



26<sup>th</sup> annual **INCOSE**  
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Edinburgh, UK  
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# 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](http://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



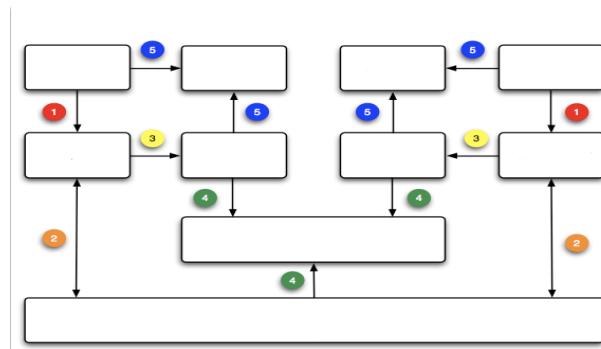
Sub committee (SC) 7



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



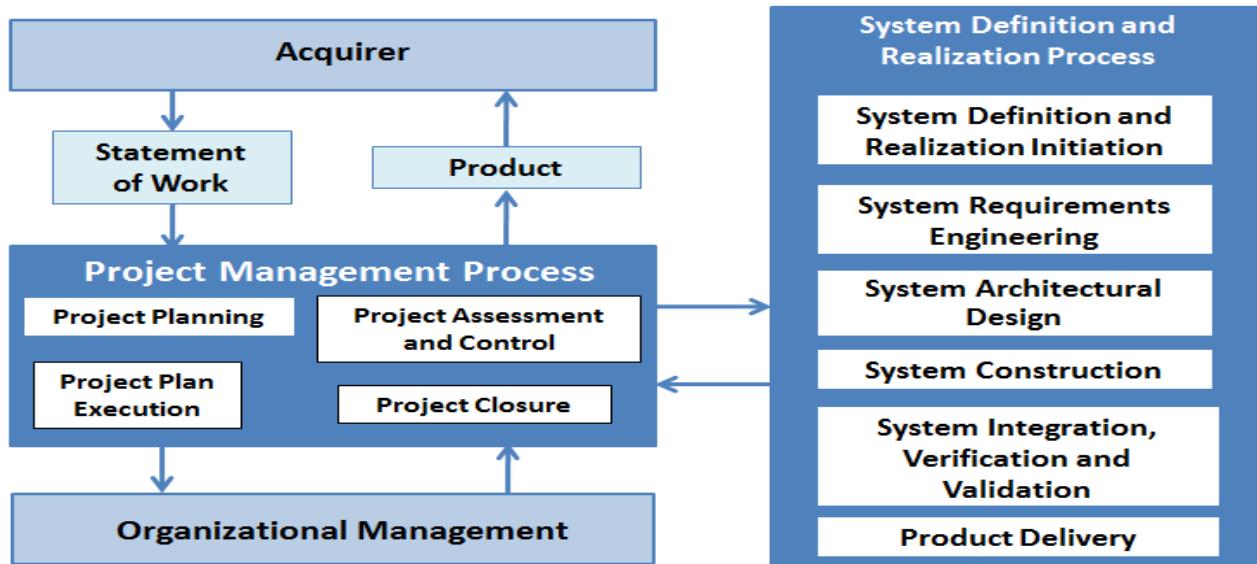
## Pre-tailored sets of Objectives/Activities/Artifacts

- **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

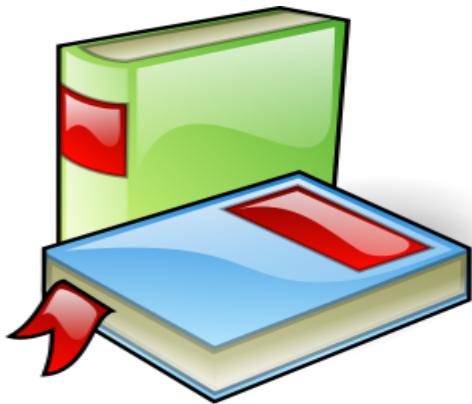
\* Generic = non-safety/security critical systems



