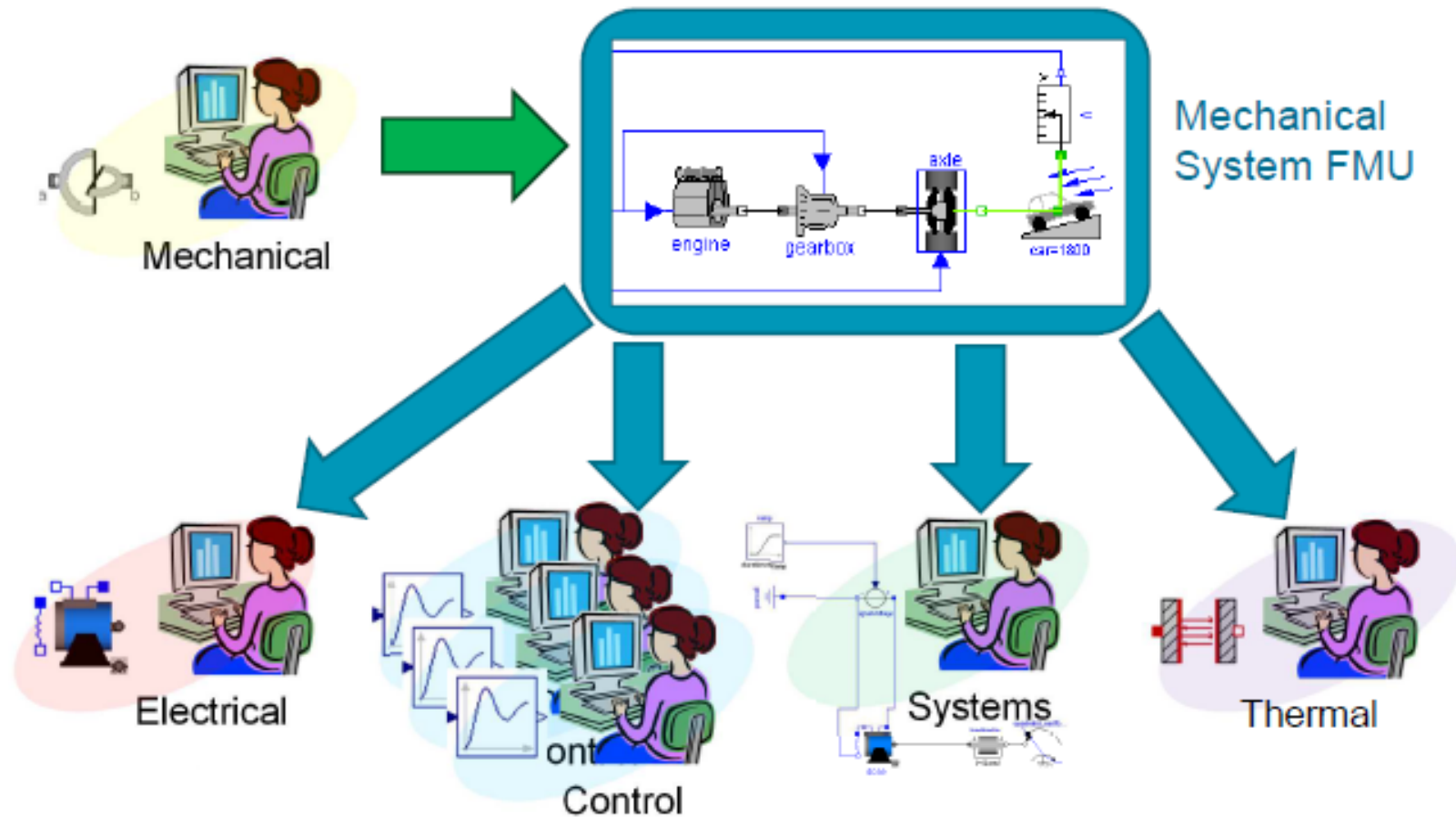


Regardless of the tools (if compatible!)

