





SmartFuel ADSP
*Automated Design and Simulation Process
for
Fuel Management Systems*

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- Project Status

Participating Partner Companies

VYSOKE UCENÍ TECHNICKE V BRNE, CZECH REPUBLIC
UNIVERSIDAD COMPLUTENSE DE MADRID, SPAIN
UNIVERSITY OF ALCALÁ, SPAIN
SECONDO MONA S.P.A., ITALY
PIAGGIO AERO INDUSTRIES S.P.A., ITALY
GOODRICH ACTUATION SYSTEMS SAS, FRANCE
EUROCOPTER DEUTSCHLAND GMBH, GERMANY
CSRC SPOL. S R.O., CZECH REPUBLIC
ASG LUFTFAHRTTECHNIK UND SENSORIK GMBH, GERMANY
AUTOFLUG GmbH, GERMANY

Location of Partners



About Autoflug

AUTOFLUG Products comprise two major product ranges:

Measuring and Sensor Technology

- Gyroscopes, Inertial Measurement Units (IMU)
- Payout dispenser systems in conventional and fibre-optical design
- **Fuel Measuring and Control Systems for utilisation in aircraft and land vehicles**

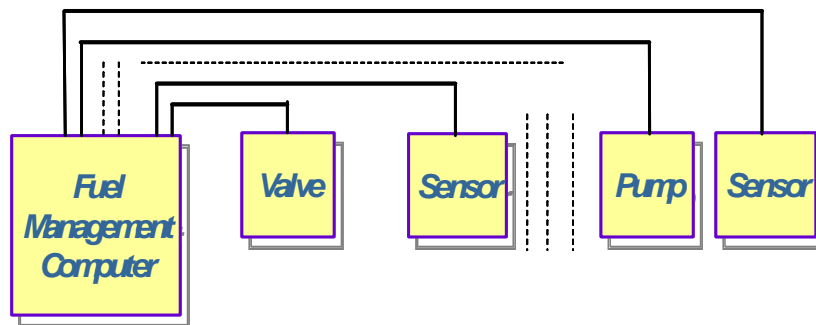
Rescue and Safety Technology

- Safety seats for helicopters, transport aircraft and armoured land vehicles
- Subsystems, maintenance and overhaul for Martin-Baker ejection seat systems
- Pilot flight equipment
- G-Race-Suit for pilots of RED BULL AIR RACES

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Flashback to SmartFuel (5th Framework Programme)

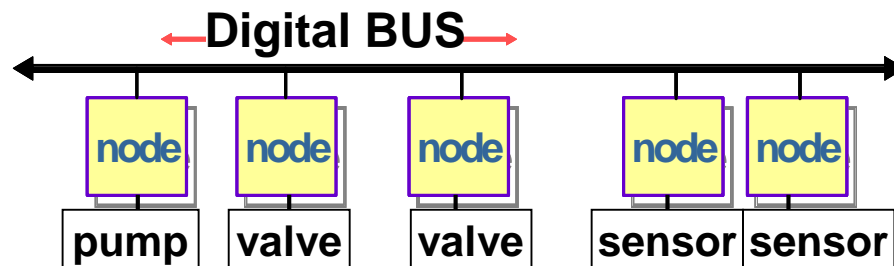
SmartFuel is a distributed control system for Fuel Management Systems



- Main Project Targets:

From the conventional solution:

- Central Computer
- Point-to-Point Connections



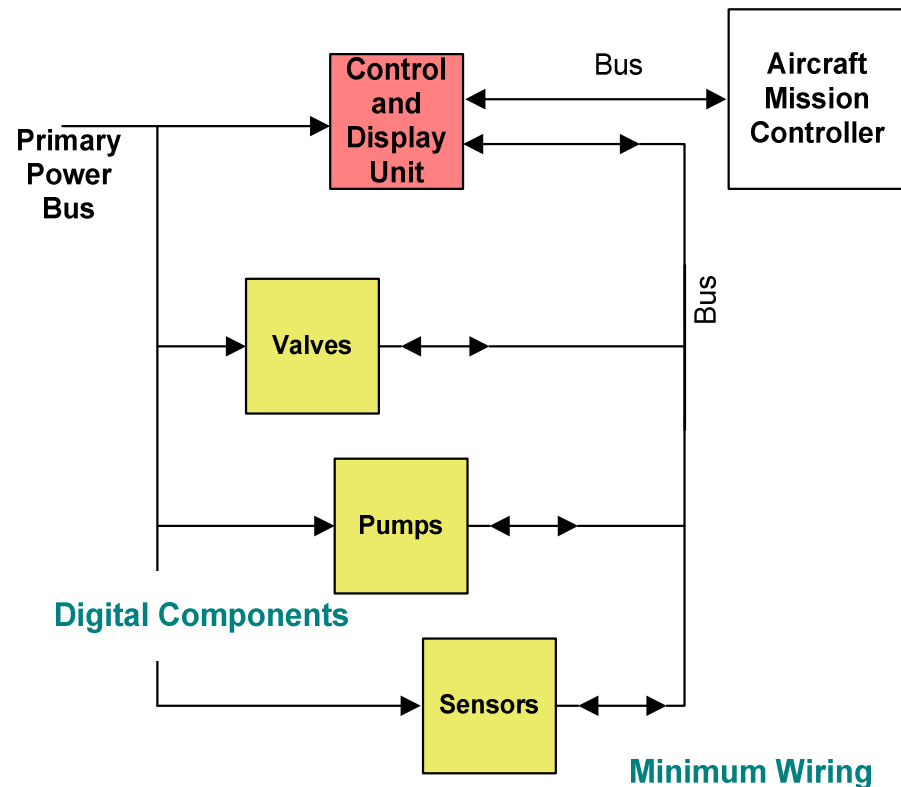
To a new distributed solution:

