



26th annual **INCOSE**
international symposium

Edinburgh, UK
July 18 - 21, 2016

ISO/IEC 29110

Deployment Packages and Case Study for Systems Engineering

The "Not-So-Secret" Ingredients That Power the Standard

Ronald (Ron) Houde



Your IS2016 Dull Moment!



Outline

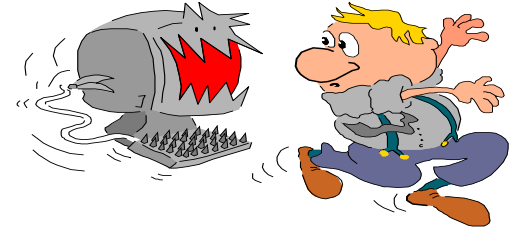
- Introduction
 - Very Small Entities (VSEs) and today's economy
 - ISO/IEC 29110 Standards for VSEs
- Beyond the Standard
 - Profile Groups and Profiles
 - Deployment Packages (DPs)
 - Tools
- Autonomous Rover Case Study

Very Small Entity

Enterprise, organization, project or department of up to 25 people

Context

- **Most VSEs**
 - Have severely limited overhead resources
 - Nb. of employees, expertise, cost and time
 - Most resources must be directed at creating value/income
 - Don't see net benefit developing/documenting processes
- **Implementing process from standards**
 - Has an inherent level of complexity
 - Resources and expertise required to
 - select applicable standards
 - appropriate standard processes
 - adapt/tailor them to the VSE context and needs



The Reality



- **VSE processes are often improvised**
 - Depend on expertise/experience of key team member
 - Not documented
 - When key members leave, most of knowledge and expertise is put at risk
- **The emerging circular, shared, collaborative economy built primarily around VSEs needs an OS**

Enterprises around the World

- Micro enterprises (up to 9 employees) account for 70% to 90% of enterprises in OECD* countries

Type of enterprise	Number of employees	Annual turnover (EUR)	Number of enterprises (% of overall)	Number of enterprises
Micro-enterprises	1 - 9	≤ 2 million	92.2 %	19 968 000
Small enterprises	10 - 49	≤ 10 million	6.5 %	1 358 000
Medium enterprises	50 – 249	≤ 50 million	1.1 %	228 000
SMEs, total	87 100 000		99.8 %	21 544 000*
Large enterprises	> 250	> 50 million		
Large enterprises, total	42 900 000		0.2 %	43 000

* Independent companies only, excluding legally independent companies that are part of large enterprises.

* OECD: Organisation for Economic Co-operation and Development

** Statistics About Business Size (including Small Business). US Census Bureau (www.census.gov/econ/smallbus.html)

*** Moll, R., Being prepared – A bird's eye view of SMEs and risk management, ISO Focus +, February 2013

International Collaboration

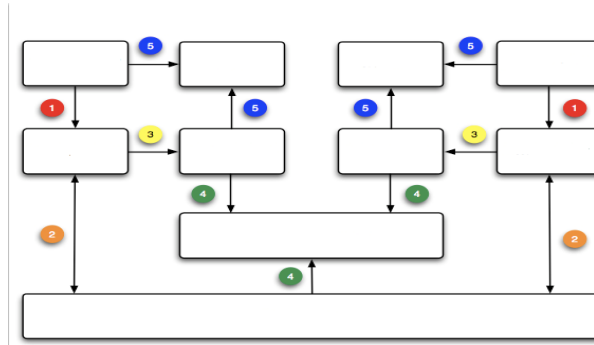


Sub committee (SC) 7

Working Group (WG) 24



SECRET INGREDIENT #1: THE PROCESS



ISO/IEC 29110 for VSEs

29110 Overview (TR 29110-1)

For VSEs
and customers

29110 Profiles (IS)

Framework and Taxonomy (IS 29110-2)

Specifications of VSE Profiles (IS 29110-4)

Specification - VSE Profile Group
m
(IS 29110-4-m)

For Standard
producers, tool
vendors, methodology
vendors

List the Requirements
i.e. '**What** to do'

29110 Guides (IS/TR)

Assessment Guide (IS/TR 29110-3)

Management and Engineering Guide (TR 29110-5)

Management and
Engineering Guide
VSE Profile m-n
(TR 29110-5-m-n)

For Assessors,
customers and VSEs

For VSEs
and customers

'**How** to do'