- Combine different modeling platforms for coherent simulation
 - Physical models, 1D-3D
 - Controls



Model deployment





History of FMI

- FMI for model exchange V 1.0 released in Q1 2010
- FMI for co-simulation V 1.0 released in Q4 2010
- First beta-version of unified FMI V 2.0 in Q4 2011
- Stewardship of FMI-standard transferred from Modelsar EU-project to Modelica association: 2012
- Release of FMI 2.0 in July 2014
 - Ongoing implementation by at least 8 tools with intensive cross-testing ongoing
 - Most Major FMI tools support FMI 2.0 by Q1 2015

The following modeling and simulation environments support or plan to support FMI (alphabetical list):

Compatibility Table

[Generated on 2015-08-20 09:01 UTC](#)

Legend

- Planned → Not available yet
- Available → No CrossCheck results submitted
- Available 12 → Passed CrossCheck, 12 FMUs exported or imported, click for results

More information about the generation of the CrossCheck results can be found in the [Rules document](#) and the [Implementation notes](#).

<https://www.fmi-standard.org/tools>

		≡ ModelExchange		🔗 CoSimulation		
Tools supporting FMI	FMI Version	Export	Import	Slave	Master	Notes
Adams	FMI_2.0	Planned	Planned	Available	Available	High end multibody dynamics simulation software from MSC Software
	FMI_1.0			Available	Available	
Amesim	FMI_2.0			Planned	Available 37 ▾	Integrated simulation platform for the analysis of multi-domain mechatronics systems by Siemens PLM Software
	FMI_1.0	Available 17 ▾	Available 27 ▾	Available 24 ▾	Available 62 ▾	
ANSYS SCADE Display	FMI_1.0	Available		Available		SCADE Display facilitates embedded graphics, display and HMI development and certified code generation for safety-critical displays from ANSYS .
ANSYS SCADE Suite	FMI_1.0	Available		Available		SCADE Suite is a model-based development environment with certified code generation for safety critical embedded applications from ANSYS .
ANSYS Simplorer	FMI_1.0		Available 35 ▾	Planned		ANSYS Simplorer is a multi-domain, multi-technology simulation program from ANSYS .
ASim - AUTOSAR Simulation	FMI_1.0	Available		Available		AUTOSAR product from Dassault Systèmes
@Source	FMI_1.0	Available				Simulink via @Source
AVL CRUISE	FMI_1.0	Planned	Available 21 ▾	Available	Available 30 ▾	Vehicle system analysis tool for the optimization of fuel efficiency, emission, performance and driveability, from office to HiL to testbed.

Tools supporting FMI	FMI Version	⇄ ModelExchange		🔗 CoSimulation		Notes
		Export	Import	Slave	Master	
Building Controls Virtual Test Bed	FMI_1.0				Available	BCVTB is a Software environment, based on Ptolemy II , for co-simulation of, and data exchange with, building energy and control systems.
CarMaker	FMI_1.0				Available 81 ▼	CarMaker is an open test- and integration-platform for MiL, SiL and HiL.
CATIA	FMI_1.0	Available 12 ▼	Available 66 ▼	Available 12 ▼	Available 57 ▼	Environment for Product Design and Innovation, including systems engineering tools based on Modelica, by Dassault Systèmes
ControlBuild	FMI_2.0			Available 14 ▼	Available	Environment for IEC 61131-3 control applications from Dassault Systèmes
	FMI_1.0	Available 18 ▼	Available	Available 32 ▼	Available	
CosiMate	FMI_1.0		Available		Available	Co-simulation Environment from ChiasTek
Cybernetica CENIT	FMI_1.0		Available		Planned	Industrial product for nonlinear Model Predictive Control (NMPC) from Cybernetica.
Cybernetica ModelFit	FMI_1.0		Available		Available	Software for model verification, state and parameter estimation, using logged process data. By Cybernetica.
DACCOSIM	FMI_2.0				Available	Master Algorithm generator & deployer from RISEGrid for a multi-OS, multi-threaded and distributed cosimulation implementing all the FMI 2.0 features.