- Digital BUS Communication
- No Central Computer
- Smart Components

SmartFuel System Architecture

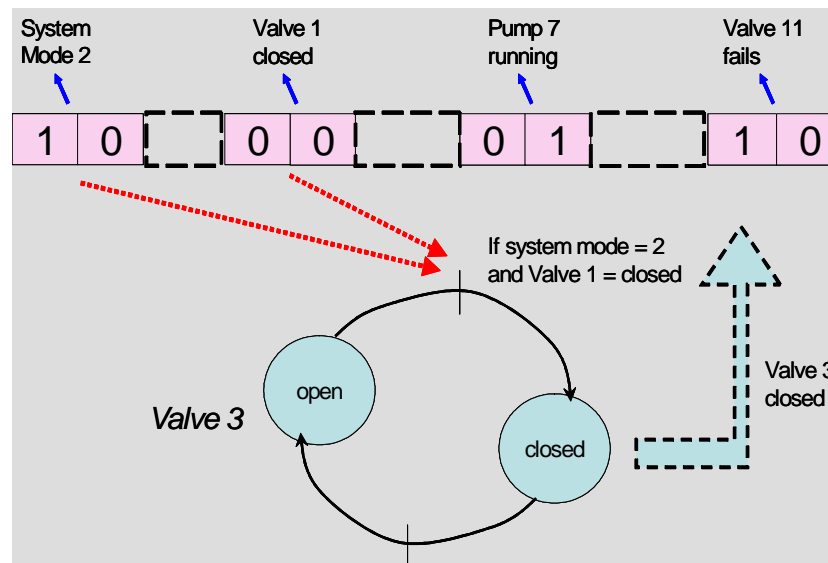
The SmartFuel system architecture is based on a “Time Triggered Data Bus” and provides the following features compared to conventional solution:

- Simplified Wiring, with less weight
- Communication in digital format
- Sensors and actuators are nodes
- Elimination of central Fuel Controller
- Primary Power Bus to each Component



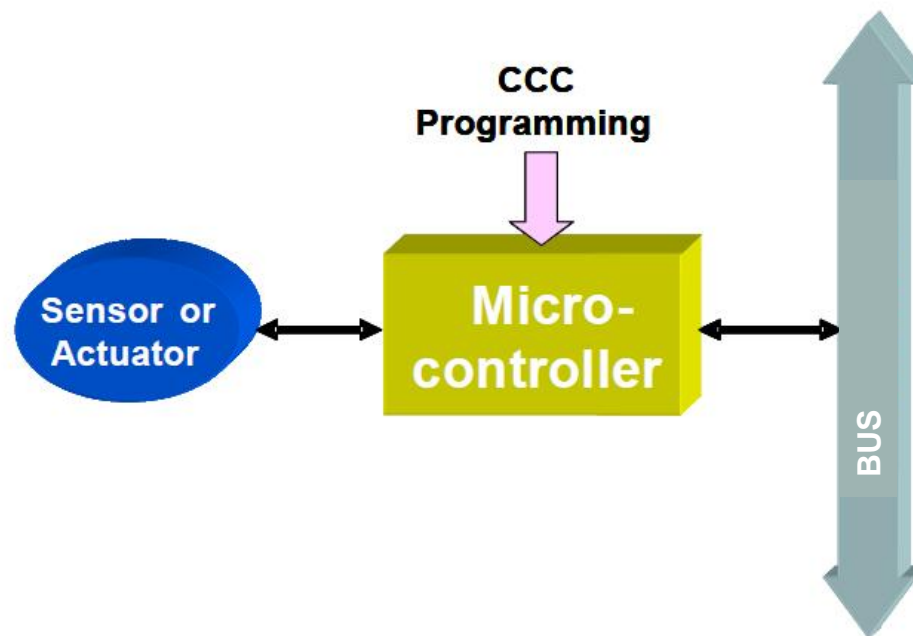
SmartFuel Functional Software

All Smart components cooperate by using a “Time Triggered Data Bus”. Each component is designed to realize certain functions, as defined by the corresponding Functional Software Code (Statemachine).