- Objectives
- Activities
  - Tasks
  - Work Products
  - Roles

# SECRET INGREDIENT #2

## THE TOOLS

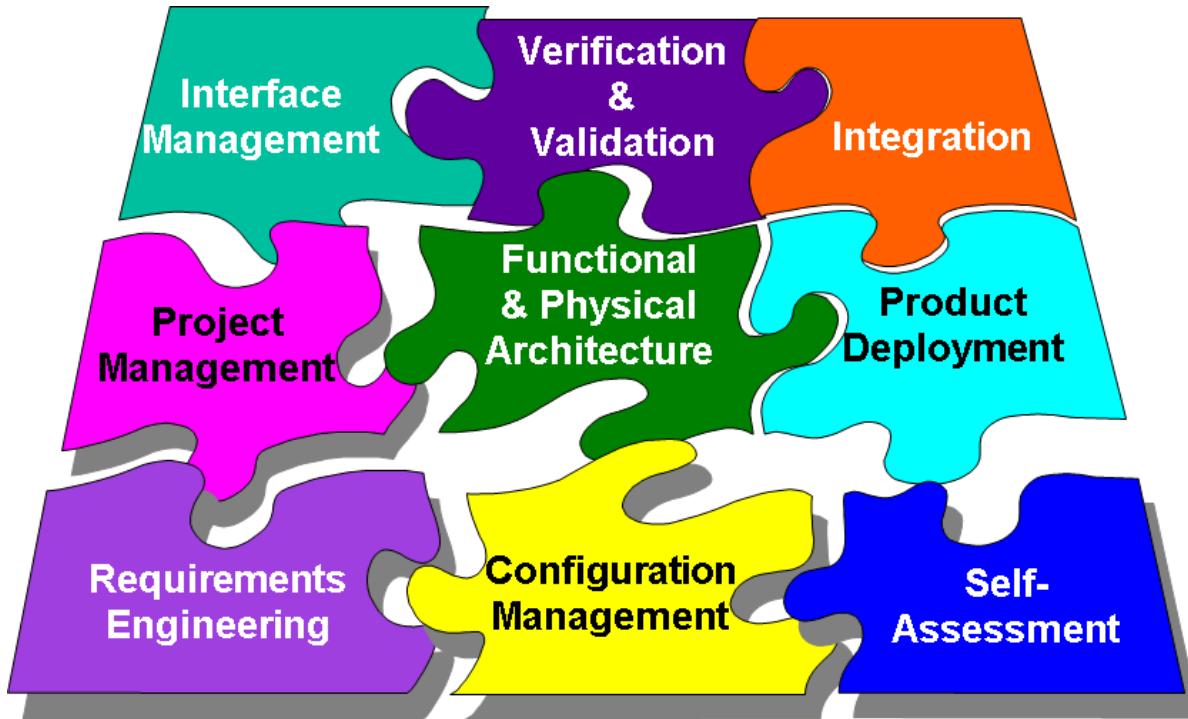


# Deployment Packages

- 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

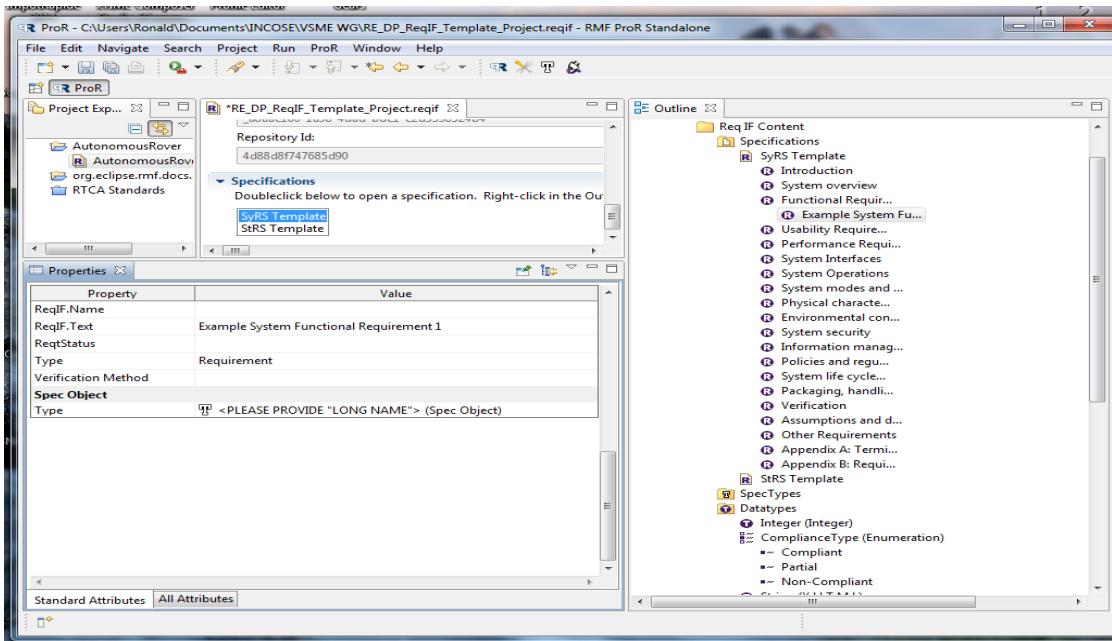


**DPs available on INCOSE Connect VSME Page**

# 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](http://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

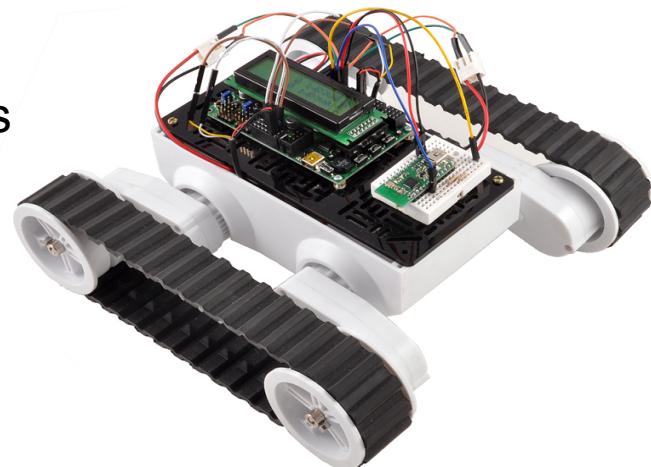


# RE DP Training

- 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](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



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[polarsys.org/wiki/ISO/IEC\\_29110\\_Lifecycle\\_Demonstration\\_Case\\_Study](https://polarsys.org/wiki/ISO/IEC_29110_Lifecycle_Demonstration_Case_Study)



**POLARsys**

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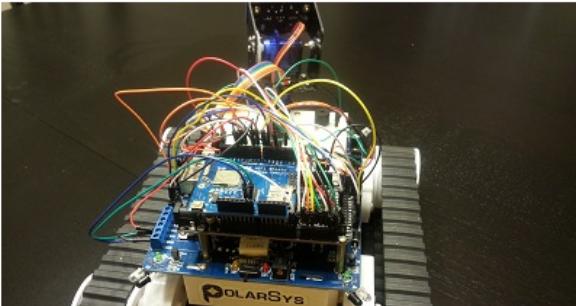
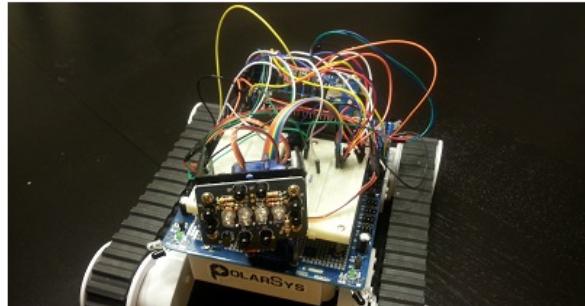
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## ISO/IEC 29110 Lifecycle Demonstration Case Study

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- [1 The Autonomous Rover Prototype for the ISO/IEC 29110 Case Study](#)
- [2 Introduction](#)
  - [2.1 Deployment Packages???](#)
  - [2.2 On to the Good Stuff](#)
  - [2.3 Autonomous Rover Case Study Resources](#)

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



# System Requirements Activities



page discussion view source history

## Step 1 Requirements Engineering

Contents [hide]

**1 Introduction**

**2 Activities - Phase 1**

- 2.1 SR.1.1 – Review Project Plan with the Work Team members
- 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**

- 3.1 SR.2.5 - Capture System Elements and Interface Requirements
- 3.2 SR.2.6b - Verify and obtain Work Team (WT) agreement on the System Elements Requirements Specifications
- 3.3 SR.2.8b - Define or update traceability between Requirements (System Element to System)