TRs are available from ISO at no cost

<http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>

Generic* Profile Group



Pre-tailored sets of Objectives/Activities/Artefacts

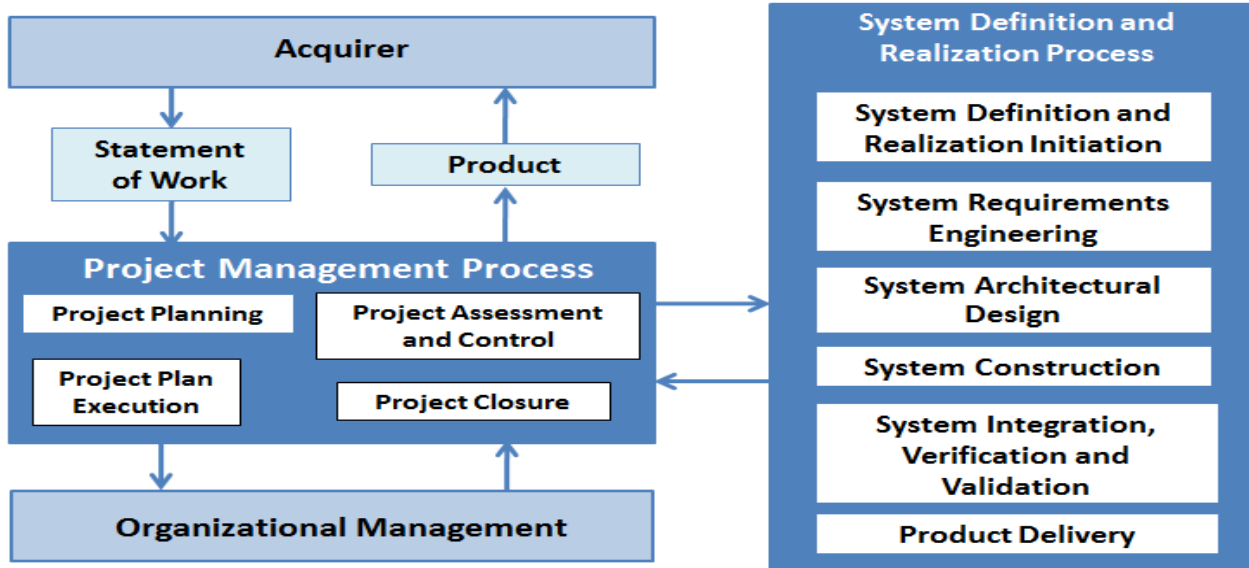
- **Entry Profile** – 6 person-month projects or start-ups
- **Basic Profile** – one project at a time
- **Intermediate Profile** – multiple projects, multiple teams
- **Advanced Profile** – sustain and grow as independent competitive system development business

Available Now

Planned for 2017

* **Generic** = non-safety/security critical systems

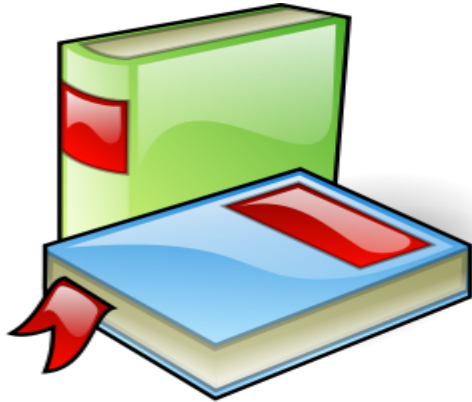
SE - Basic Profile



- Objectives
- Activities
 - Tasks
 - Work Products
 - Roles

SECRET INGREDIENT #2

THE TOOLS

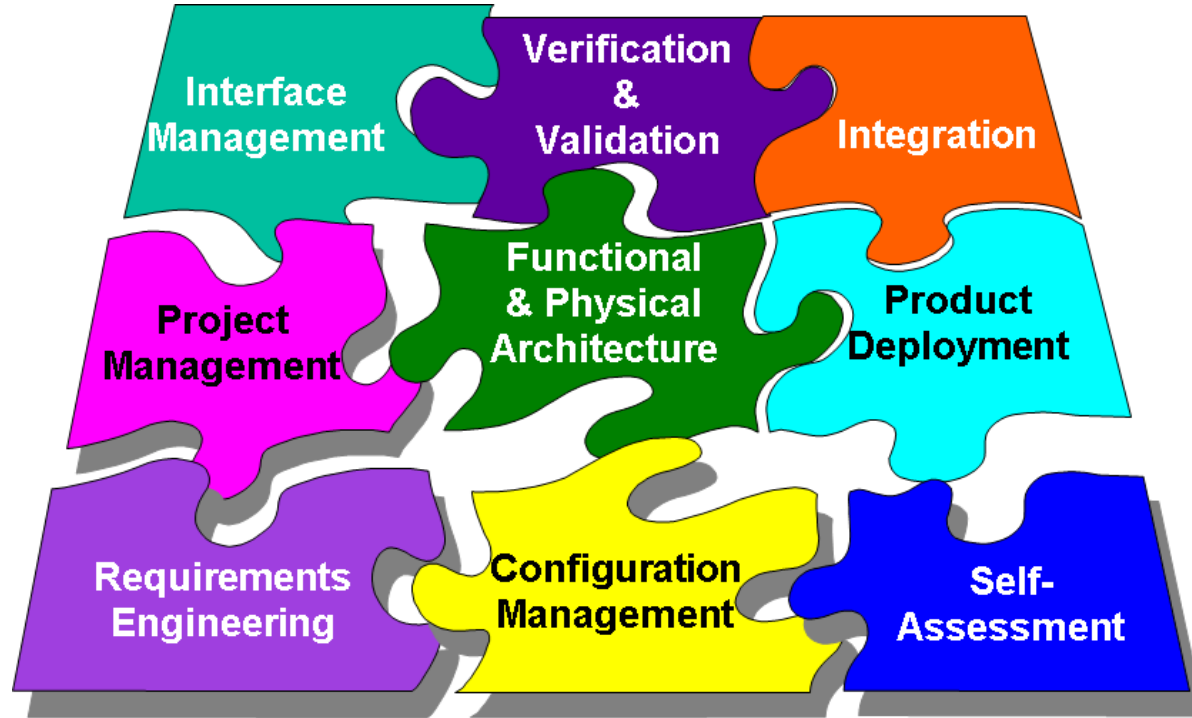


Deployment Packages

- Use is optional and creates a “starting point” for a VSE
- Collection of artefacts developed
 - to [facilitate step-wise implementation](#) by the VSE
 - of a [logical subset of practices](#) of the selected Profile
- [Not intended to preclude or discourage](#) use of additional guidelines that VSEs find useful/relevant.
- Designed such that a VSE can implement its content, without having to implement the [complete framework](#) all at once
- In “collaborative project”, DPs can define Work Packages
- Each DP is authored/edited by at least 2 persons



