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!

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Outline

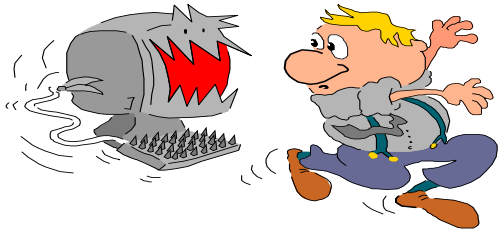
- Introduction
  - Very Small Entities (VSEs) and today's economy
  - ISO/IEC 29110 Standards for VSEs
- Beyond the Standard
  - Profile Groups and Profiles
  - Deployment Packages (DPs)
  - Tools
- Autonomous Rover Case Study

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

INCOSE
International Council on Systems Engineering

eclipse

AFIS Association Française d'Ingénierie Système

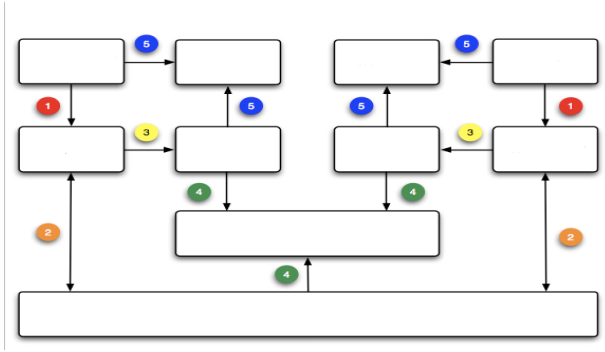
ISO JTC1 IEC
INFORMATION TECHNOLOGY STANDARDS