**4 Navigation Links**

navigation

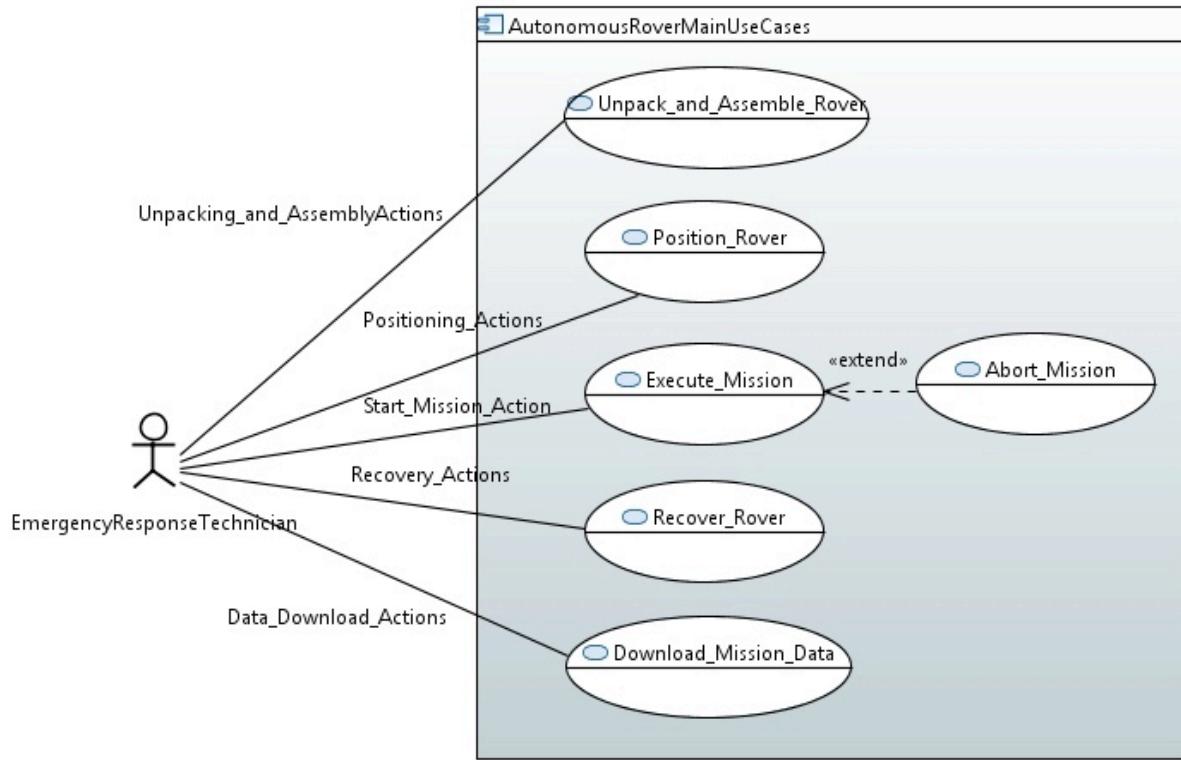
- Main page
- Community portal
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search

