The Development of Generic AOCS Unit Simulation Models

Matthew Pigg, Tessella, Tuesday 2 November

Agenda

- Identification of need

- Aims of project

- Project structure

- Key areas to focus on

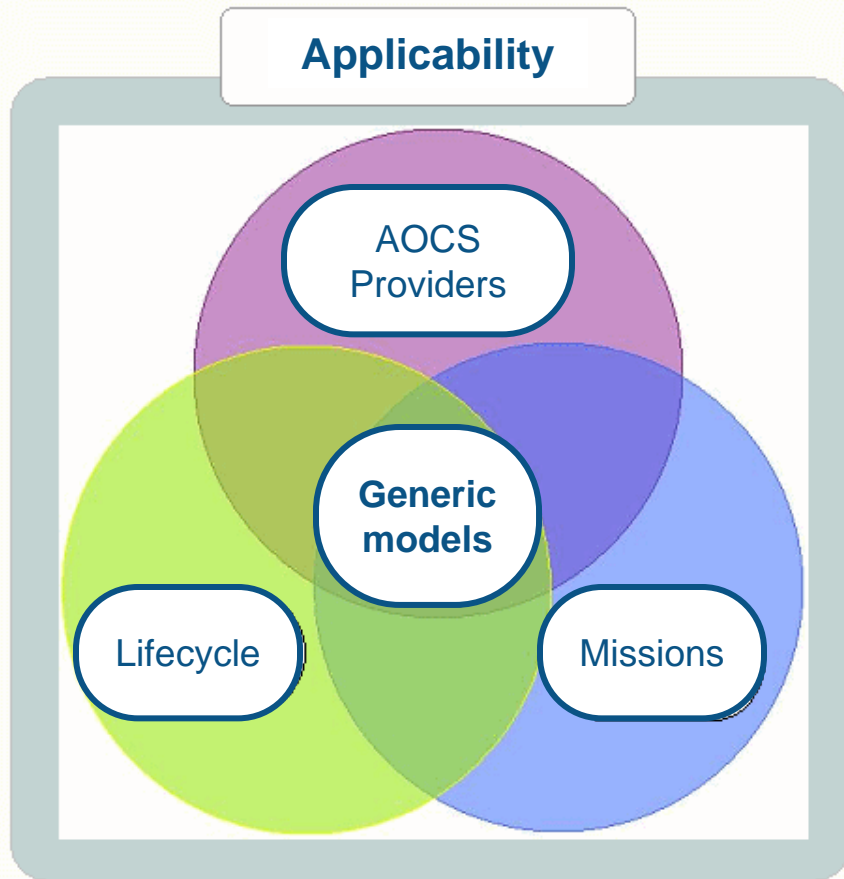- Preliminary guidelines (subset)

- Summary

Identification of Need

- Cost saving from re-use:
  - Already occurring across life-cycle and missions
  - Not yet across providers

- Unit models often developed in-house - problems with models supplied by external entities:
  - Visibility of the supplied code
  - IP issues
  - Interfacing
  - Run time
  - Level of fidelity
  - Validation