System Engineering DPs

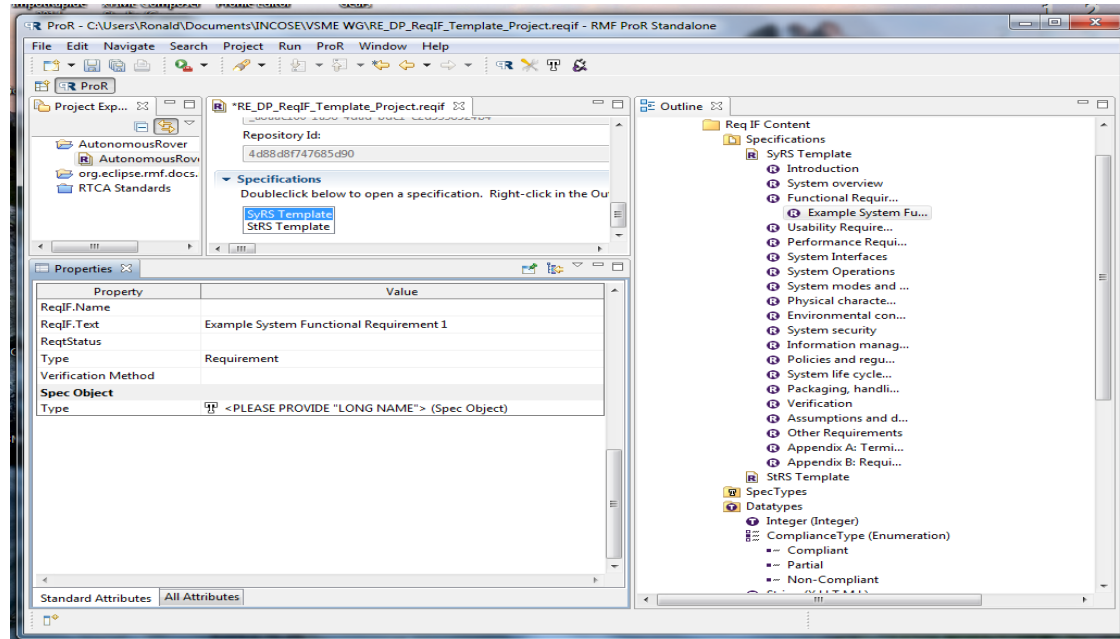


DPs available on INCOSE Connect VSME Page

SE/RE Tools

- VSEs rarely can afford « Big League » toolchains
- Desktop Office Applications can only go so far
 - MS-Office, OpenOffice, etc.
- May need roundtrip compatibility/exchange mechanism with « Big League » tools
- Open Source Eclipse-based toolchain provides one possible solution
 - Polarsys Project (www.polarsys.org)
 - Requirements Management Framework (RMF)/ProR GUI
 - ReqCycle for traceability management
 - Integrates with EMF-based toolset, e.g. Papyrus SysML modelling
 - Either « barebones » or within value-added distributions
 - formal mind Studio <http://formalmind.com/studio>
 - OpenETCS <http://openetcs.org/>
 - Capella <https://www.polarsys.org/capella/>

RE Project Template in Eclipse RMF/ProR



Eclipse Polarsys Toolchain



- Eclipse-based/Open Source
 - Developed/supported by Industry partners
- RMF/ProR or ReqCycle
 - Requirements Engineering/Management
- Papyrus
 - UML/SysML modelling
 - Papyrus-RT (Real-Time Extension)
- TITAN
 - Verification and Validation
- **CDT**
 - Language IDE, Compiler/Cross-compiler
- Trace Compass
 - Software Tracing
- Egit
 - Version Control



SECRET INGREDIENT #3

THE PEOPLE

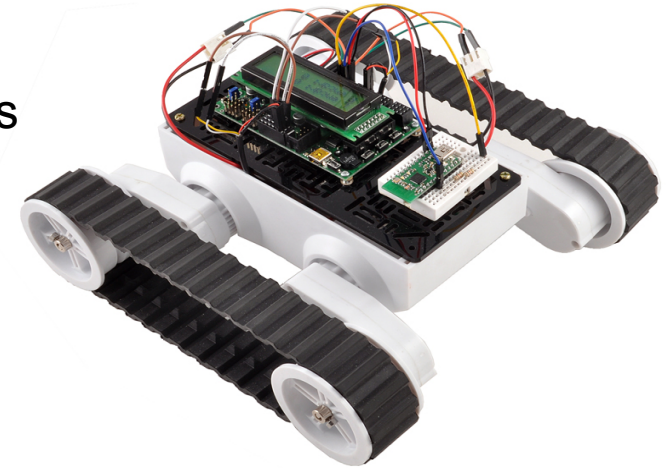


RE DP Training

- Collaborative and shared approach
 - Open License under Apache License 2.0
 - Royalty-free
 - Can be tailored without restrictions
 - <http://jastram.github.io/teaching/>
- Case Study
 - Must be able to grow as other DPs need training
 - Simple Traffic Light System
 - Jastram SE-Teaching Case Study
 - Polarsys Autonomous Rover Case Study
 - https://polarsys.org/wiki/PolarSys_Rover_Demo

