

ASTOS®

AOCS Testing and Check-Out



ASTOS Overview

ASTOS is a multi-purpose software for various space scenarios and space applications. It comprises a flexible aerospace model for the environment, space vehicle dynamics, vehicle components and subsystems. Due to its flexibility and numerous external interfaces it can be used throughout all project phases.

ASTOS for AOCS Testing & AIV

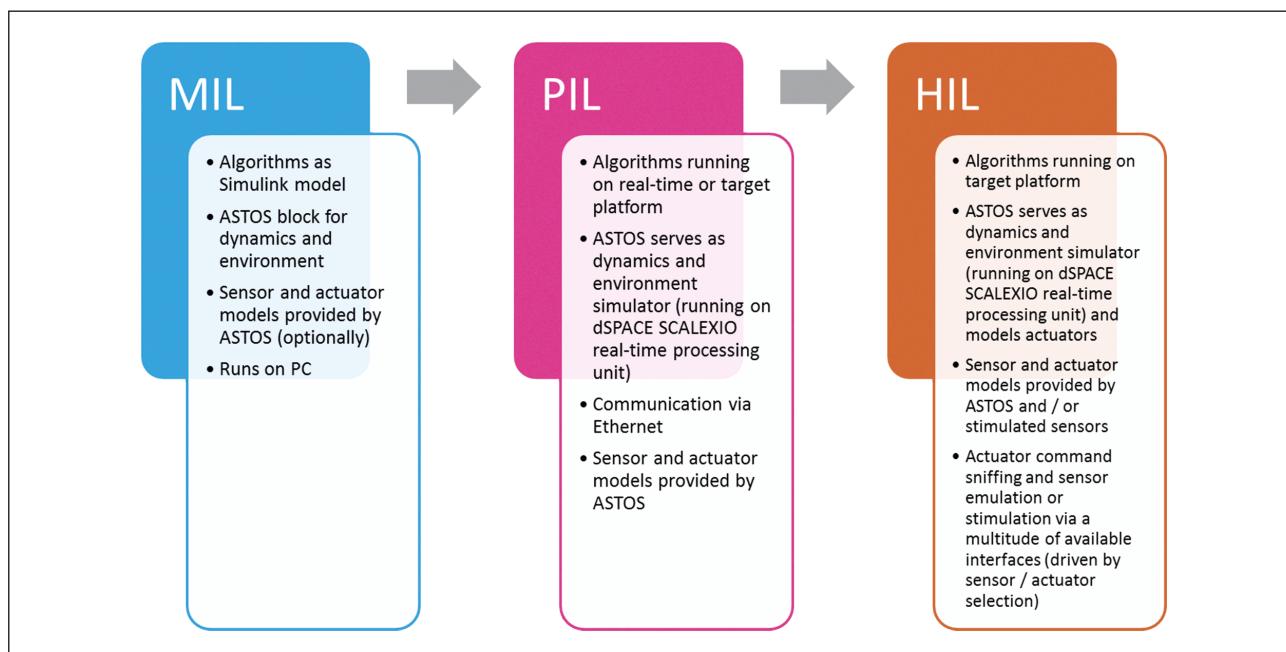
- Dynamics and environment simulation for MIL, SIL, PIL & HIL
- Sensor and actuator modelling with runtime-adjustable error definition
- Multi-body dynamics simulation (for berthing, sloshing, CMG, etc. modelling)
- Flexible hardware solution based on industry-proven dSPACE® components (processing units & interface cards)
- Multitude of supported emulation, stimulation and sniffing interfaces (analogue, digital, RS232, RS422, SpaceWire, MIL-STD-1553, CAN, Ethernet, etc.)
- Local and remote control from central check-out system