- Generic development recommended by ADCSS in 2007

Aims of Project

Applicability

- AOCS Providers
- **Generic models**
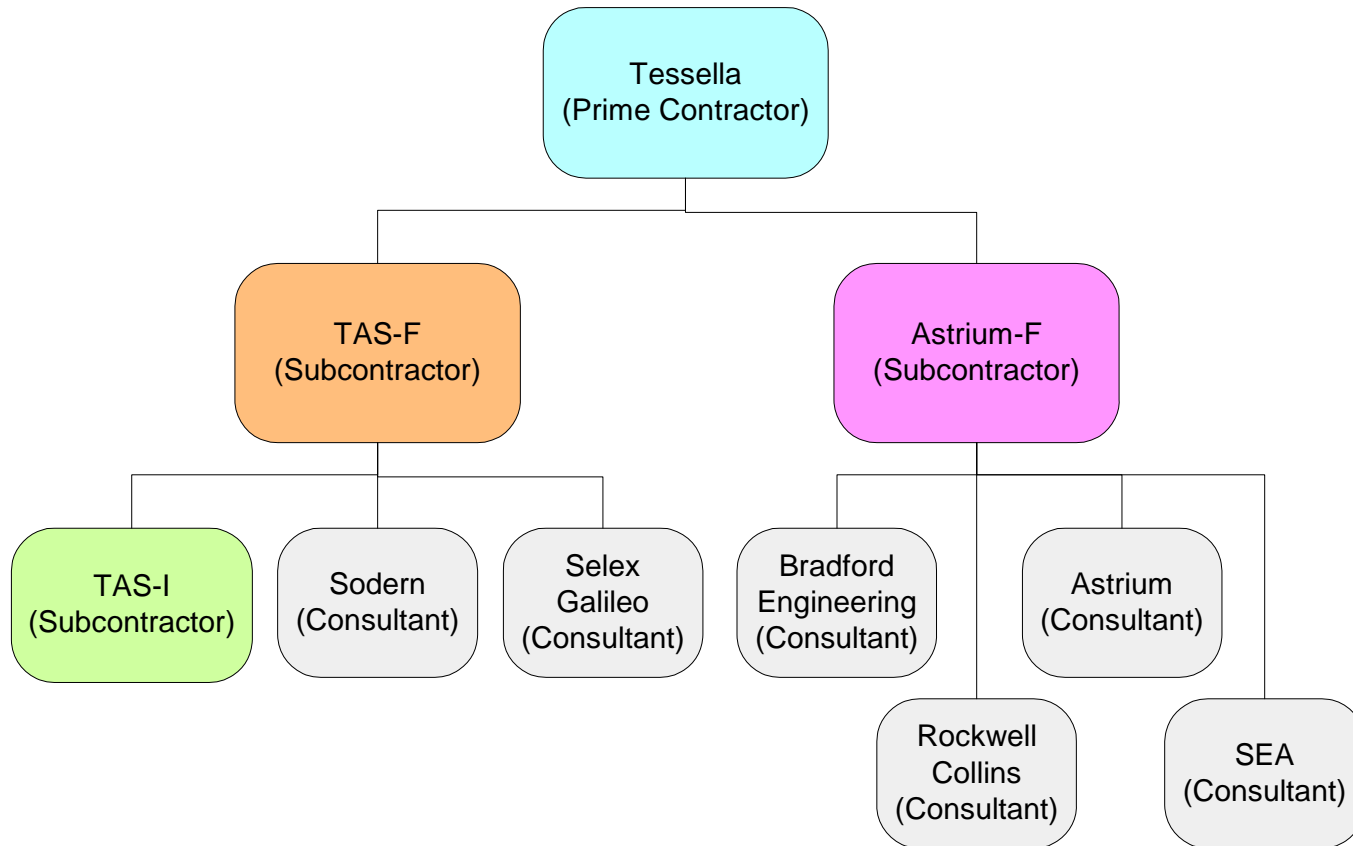- Lifecycle
- Missions

- Develop prototype generic unit models for:
  - Gyroscope
  - Star tracker
  - Reaction wheel
- Validate:
  - Models against real hardware
  - Model usage on range of test benches
- Make available to industry

Project Structure (i)

- Project team

Project Structure (ii)