Polarsys Autonomous Rover


- Goal: Develop an Autonomous Rover capable to carry a sensor payload into a confined theatre to:
 - map the zone;
 - collect sensor data; and
 - Indicate if zone safe to enter.
- Uses COTS Dagu Electronics Rover 5 chassis
 - 2 DC Motors with encoders
- Multi-specialty development exposure
 - Electronics
 - Microcontrollers
 - Printed Circuit Board
 - Mechanical
 - Software
- Supports training activities for Deployment Packages



Autonomous Rover Wiki



[←](#) [→](#) [↻](#) | [🔒](#) [polarsys.org/wiki/ISO/IEC_29110_Lifecycle_Demonstration_Case_Study](#) [📖](#) [☆](#)



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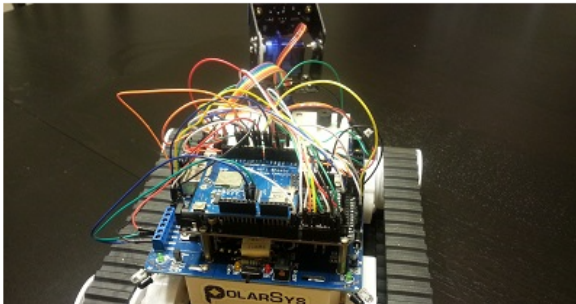
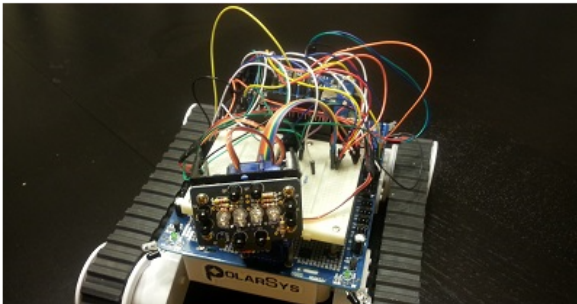
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ISO/IEC 29110 Lifecycle Demonstration Case Study

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 - [2.3 Autonomous Rover Case Study Resources](#)

The Autonomous Rover Prototype for the ISO/IEC 29110 Case Study



System Requirements Activities



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Step 1 Requirements Engineering

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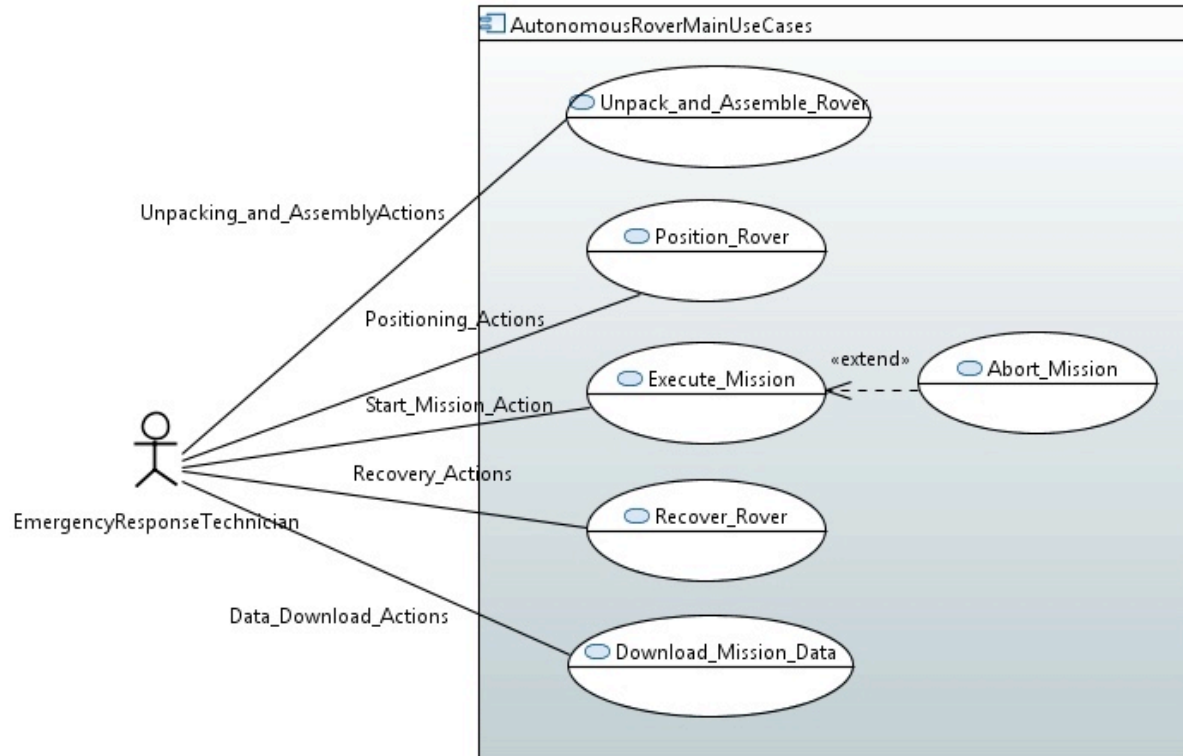
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 - [2.2 SR.2.1 - Elicit Acquirer and other stakeholders requirements and analyze system context](#)
 - [2.3 SR.2.2 - Review Stakeholders Requirements Specifications with PM](#)
 - [2.4 SR.2.3 - Baseline Stakeholders Requirements Specification with the Acquirer and Stakeholders](#)
 - [2.5 SR.2.4 - Capture System Requirements and Interfaces](#)
 - [2.6 SR.2.6a - Verify and obtain Work Team \(WT\) agreement on the System Requirements Specification](#)
 - [2.7 SR.2.7 - Validate that System Requirements Specification satisfies Stakeholders Requirements Specification](#)
 - [2.8 SR.2.8a - Define or update traceability between Requirements \(System to Stakeholder\)](#)
- [3 Activities - Phase 2](#)
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Use Case Analysis