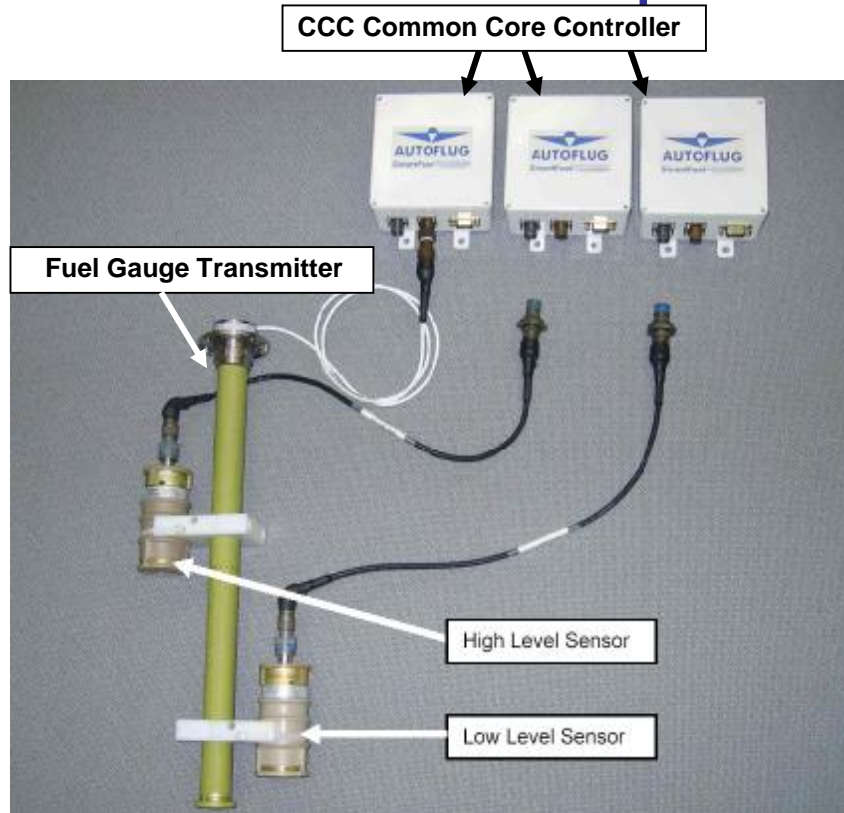
SmartFuel Components

Each SmartFuel Component use the Common Core Controller (CCC)
Each SmartFuel Component use the Common Functional Software
Each SmartFuel Component use a Component Specific Software



Block Diagram of a generic SmartFuel component

SmartFuel Components 5th Framework Programme



Example of Smart Fuel Components with a Common Core Controller (CCC)

SmartFuel **ADSP** Fuel Gauge Transmitters for Rig and Flight Tests



Photo: AUTOFLUG



Controller Board (CCC)



Power Board



Gauging Board



SmartFuel **ADSP** Fuel Pump for Rig and Flight tests



Photo: Secondo Mona



Controller Board (CCC)

SmartFuel Automated Design and Simulation Process

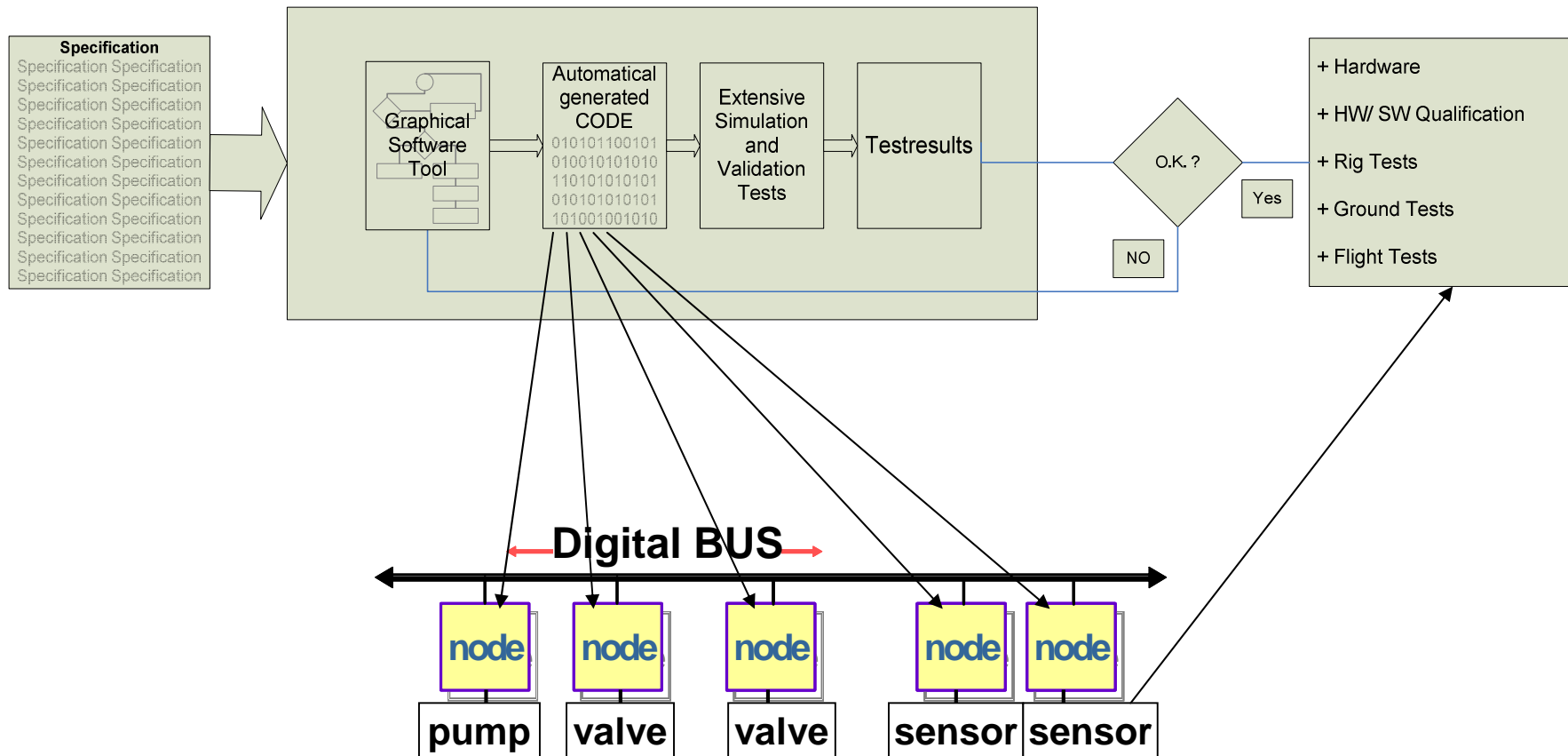
The scientific and technological objectives of SmartFuel ADSP are