- Industry input
  - Round table event 3rd November

- Project phases:
  - **Guidelines**
  - Specs
  - Development & verification
  - Validation
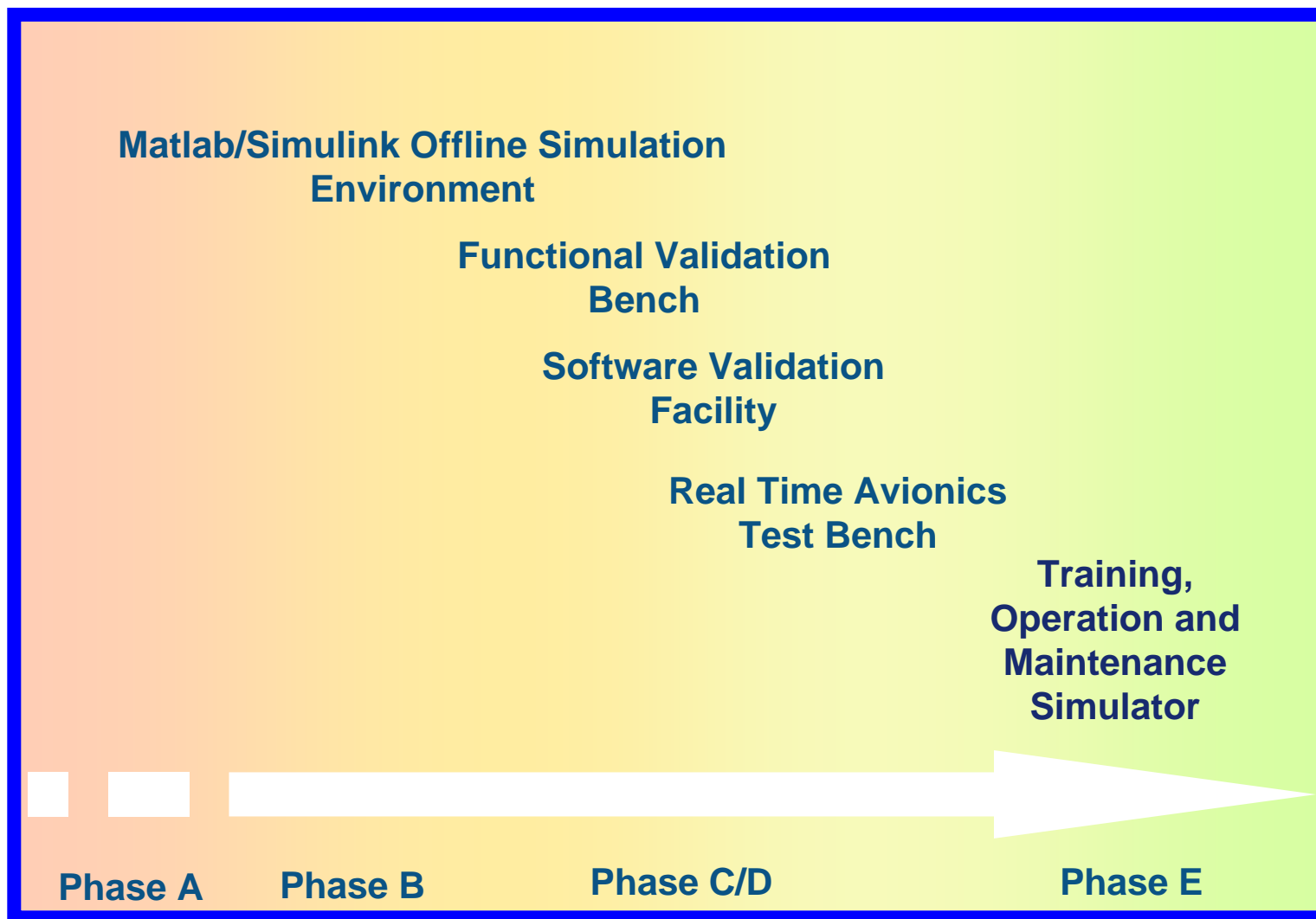 - Promotion & maintenance policy