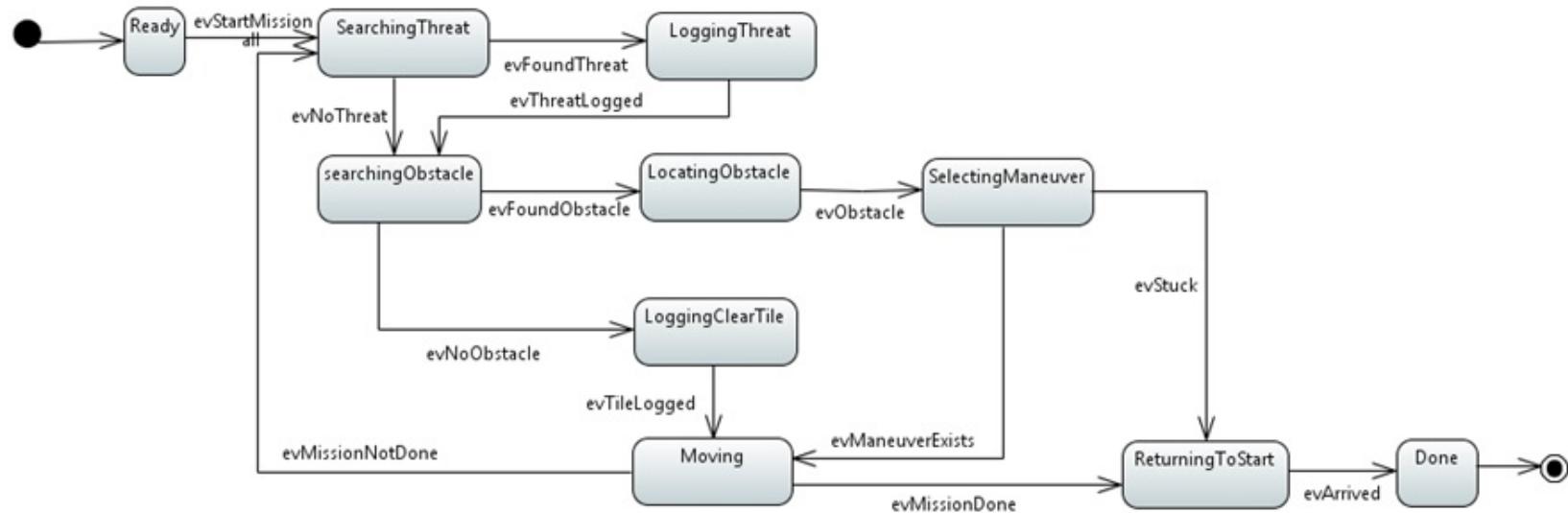
toolbox

- What links here
- Related changes

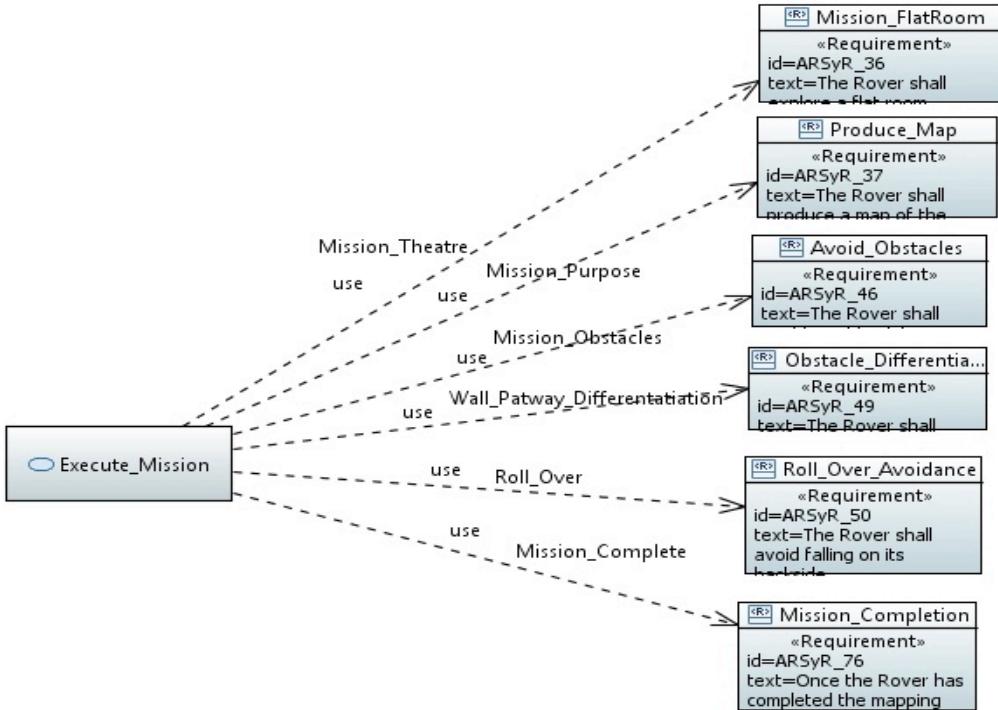
# Use Case Analysis



# State Machine Diagram



# Requirements Traceability



# System Architecture Activities



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## Step 2 Functional and Physical Architecture