Sub committee (SC) 7

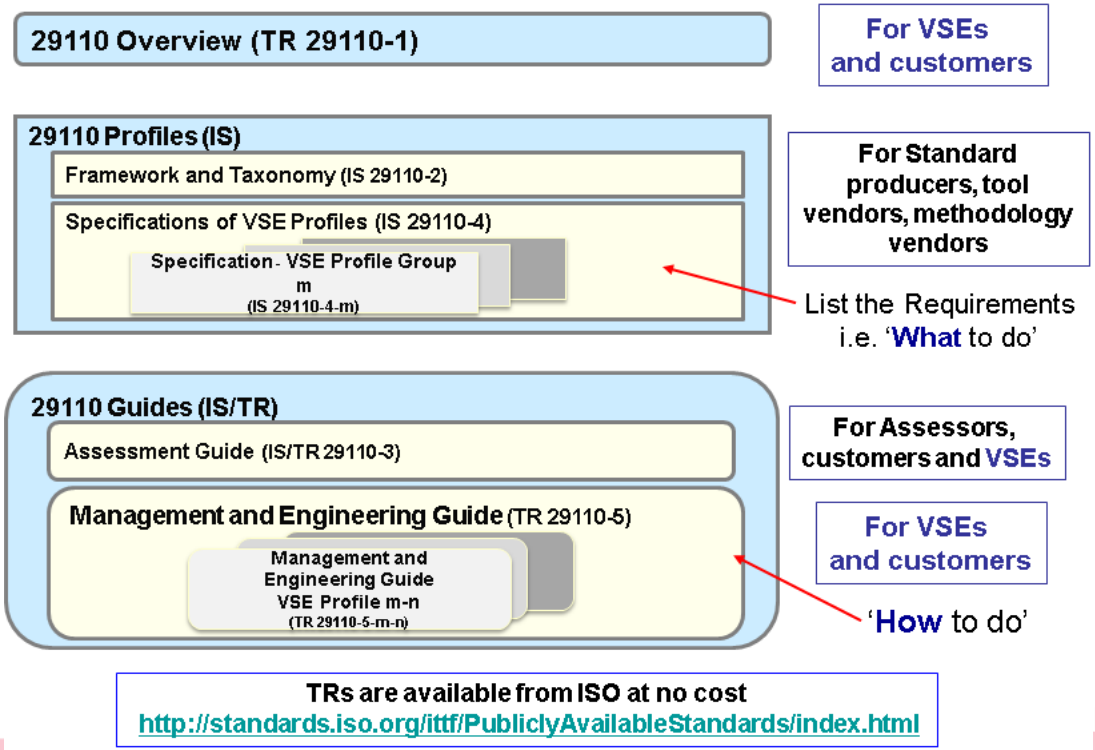
Working Group (WG) 24

PolarSys
Open Source Tools for Embedded Systems

SECRET INGREDIENT #1: THE PROCESS



ISO/IEC 29110 for VSEs



Generic* Profile Group

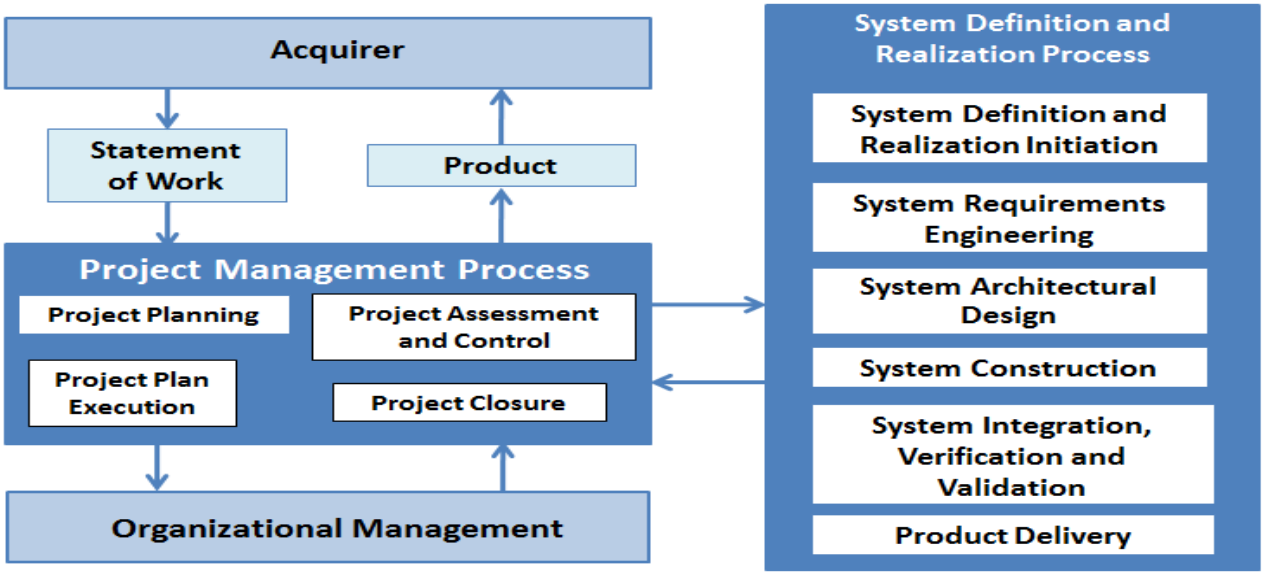
Pre-tailored sets of Objectives/Activities/Artefacts

- **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

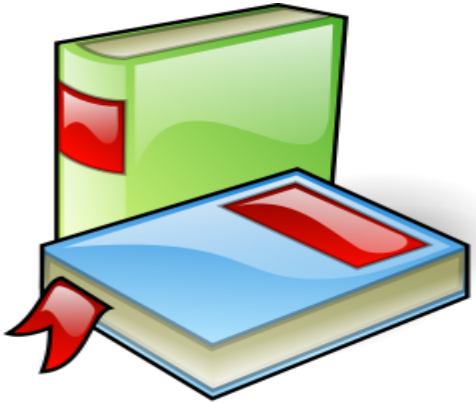
* Generic = non-safety/security critical systems