Key areas to focus on

- Architecture
- Re-usability
- Tuneability
- Configurability
- Run time
- Fidelity
- Interface
- Format & language
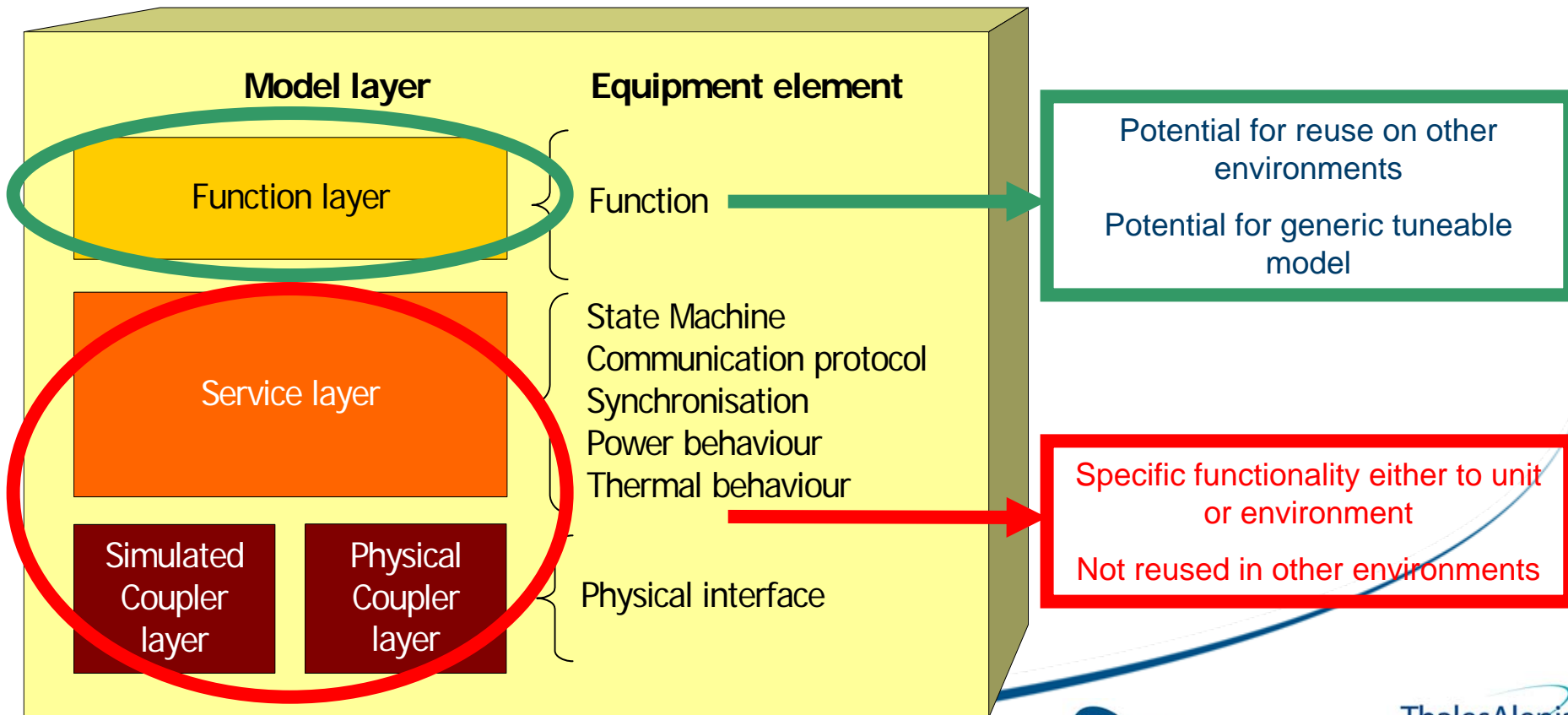- Validation
- Model parameter handling

Typical Use of Unit Simulation Models

**Matlab/Simulink Offline Simulation
Environment**

**Functional Validation
Bench**

**Software Validation
Facility**

**Real Time Avionics
Test Bench**

**Training,
Operation and
Maintenance
Simulator**

Phase A **Phase B** **Phase C/D** **Phase E**

Architectural Requirements & Scope of Generic Models

- Driven by architecture to support different environments

- Assess potential for genericity and ease of reuse of elements of models

Model Validation

- Two aspects:
  - Representative of real units
  - Ability to use on multiple environments
- Approach:
  - Tune models
  - Build appropriate open loop test harness environments
  - Plan, define and execute tests
  - Validate against real unit or hi-fidelity simulated data
  - Validation against 2 examples of each unit
  - Validation of operation on real-time environment architecture

Summary

- Identification of need

- Aims & how project is structured to meet them

- Areas to focus on

- Round table event: 9:00-12:00 Wednesday 3rd Nov, Ba024

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