Tools supporting FMI	FMI Version	⇄ ModelExchange		🔗 CoSimulation		Notes
		Export	Import	Slave	Master	
DS - FMU Export from Simulink	FMI_2.0	Available 14		Available 14		Simulink Coder Target developed by Dassault Systèmes for export of FMUs from Simulink.
	FMI_1.0	Available 14		Available 14		
DS - FMU Import into Simulink	FMI_2.0				Planned	FMU import into Simulink developed by Dassault Systèmes.
	FMI_1.0				Planned	
DSHplus	FMI_1.0	Planned		Available 3		Fluid power simulation software from FLUIDON
dSPACE SCALEXIO	FMI_2.0				Available	dSPACE SCALEXIO is a Hardware-in-the-Loop (HIL) integration and simulation platform from dSPACE . Please also refer to the dSPACE FMI sites for more information about the FMI 1.0 and FMI 2.0 support.
	FMI_1.0				Available	
dSPACE SYNECT	FMI_2.0				Available	dSPACE SYNECT is a data management tool from dSPACE that enables you to manage FMUs and Simulink models as well as their dependencies, versions and variants throughout the entire software development process. Please also refer to the dSPACE FMI sites for more information about the FMI support.
	FMI_1.0				Planned	
dSPACE TargetLink	FMI_2.0			Planned		TargetLink is a production code generator from dSPACE that generates highly efficient C-code directly from Simulink/Stateflow models. Please also refer to the dSPACE FMI sites for more information about the FMI support.

Tools supporting FMI	FMI Version	ModelExchange		CoSimulation		Notes
		Export	Import	Slave	Master	
dSPACE VEOS	FMI_2.0				Available 19	dSPACE VEOS is a PC-based virtual integration and simulation platform from dSPACE. Please also refer to the dSPACE FMI sites for more information about the FMI 1.0 and FMI 2.0 support.
	FMI_1.0				Available 12	
Dymola	FMI_2.0	Available 12	Available	Available 17	Available 41	Modelica environment from Dassault Systèmes.
	FMI_1.0	Available 53	Available 61	Available 59	Available 59	
EnergyPlus	FMI_1.0			Available	Available	Whole building energy simulation program
ETAS - ASCMO	FMI_2.0			Available		Creation and export of statistical (meta) models using Design of Experiments (DoE) from ETAS.
	FMI_1.0			Available		
ETAS - FMI-based Integration and Simulation Platform	FMI_1.0		Planned		Planned	Integration and simulation platform based on FMI 1.0 from ETAS.
ETAS - FMU Generator for ASCET	FMI_1.0	Planned				FMU Generator for ASCET from ETAS.
ETAS - FMU Generator for Simulink®	FMI_1.0	Planned		Planned		FMU Generator for Simulink® from ETAS.
ETAS - INCA-FLOW (MiL/SiL Connector)	FMI_1.0		Planned		Available	Guided and automated calibration of FMUs with connection to ETAS INCA.

Tools supporting FMI	FMI Version	ModelExchange		CoSimulation		Notes
		Export	Import	Slave	Master	
ETAS - ISOLAR-EVE (ETAS Virtual ECU)	FMI_1.0			Available		PC based platform from ETAS for ECU software validation at the component, sub-system or system level; allows for validation of Application Software, Basis Software and complete ECU software in a virtual environment.
ETAS - LABCAR-OPERATOR	FMI_1.0				Available	Frontend for ETAS HiL systems LABCAR, operating on the creation of experiments and their subsequent execution.
Flowmaster	FMI_1.0	Available				High capability 1D CFD tool for thermo-fluid simulation from Mentor Graphics .
FMI Add-in for Excel	FMI_1.0				Available 11	FMI Add-in for Microsoft Excel by Modelon . Offers support for batch simulation of FMUs.
FMI add-on for NI VeriStand	FMI_1.0		Available 59		Available 49	NI VeriStand supports FMI through the use of the FMI add-on for NI VeriStand from Dofware
FMI Blockset for Simulink	FMI_2.0		Planned		Available	The FMI Blockset for Simulink enables the import of FMU's for use in Simulink - developed by Claytex .
	FMI_1.0				Available 109	
FMI Library	FMI_2.0	Planned	Available	Planned	Available	Open source (BSD) C library for integration of FMI technology in custom applications by Modelon .
	FMI_1.0	Planned	Available 30	Planned	Available 19	
FMI Target for Simulink Coder	FMI_1.0			Available		Export of stand-alone FMUs for Co-Simulation from Simulink using Simulink Coder - provided by ITI