Reliable Hardware Concept

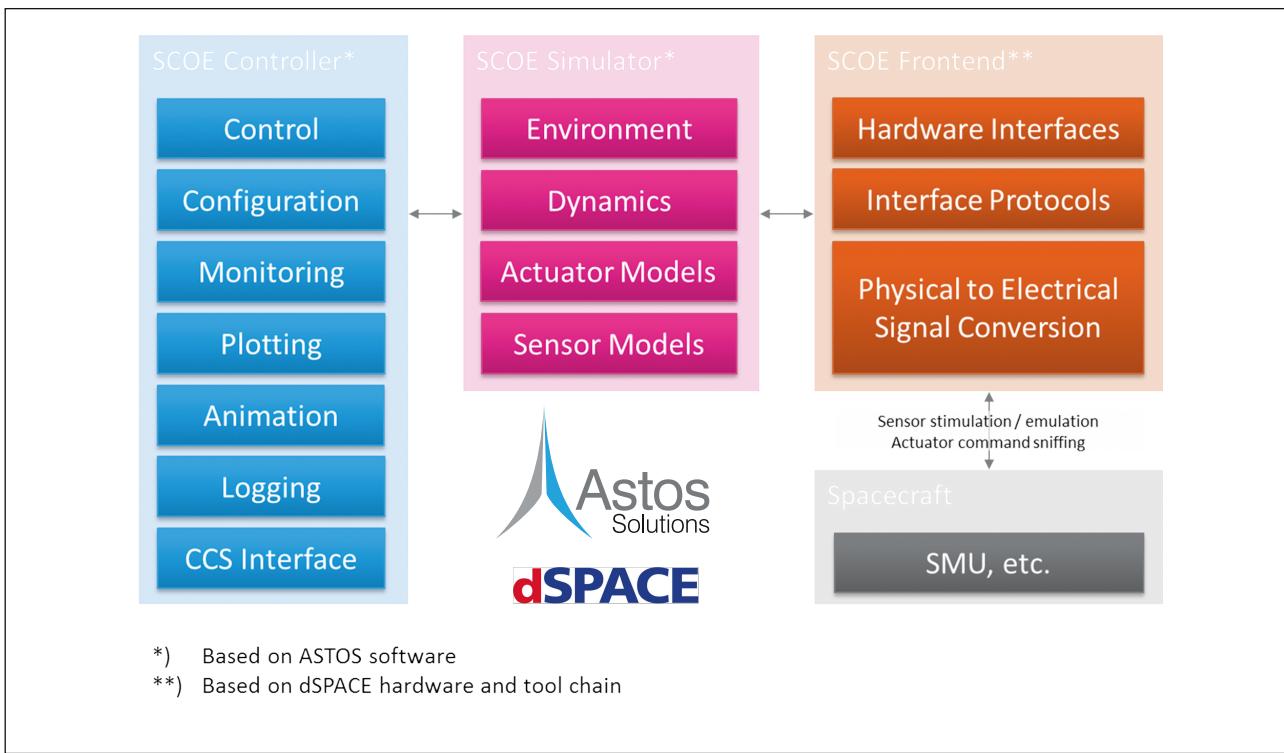
- Utilization of off-the-shelf dSPACE® components that have proven their reliability in many applications
- Designed and developed in cooperation with dSPACE
- Galvanic isolation
- Protected interfaces
 - Over-voltage protection of interface
 - Safe mode at start-up and after failure
- Power-on self-tests and continuous status monitoring
- Health monitoring (e.g. smoke, temperature, isolation)
- Time-synchronization based on PPS and NTP

Fast Adaptation to Specification Changes

- Physical to electrical IO conversion defined in Simulink model allowing easy adaptation
- Replaceable off-the-shelf interface cards
- Definition of the spacecraft including the nominal orientation of sensors and actuators using the ASTOS GUI. Changes of the specification can be easily incorporated at any time.
- ASTOS provides a multitude of environment models that can be selected via the GUI. Effects can be adjusted at run-time.



Usage of ASTOS throughout the AOCS development process



Architecture of the ASTOS-based AOCS SCOE

Feature-Rich User Interface

- Realistic real-time and post-processing animation
 - Shadowing, reflections, atmospheric scattering, articulation, thruster exhausts
 - Data overlays (sensor frustums, velocity, force, torque, etc. vectors, coordinate systems)
 - Real-time and post-processing plotting
 - Multi-axis, multi-data 2D plots
 - Unit conversion
 - Logarithmic and linear scales
 - Map plots (2D and 3D) with optional GIS data overlay
 - Excel and database input data import
- NASTRAN is a registered trademark of the National Aeronautics & Space Administration
- SCALEXIO is a registered trademark of dSPACE GmbH

Detailed Modelling

- Illumination of solar arrays and sun sensors
 - Local shadowing
 - Eclipses due to earth and moon
 - Zonal and seasonal albedo model
 - Electrical connection of solar arrays (parallel/serial) can be considered in electrical output calculation
- Flexible multi-body dynamics
 - NASTRAN models can be imported
 - Sloshing & flexible structures
 - Reaction wheels and CMGs
- System modelling (and concept analysis)
 - Power system (solar arrays, batteries, PCDUs, consumers)
 - Thermal control system (irradiation, heat conduction, thermal source)
 - Data system (data sources, storage, transmission)
 - Activity / state dependent power consumption and thermal heat generation of equipment