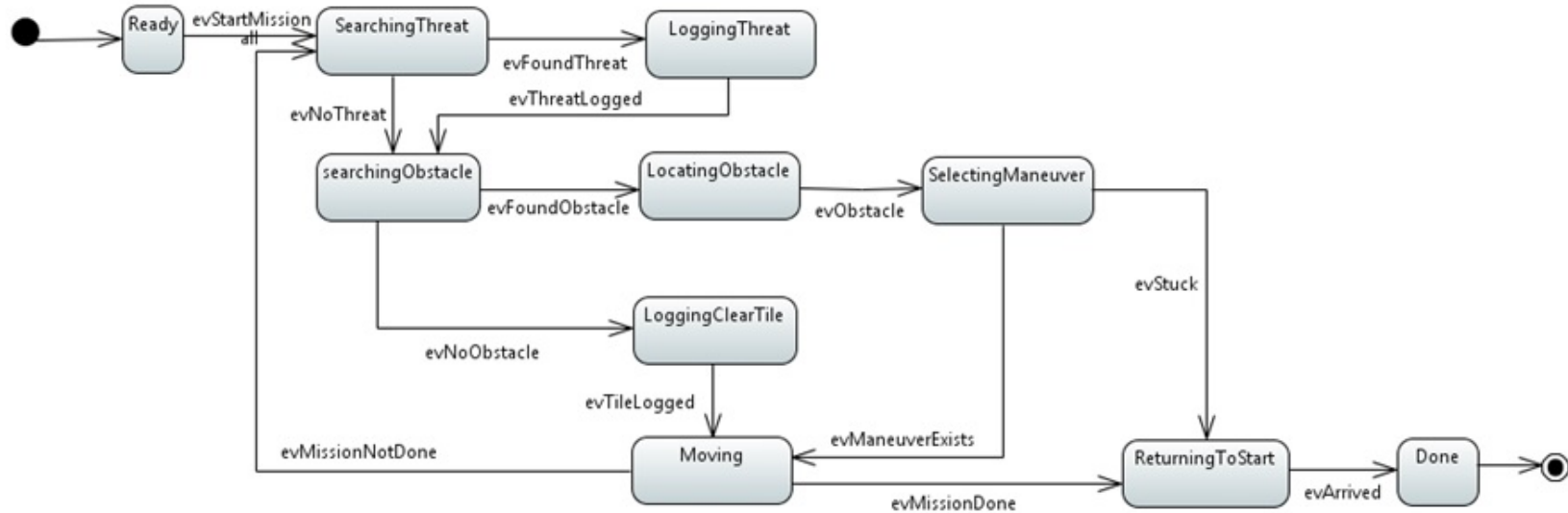


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State Machine Diagram

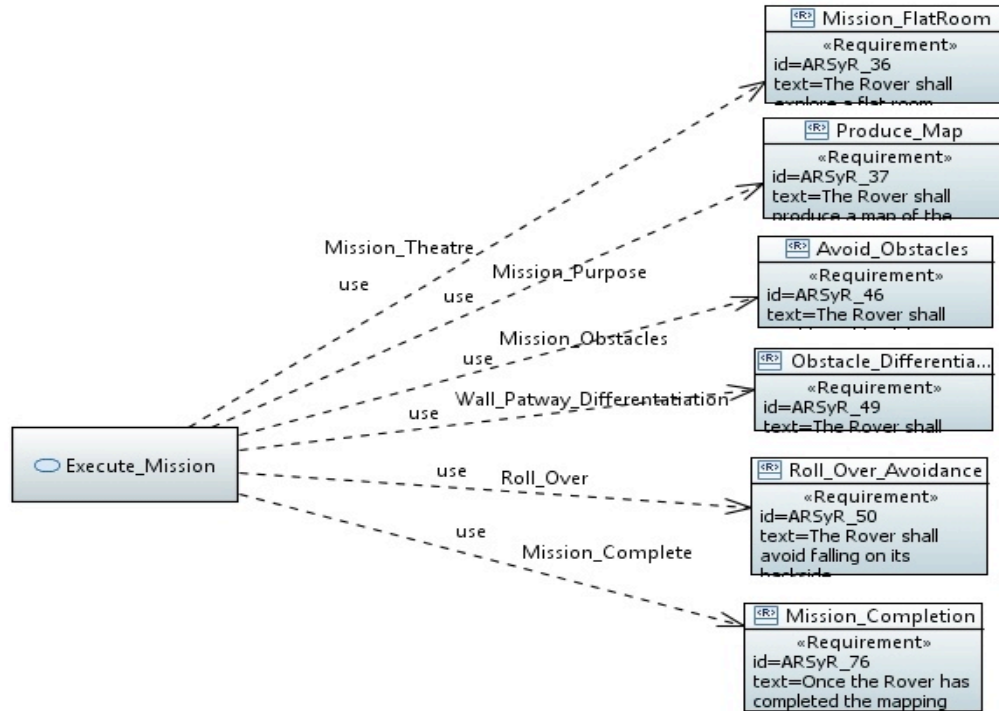


Requirements Traceability




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System Architecture Activities



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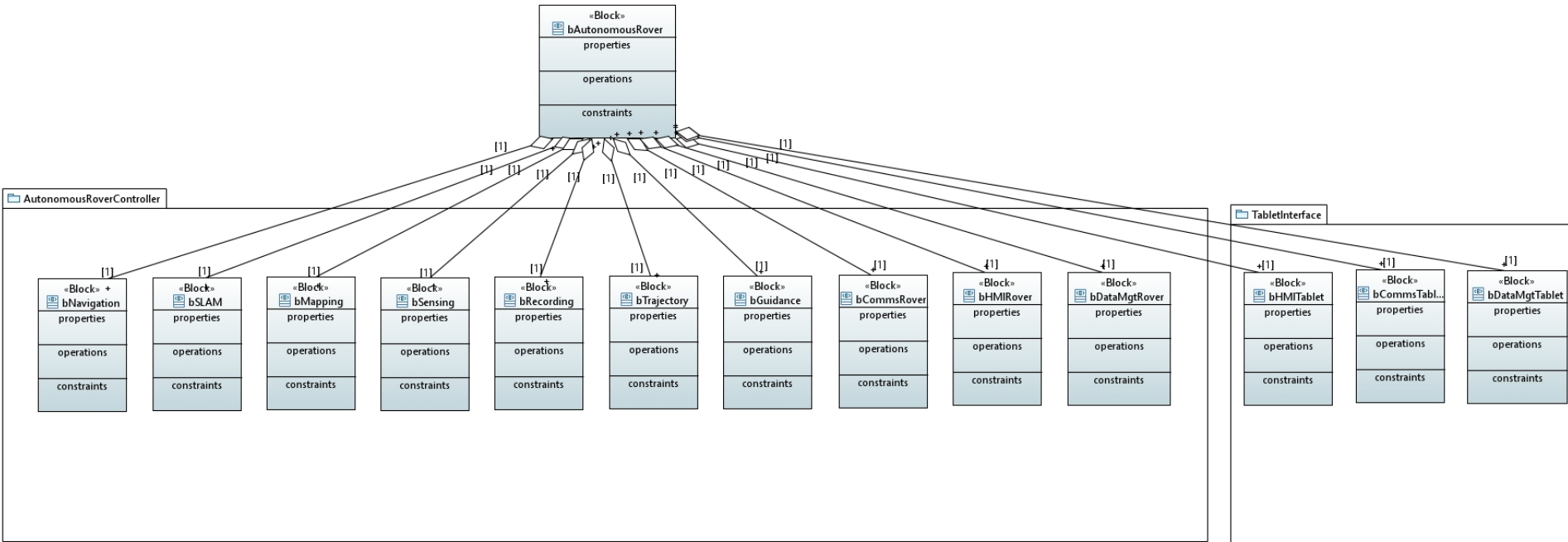
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Step 2 Functional and Physical Architecture