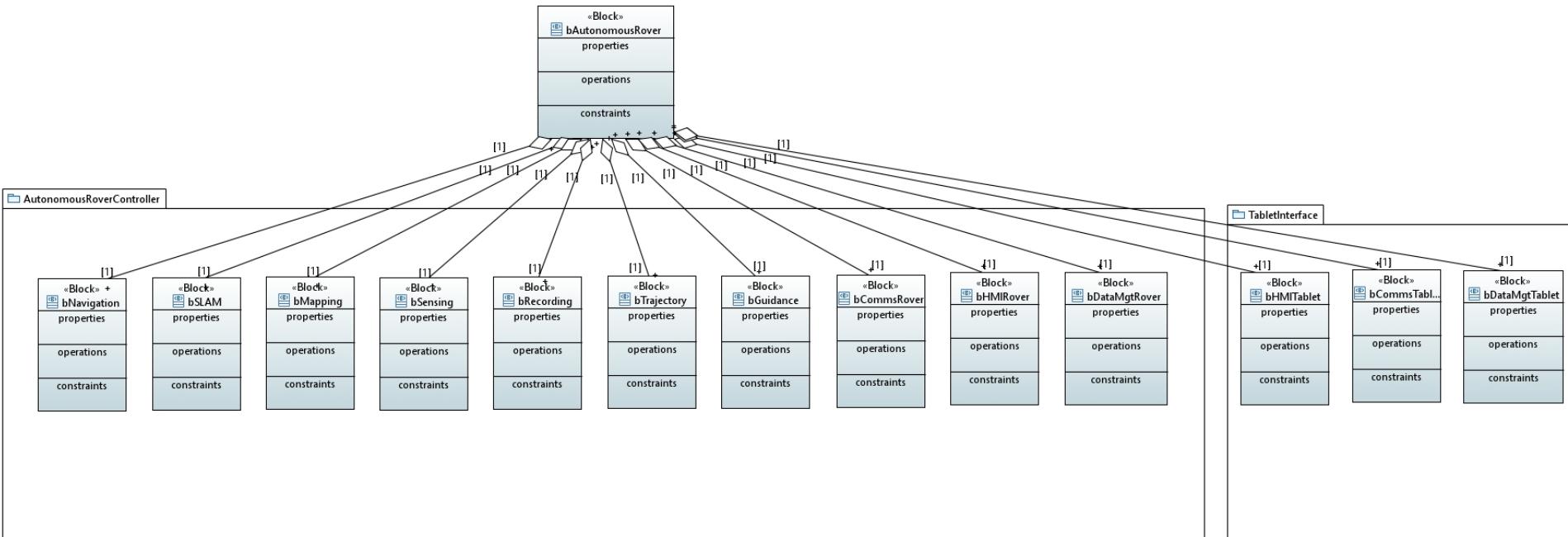
Contents [hide]

**1 Introduction**

**2 Activities - Phase 2**

- 2.1 SR.3.1 - Document or update the Functional System Design**
- 2.2 SR.3.2 - Make trade-offs of the System Functional Architecture**
  - 2.2.1 Navigation and Mapping Algorithm**
  - 2.2.2 Threat Detection and Assessment**
  - 2.2.3 User Interface**
- 2.3 SR.3.3 - Document or update the Physical System Design**
- 2.4 SR.3.4 - Make trade-offs of the System Physical Architecture**
  - 2.4.1 Autonomous Rover Cost**
    - 2.4.1.1 Selection Criteria**
  - 2.4.2 Power Source**
  - 2.4.3 Processing Hardware**
  - 2.4.4 Operating System**
  - 2.4.5 Platform Support**
  - 2.4.6 Navigation Sensor**
  - 2.4.7 Mapping Sensor**
  - 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)**