SE - Basic Profile



- Objectives
- Activities
  - Tasks
  - Work Products
  - Roles

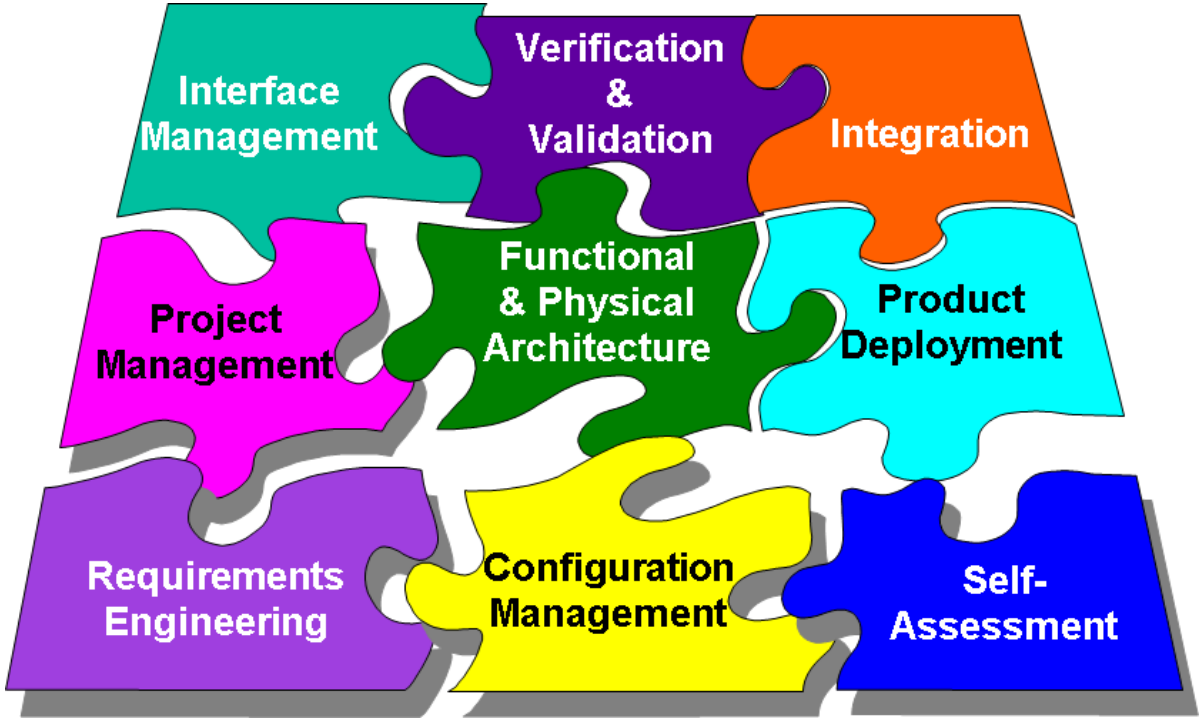
SECRET INGREDIENT #2
THE TOOLS



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/

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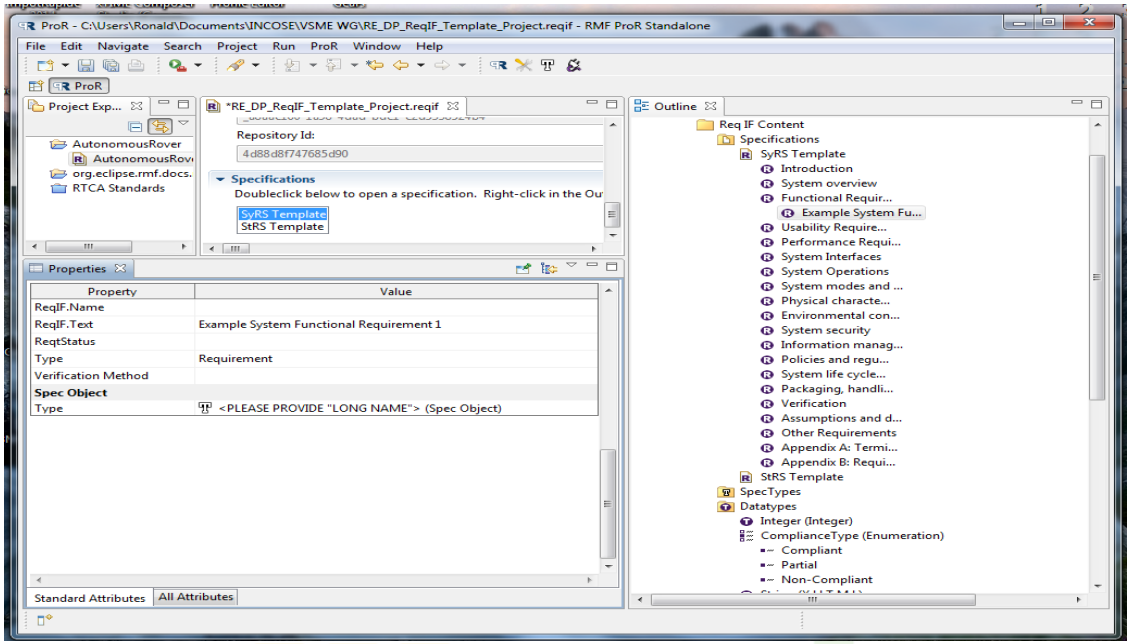
RE Project Template in Eclipse RMF/ProR



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

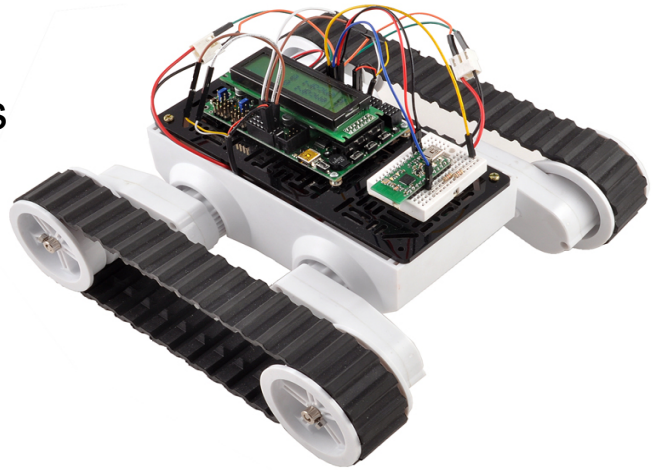
SECRET INGREDIENT #3
THE PEOPLE

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

PolarSys

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ISO/IEC 29110 Lifecycle Demonstration Case Study