- Development and testing of a tool-based automated design and simulation process (ADSP) for aircraft fuel management systems.
- Applicability of achievements to other distributed real-time systems since those systems are basically designed with similar kinds of components.

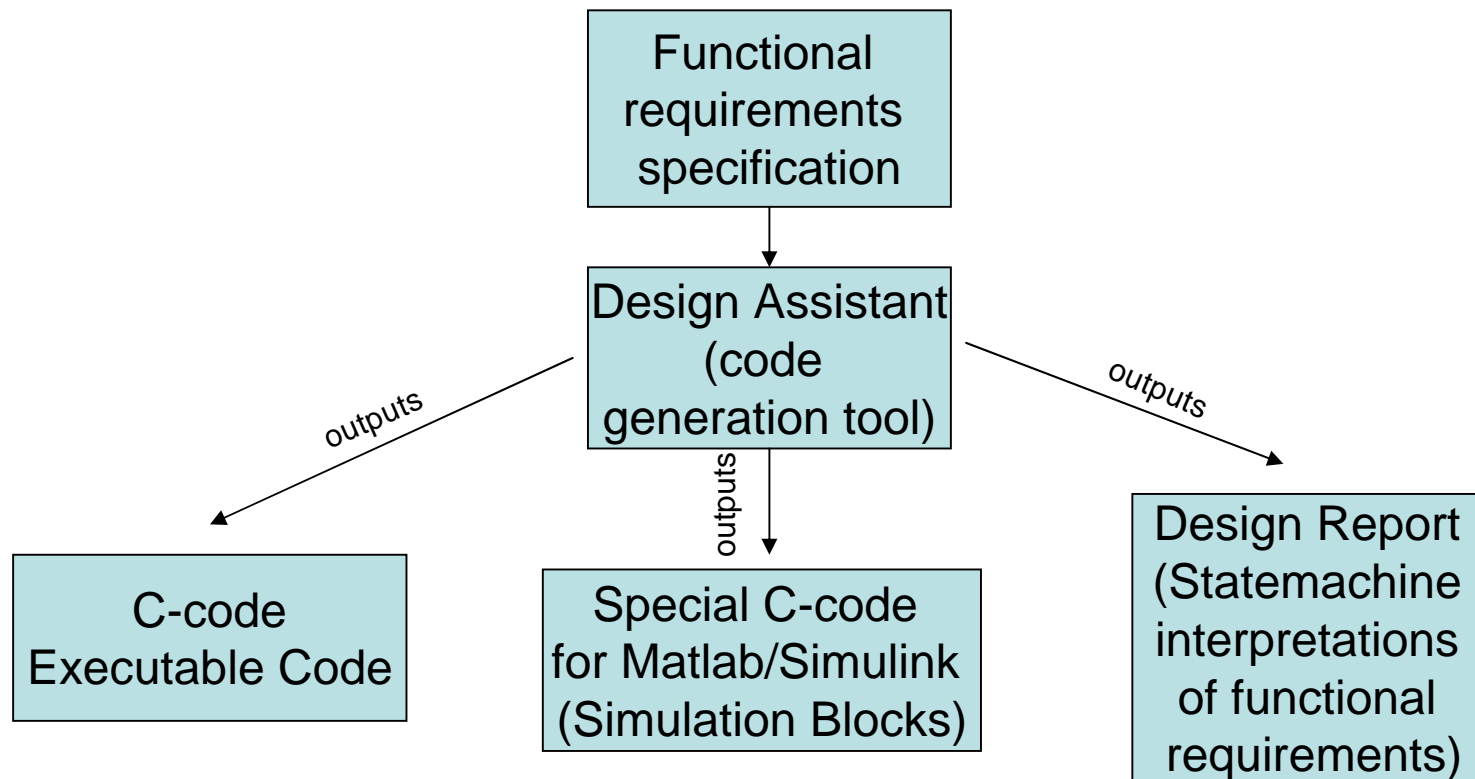
SmartFuel **ADSP** Development Process

- The ADSP design process is based on a software tool which describes the system behaviour by diagrams. This software tool is developed by the partners
- The software tool automatically generates the functional software which is common to each component for the Fuel Management System
- Integration of functional software in an overall system simulator including data-bus model
- Individual behaviour of each component including piping is considered in the system simulator

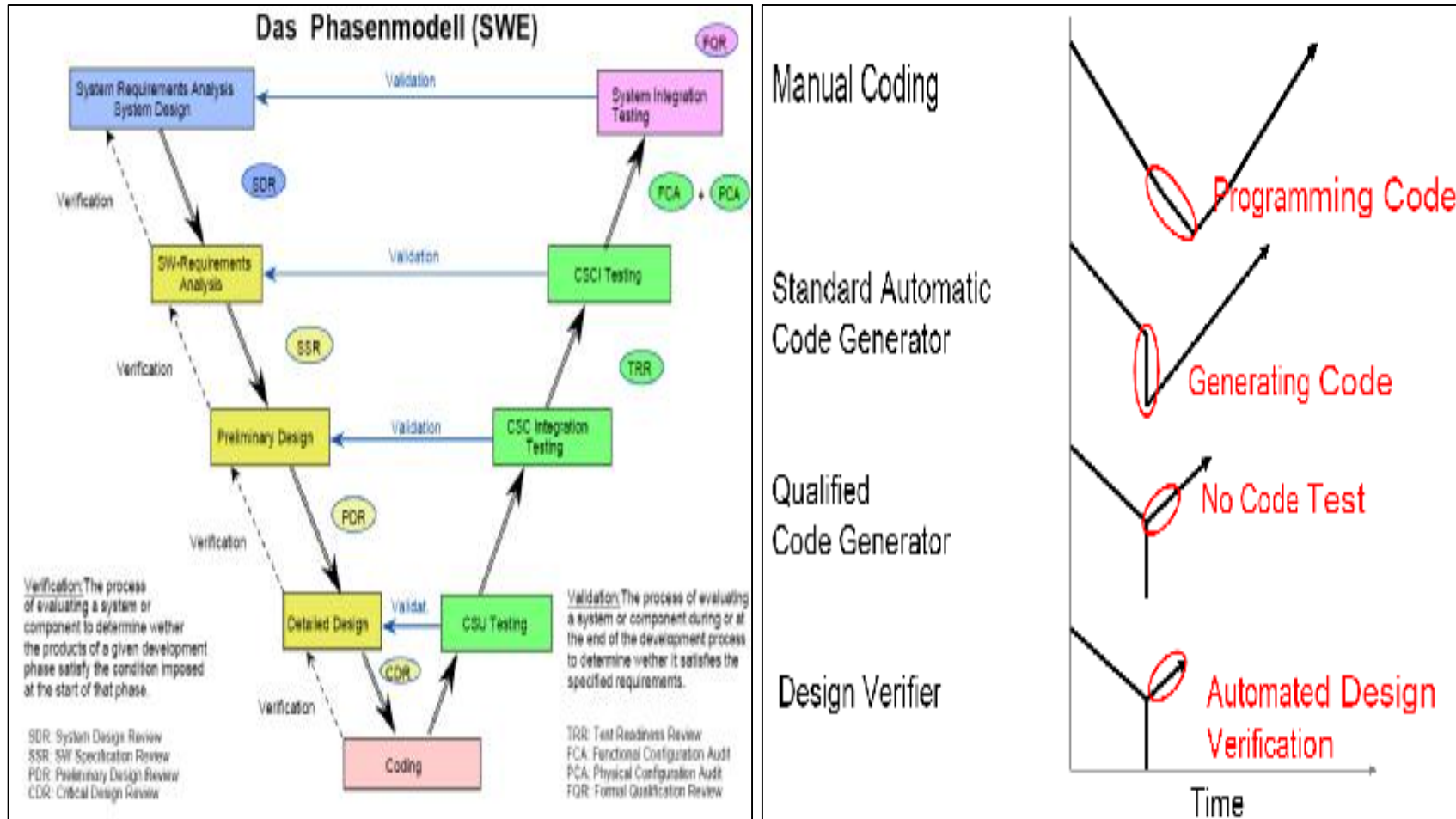
ADSP Development Process based on SmartFuel Components