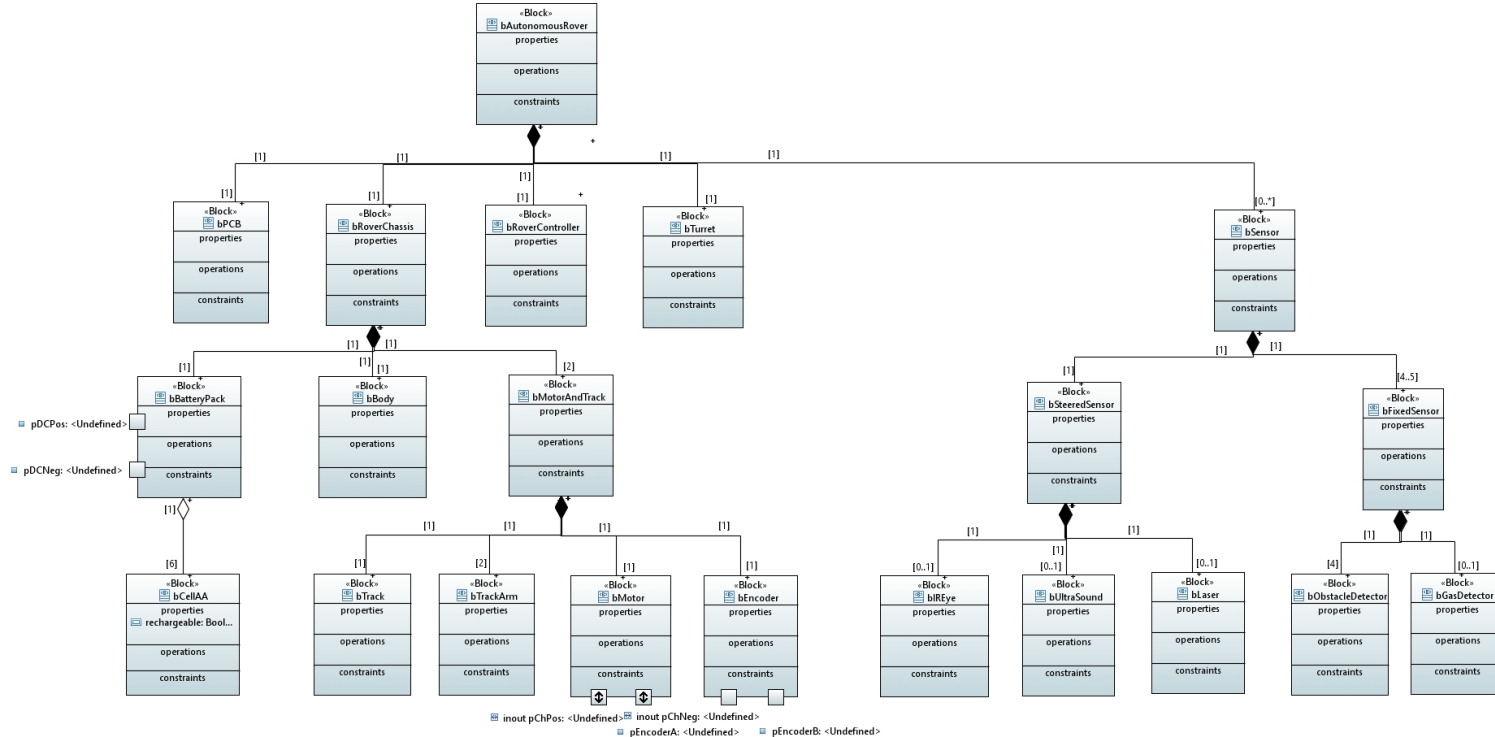
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 - [2.2.2 Threat Detection and Assessment](#)
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 - [2.4.1 Autonomous Rover Cost](#)
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 - [2.4.3 Processing Hardware](#)
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 - [2.4.8 Android Tablet](#)
 - [2.5 SR.3.5 - Verify and obtain approval of the System Design](#)
 - [2.6 SR.3.6 - Establish or update the Integration plan and Integration Procedures for System integration](#)
 - [2.7 SR.3.7 - Document the System User Manual \(Optional\)](#)
 - [2.8 SR.3.8 - Verify and obtain approval of the System User Manual \(Optional\)](#)