		⇄ ModelExchange		🔗 CoSimulation		
Tools supporting FMI	FMI Version	Export	Import	Slave	Master	Notes
FMI Toolbox for CarMaker	FMI_1.0		Available		Available	For IPG CarMaker via FMI Toolbox for CARMaker from Modelon .
FMI Toolbox for MATLAB/Simulink	FMI_2.0	Planned	Available 23 ▾	Available 10 ▾	Available 29 ▾	The FMI Toolbox for MATLAB/Simulink from Modelon enables FMU import and export for MATLAB/Simulink for both model exchange and co-simulation.
	FMI_1.0	Available 16 ▾	Available 49 ▾	Available 13 ▾	Available 53 ▾	
FMUSDK	FMI_2.0	Available 8 ▾		Available 8 ▾		FMU Software Development Kit from QTronic .
	FMI_1.0	Available	Available	Available	Available	
General Energy Systems (GES)	FMI_2.0	Planned	Planned	Planned	Planned	GES is an object oriented simulation tool, for dynamic and static (algebraic) systems, Based on a hybrid bondgraph model. The tool is mainly used for ship power designs. Provided by TNO .
	FMI_1.0	Available	Available	Planned	Planned	
GT-SUITE	FMI_2.0		Planned	Planned	Planned	Multi-Physics Simulation Platform for Powertrain and Vehicle Systems
	FMI_1.0		Available 12 ▾	Available	Available 13 ▾	
Hopsan	FMI_1.0	Available	Available			Hopsan is a free simulation tool developed at Linköping University. It is using distributed solver techniques with good support for parallelism using multi-core processors.
IBM Rational Rhapsody	FMI_1.0	Available	Planned	Planned	Planned	IBM® Rational® Rhapsody® family provides a collaborative design, development and test environment for systems engineers and software engineers.

Tools supporting FMI	FMI Version	⇄ ModelExchange		🔗 CoSimulation		Notes
		Export	Import	Slave	Master	
ICOS "Independent Co-Simulation"	FMI_1.0		Available	Available	Available	ICOS is a co-simulation tool developed by Virtual Vehicle
IGNITE	FMI_2.0			Planned	Planned	Physics-based system simulation software for complete vehicle system modeling and simulation from Ricardo Software .
	FMI_1.0			Planned	Available	
JavaFMI	FMI_2.0				Available	JavaFMI is a Java wrapper for the Functional Mock-up Interface (1.0 or 2.0) both for Windows/Linux 32 or 64 bit OS.
	FMI_1.0				Available	
JFMI	FMI_1.0			Available	Available	A Java Wrapper for the Functional Mock-up Interface, based on FMU SDK
JModelica.org	FMI_2.0	Available 8		Available 8	Available 26	Open source Modelica environment from Modelon
	FMI_1.0	Available 20	Available 45	Available 14	Available 49	
LMS Virtual.Lab Motion	FMI_1.0		Available	Available	Available	Virtual.Lab Motion is a high end multi body software from LMS International
MapleSim	FMI_2.0	Available 30	Planned	Available 33	Planned	Modelica-based modeling and simulation tool from Maplesoft
	FMI_1.0	Available 26		Available 12		
Mechanical Simulation: CarSim, TruckSim, BikeSim	FMI_2.0			Planned	Planned	CarSim, TruckSim, and BikeSim are vehicle dynamics software solutions from Mechanical Simulation that support XiL development workflows and power real-time driving simulators around the globe. Support for FMI 1.0 will be released first, followed by support for FMI 2.0.
	FMI_1.0			Planned	Planned	

Tools supporting FMI	FMI Version	⇄ ModelExchange		🔗 CoSimulation		Notes
		Export	Import	Slave	Master	
MESSINA	FMI_1.0		Available		Available	MESSINA is a test platform for model-based ECU function development.
MWorks	FMI_1.0	Available	Planned	Planned	Planned	Modelica environment from Suzhou Tongyuan
NI LabVIEW	FMI_1.0		Planned			Graphical programming environment for measurement, test, and control systems from National Instruments
OpenModelica	FMI_1.0	Available 3	Available	Planned	Available	Open source Modelica environment from OSMC
Ptolemy II	FMI_1.0				Planned	Software environment for design and analysis of heterogeneous systems.
PyFMI	FMI_2.0		Available 23		Available 32	For Python via the open source package PyFMI from Modelon . Also available as part of the JModelica.org platform.
	FMI_1.0		Available 63		Available 59	
RecurDyn	FMI_1.0	Planned	Planned	Planned	Available	High End Multi Flexible Body Dynamcis Software from FunctionBay
Reference FMUs	FMI_1.0	Planned		Planned		Reference FMUs supplied by enthusiasts and volunteers to show case specific FMU features
Silver	FMI_2.0		Available 24	Available 3	Available 30	Generation of virtual ECUs and virtual integration platform for Software in the Loop from QTronic .
	FMI_1.0	Available 6	Available 94	Available 6	Available 88	
SIMPACK	FMI_1.0	Planned	Available 85	Available	Available 113	High end multi-body simulation software from SIMPACK AG