ADSP Design Assistant (Code Generation Tool)



From the V-Model to the Y-Model



SmartFuel **ADSP** Achievements

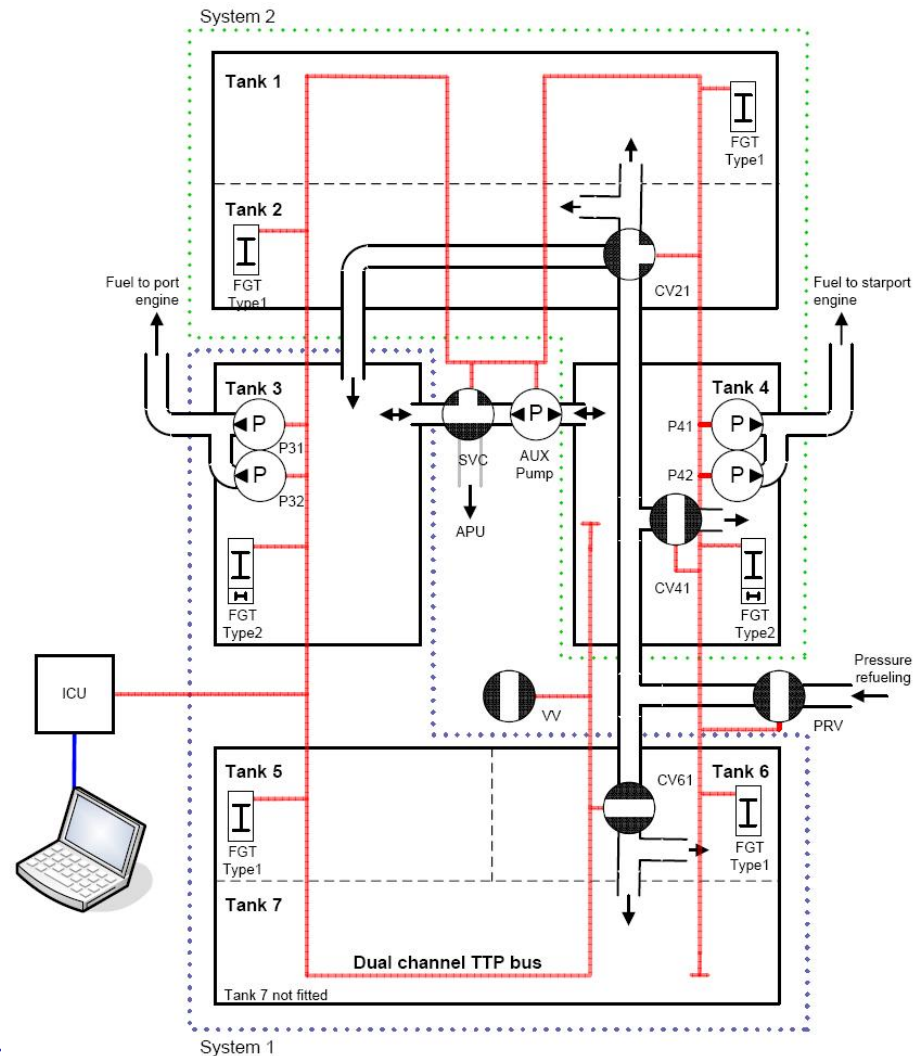
- Automatically software code generation by the graphical software tool
- Complete system functional test without hardware
- Hardware tests involving rigs and aircraft can be reduced
- Hardware tests are starting with pretested functional software