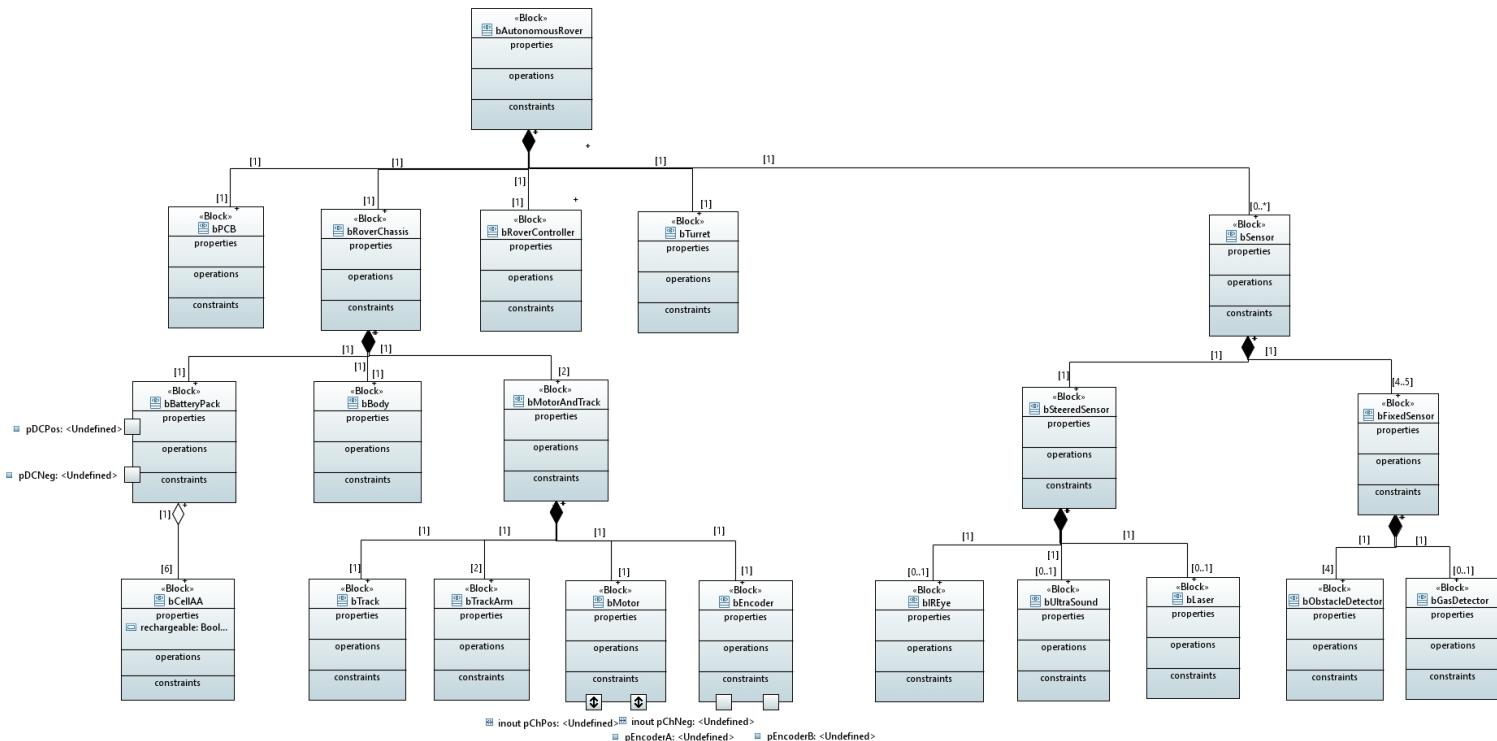
# Functional Architecture BDD



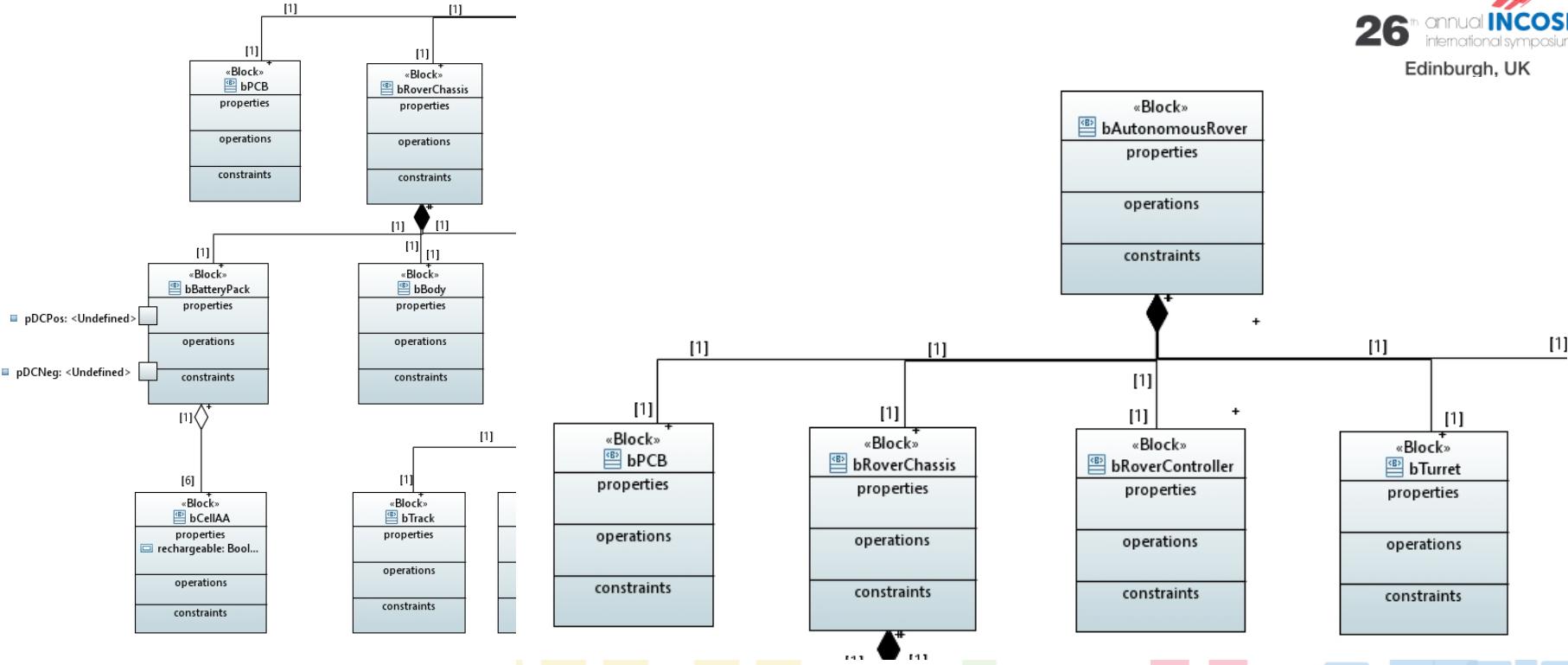
# Physical Architecture BDD



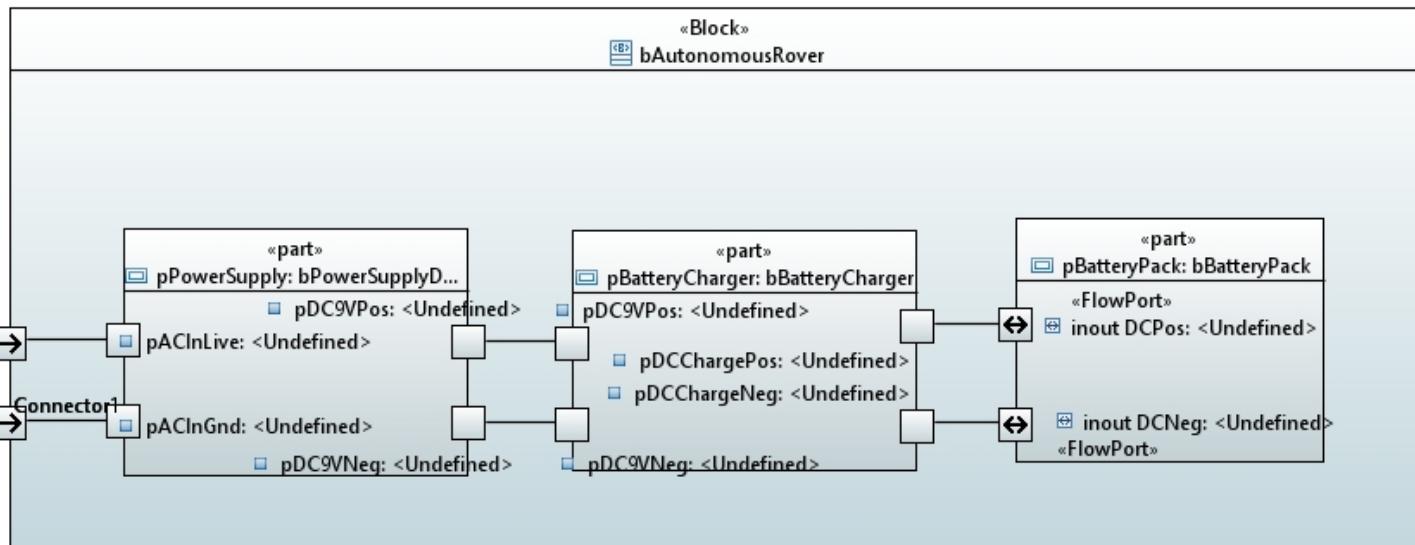
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# Autonomous Rover BDD Highlights



# 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](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\\_Stu](https://polarsys.org/wiki/ISO/IEC_29110_Lifecycle_Demonstration_Case_Stu)
- 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