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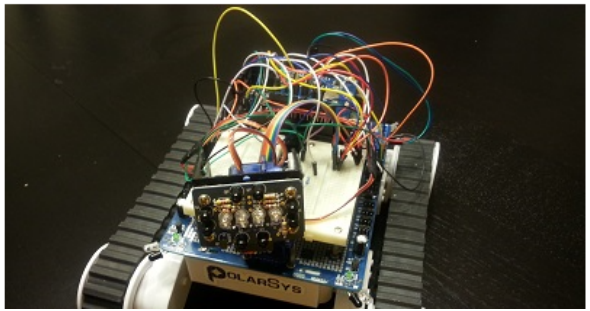
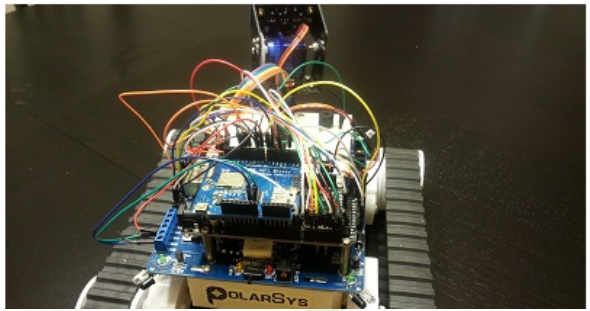
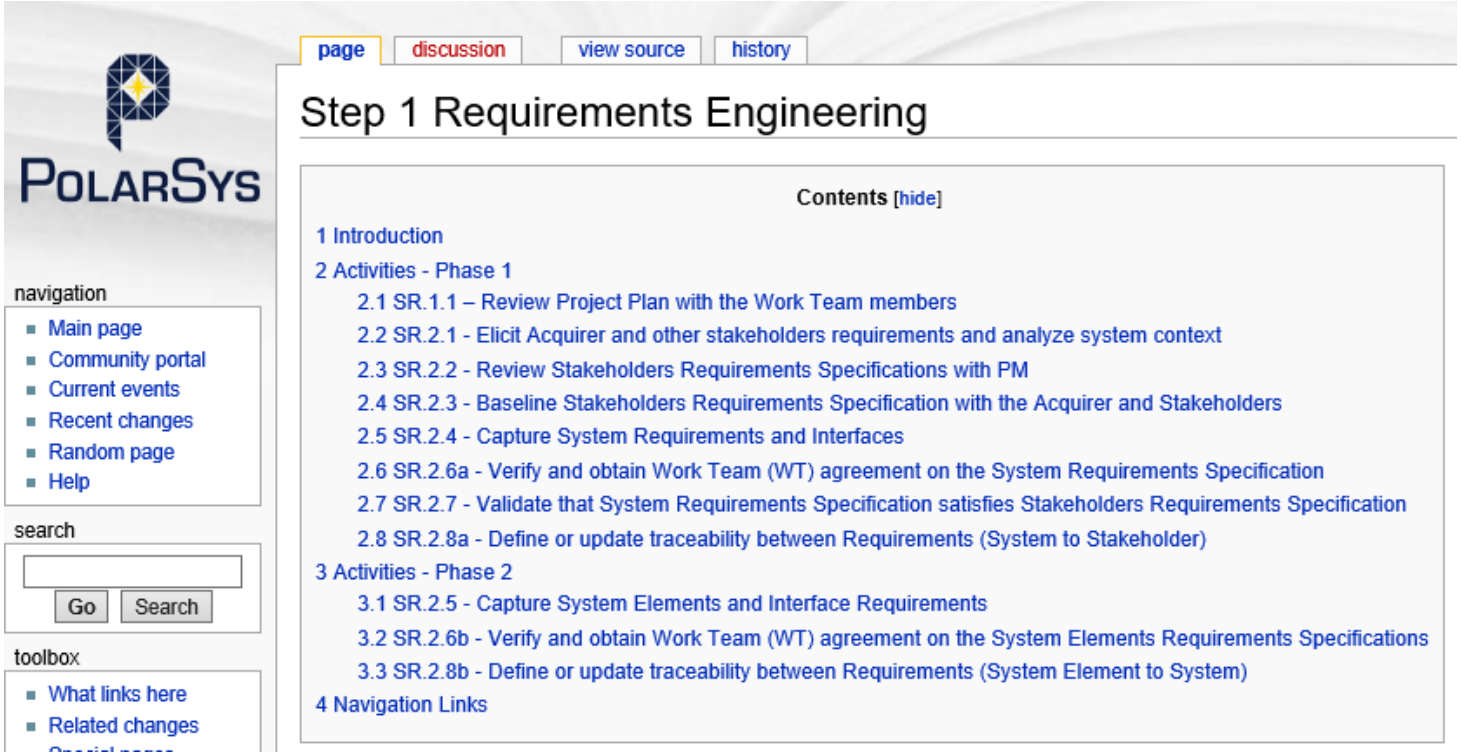
The Autonomous Rover Prototype for the ISO/IEC 29110 Case Study