SmartFuel **ADSP** Advantages

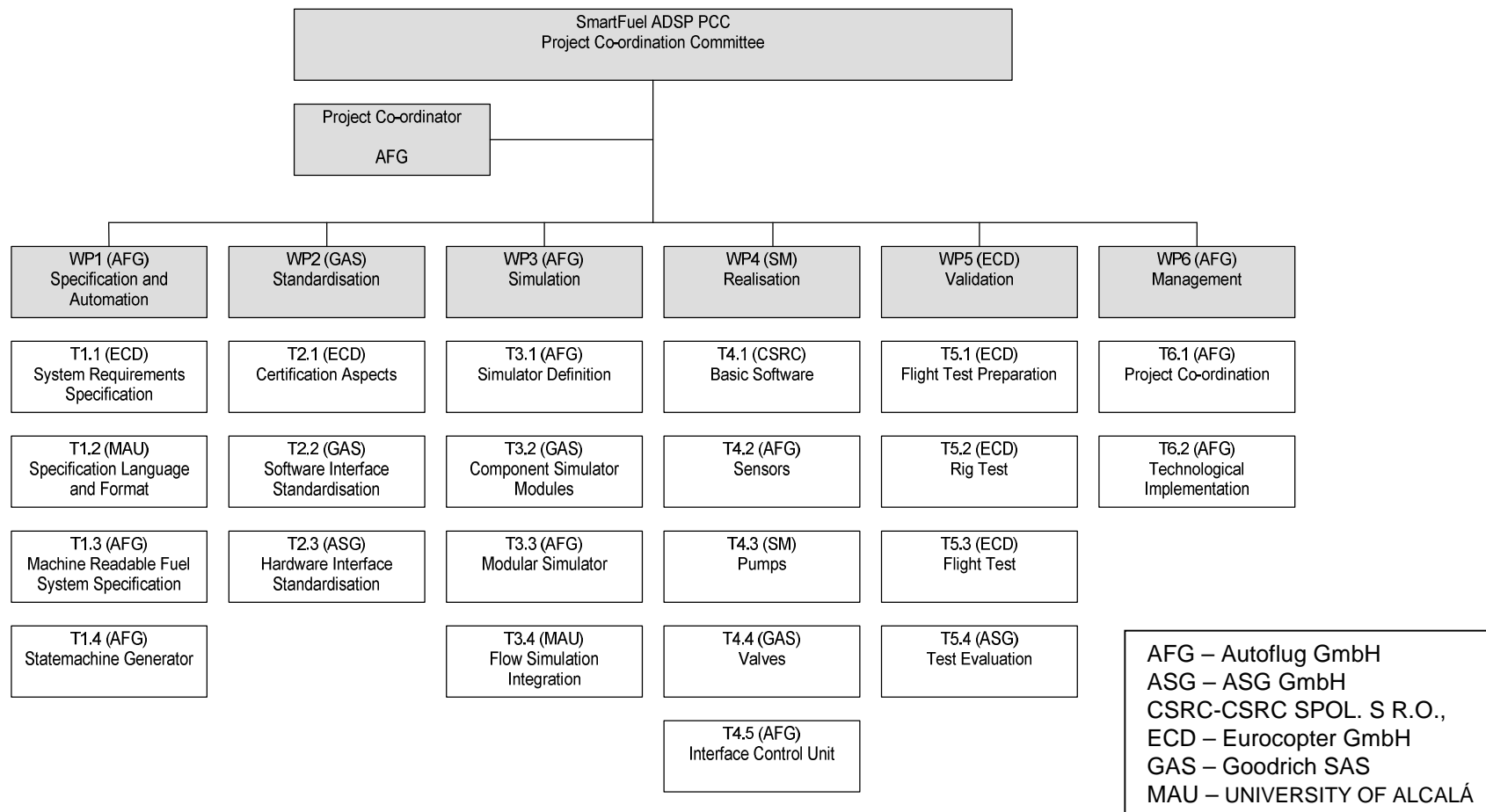
It is expected that automatically designed fuel management systems will lead to:

- reduction of development time/costs for Fuel Management Systems
- improvement of system reliability
- reduction of production prices due to increased use of COTS components