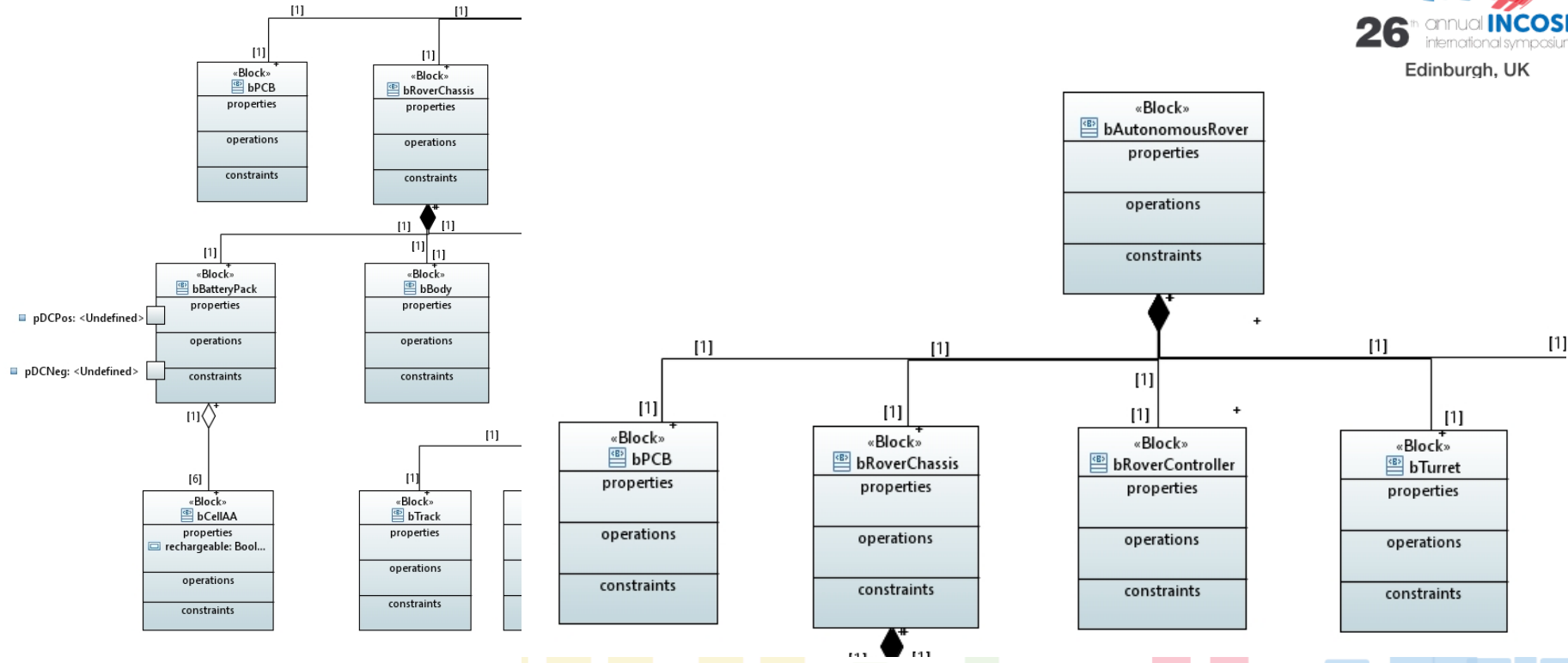
Functional Architecture BDD



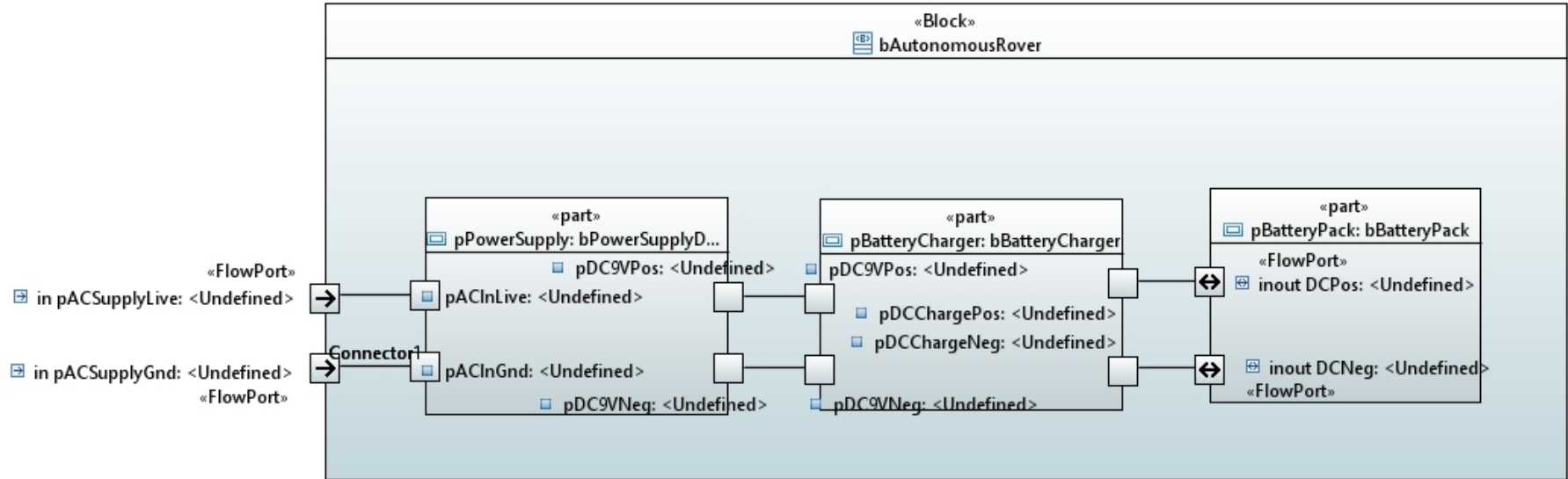
Physical Architecture BDD



Autonomous Rover BDD Highlights



Battery Charging IBD



Summary



- Means of making Systems Engineering accessible to VSEs being developed and deployed
 - Lead by ISO JTC 1/SC 7/WG 24
 - Supported by INCOSE VSE WG and Eclipse Polarsys Project
- “Out-of-the-Box” turnkey approach
- **Work Status**
 - ISO/IEC 29110 Systems Engineering Generic Profile Group
 - Entry Profile (Published)
 - Basic Profile (Published)
 - RE and Functional/Physical Architecture Deployment Packages
 - Intermediate Profile (Planned for 2017)

What Next?

- I want to use:
 - Download ISO/IEC 29110-5-6 (free download)
 - http://standards.iso.org/ittf/PubliclyAvailableStandards/c063371_ISO_IEC_29110-5-6_2_2014.zip
 - INCOSE Connect - SE for VSE WG Site (all the latest goodies)
 - <https://connect.incose.org/WorkingGroups/VSE/ISO%20DP%20Draft/Forms/AllItems.aspx>
 - DPs, Articles, etc.
 - <http://profs.etsmtl.ca/claporte/english/vse/>
 - Eclipse Polarsys Autonomous Rover Case Study
 - https://polarsys.org/wiki/ISO/IEC_29110_Lifecycle_Demonstration_Case_Study
- I want to contribute:
 - ISO/IEC JTC 1/SC 7/WG24
 - Participate in development of SLC Profile and guidelines for VSE
 - INCOSE Systems Engineering for VSE WG
 - Participate in development of one or more Deployment Packages
 - <https://connect.incose.org/WorkingGroups/VSE/Pages/Home.aspx>
- I want to exchange with other professionals:
 - LinkedIn “ISO 29110 International Standard” Group
 - <https://www.linkedin.com/grp/home?gid=8265224&sort=POPULAR>

감사합니다 Natick
Grazie Danke Ευχαριστίες Dalu
Thank You Köszönöm
Tack
Спасибо Dank Gracias
谢谢 Merci Seé
ありがとう

Obrigado