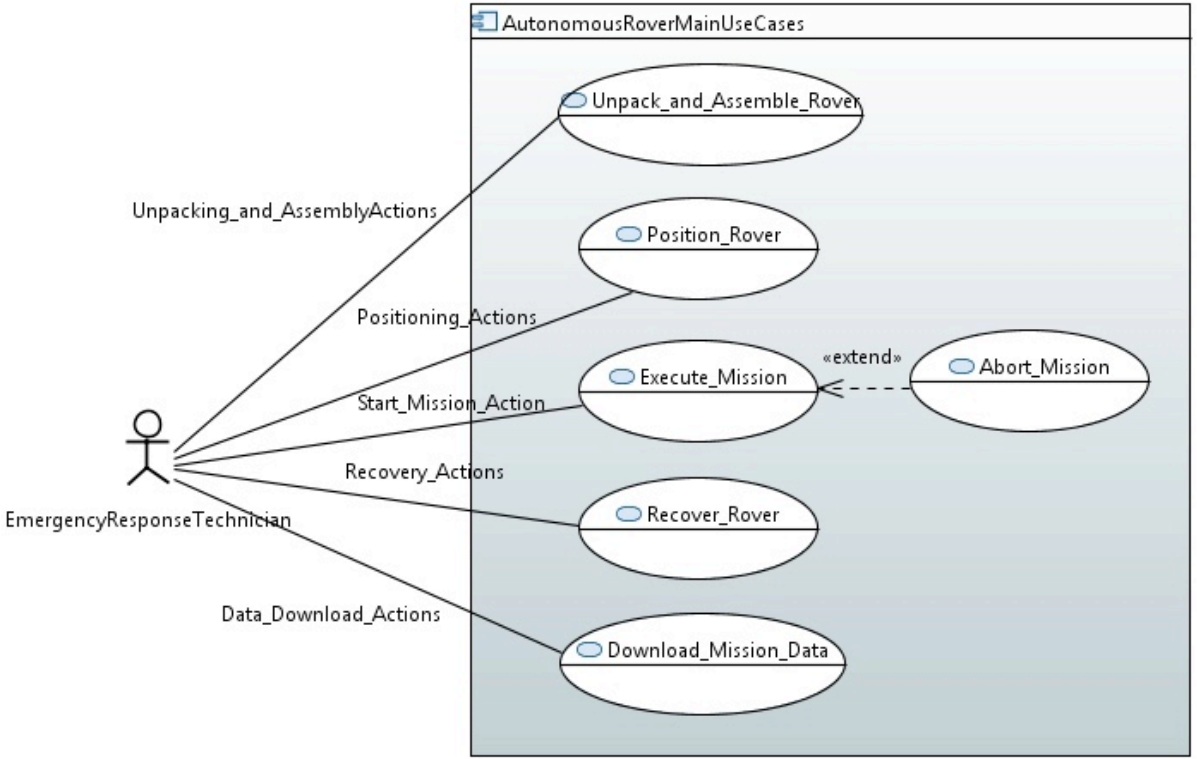




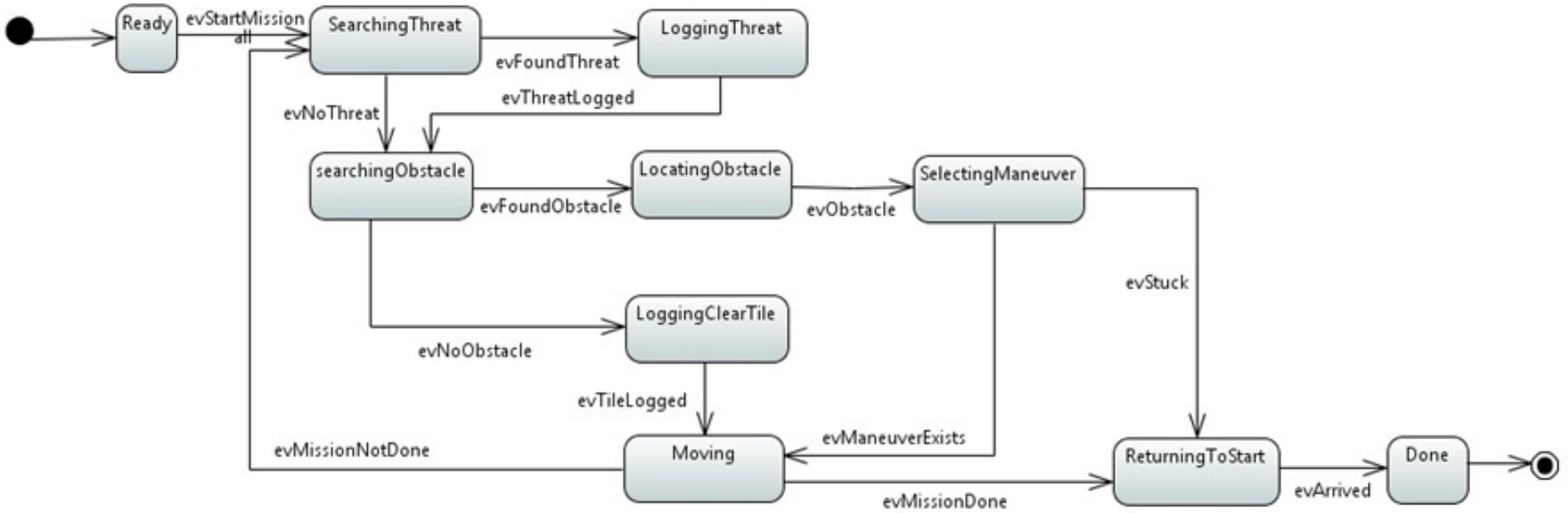