- reduction of maintenance costs due to improved design quality.
- simple system extension by adding nodes (e.g. Auxiliary Fuel Tanks)
- debug support on system level for Rig Tests

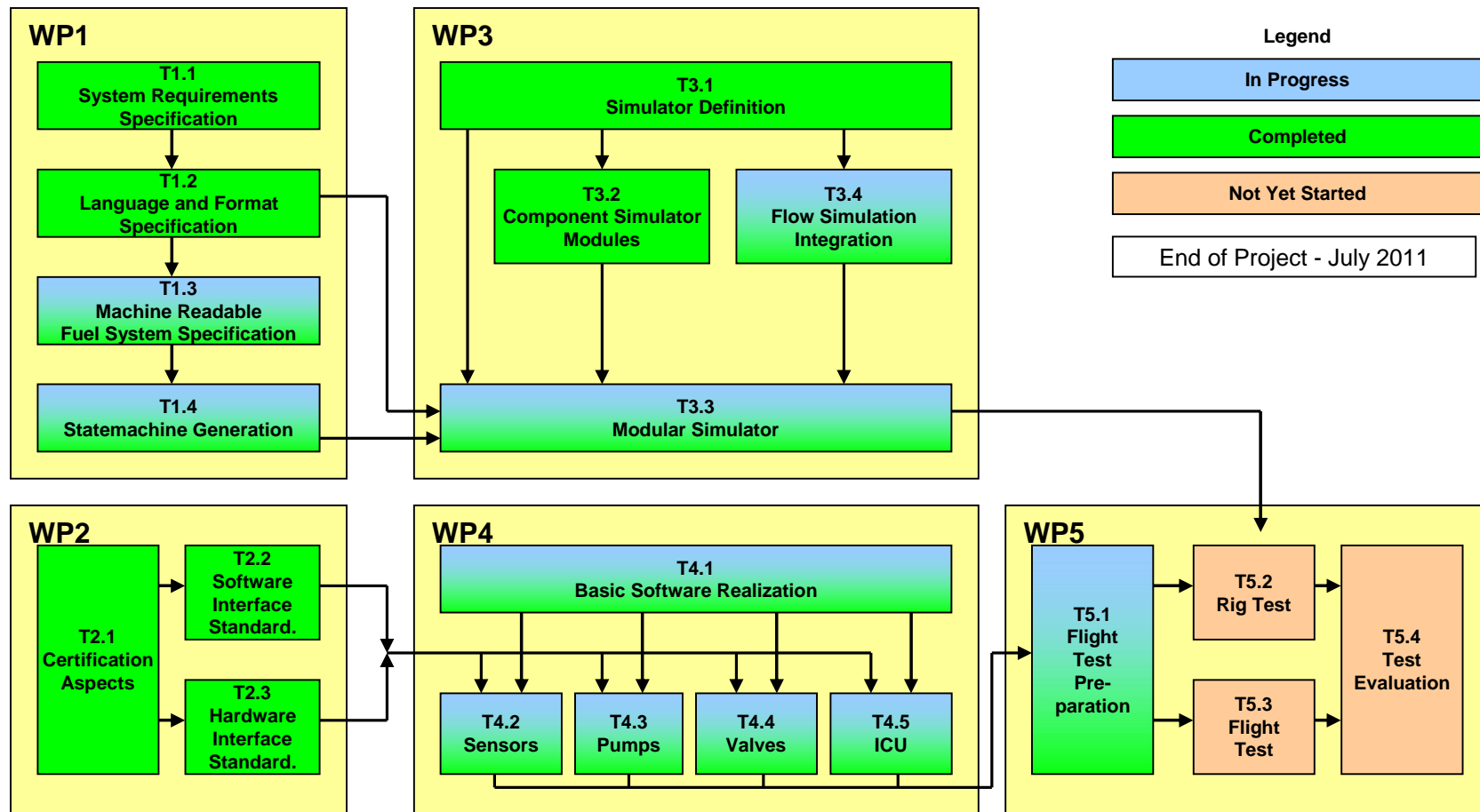
SmartFuel System Integration in Test Rig and Helicopter