		⇄ ModelExchange		🔗 CoSimulation		
Tools supporting FMI	FMI Version	Export	Import	Slave	Master	Notes
SimulationX	FMI_2.0	Planned	Planned	Planned	Planned	Multi-domain simulation tool for design, analysis and virtual prototyping of complex systems by ITI .
	FMI_1.0	Available 18	Available 80	Available 18	Available 48	
SystemModeler	FMI_1.0	Available	Available	Planned	Planned	Modelica environment from Wolfram Research .
TLK FMI Suite	FMI_1.0		Available		Available	TLK FMI Suite provides LabVIEW and Simulink blocks for FMU simulation
TLK TISC Suite	FMI_1.0		Available		Available	Co-simulation environment from TLK-Thermo
TWT Co-Simulation Framework	FMI_1.0			Available	Available	Communication layer tool to flexibly plug together models for performing a co-simulation; front-end for set-up, monitoring and post-processing included
TWT FMU Trust Centre	FMI_1.0			Available		Cryptographic protection and signature of models including their safe PLM storage; secure authentication and authorization for protected (co-)simulation
VALDYN	FMI_2.0			Planned		Multi-body dynamic and kinematic simulation for valvetrain, powertrain and transmission systems from Ricardo Software .
	FMI_1.0			Available		
WAVE-RT	FMI_2.0			Planned		Real-time, crank-angle resolved engine simulation tool for testing new engine management systems in SiL, HiL, and rapid-prototyping from Ricardo Software .
	FMI_1.0			Available		

Tools supporting FMI	FMI Version	⇄ ModelExchange		🔗 CoSimulation		Notes
		Export	Import	Slave	Master	
XFlow	FMI_1.0			Available		Computational Fluid Dynamics (CFD) code which uses a particle-based kinetic solver based on the Lattice-Boltzmann Method, thus avoids the meshing process and allows complex fluid-structure interaction including through FMI standard co-simulation.
xMOD	FMI_2.0		Available		Available	Heterogeneous model integration environment & virtual instrumentation and experimentation laboratory from IFPEN distributed by D2T .
	FMI_1.0		Available 35 ▾		Available 32 ▾	

Note, the information above is provided without any guarantee. Please, contact the respective tool provider for more information.

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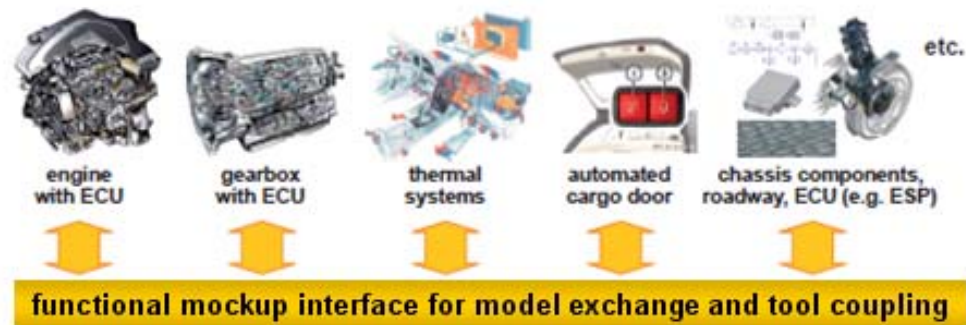
Literature

History

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Contact

Functional Mock-up Interface



Come to the FMI User Meeting at the **Modelica Conference 2015**, 21st September 2015, Versailles, France.

In order to participate, please register for the Modelica Conference and later select the FMI User Meeting as your desired workshop/tutorial for the first day.

For the agenda, have a look at the description of the tutorial/workshop no.5 at the **preliminary conference program**.

Conclusions

- FMI provides a tool independent standard to support both model exchange and co-simulation of dynamic models
 - Original development of standard part of EU-funded MODELISAR project led and initiated by Daimler
 - First version FMI 1.0 published in 2010
- FMI currently supported by over 50 tools (see www.fmi-standard.org for most up to date list)
 - Active development as Modelica Association project
- FMI 2.0 brings additional functionality to FMI standard