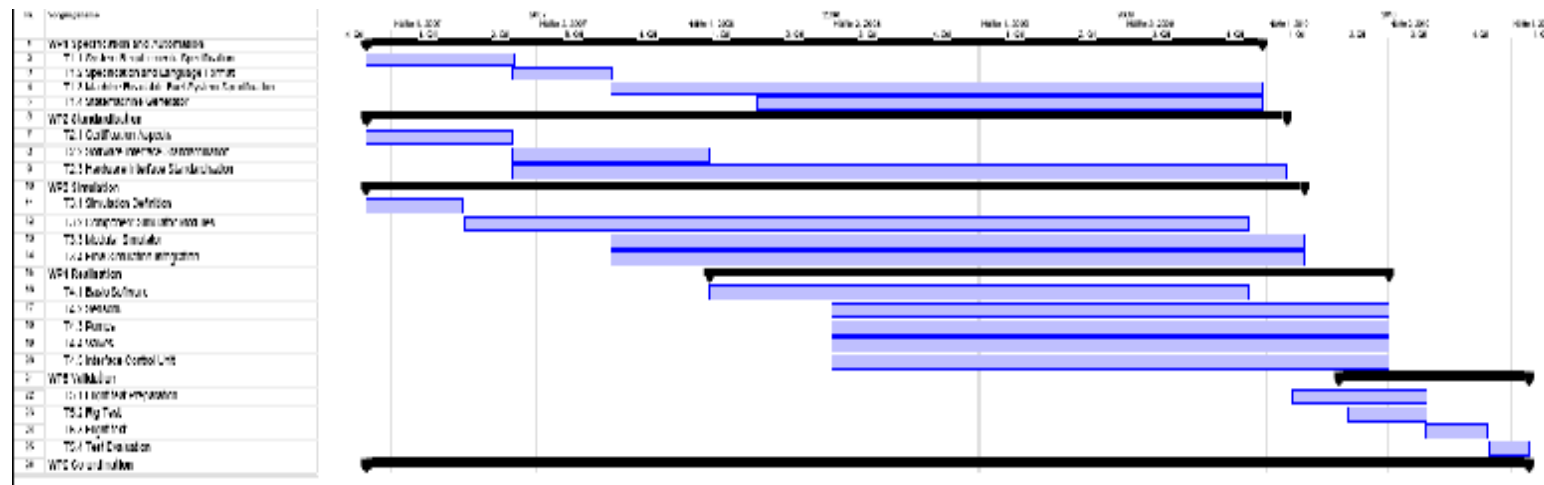
SmartFuel ADSP Work Packages and Tasks



SmartFuel ADSP Project Status



Schedule and Costs



Partner	AFG	ASG	ECD	SM	GAS	BRU	MAU	ALU	CSRC	PIA	Total
Total Budget	1,065,842,000 €	456,621,500 €	1,179,000,000 €	750,000,000 €	826,600,000 €	263,577,000 €	301,969,000 €	191,817,000 €	226,000,000 €	237,800,000 €	5,494,110,000 €
FRN-116											
Total Contribution of EC	592,114,000 €	232,700,000 €	600,500,000 €	301,500,000 €	119,950,000 €	263,577,000 €	301,969,000 €	191,817,000 €	116,642,000 €	121,100,000 €	3,221,957,000 €