System Requirements Activities



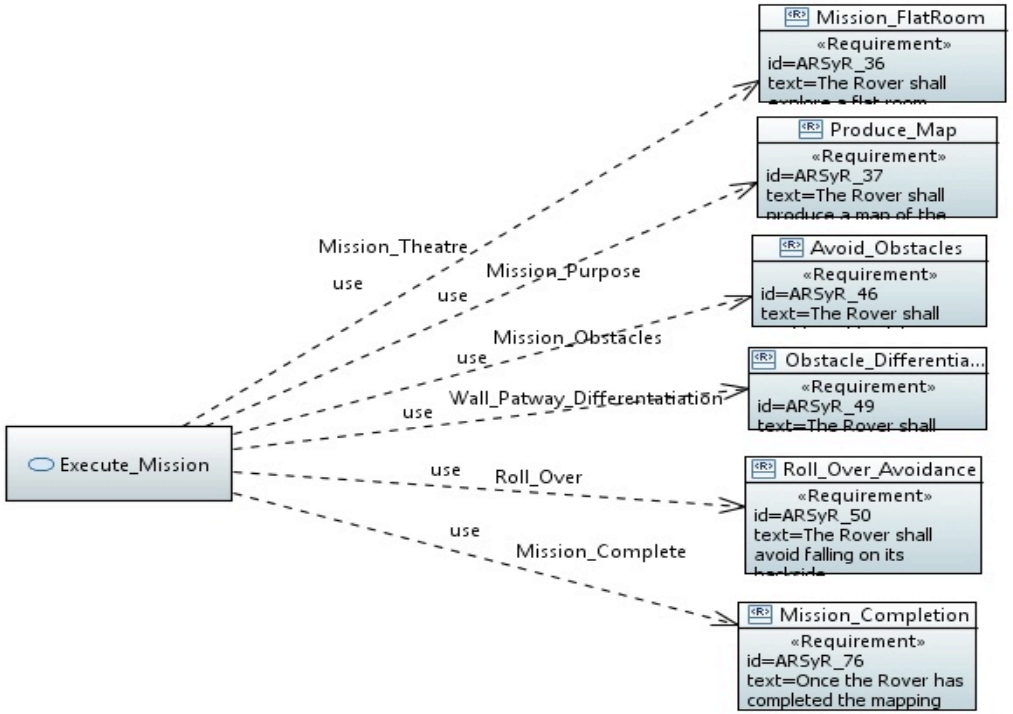
Use Case Analysis



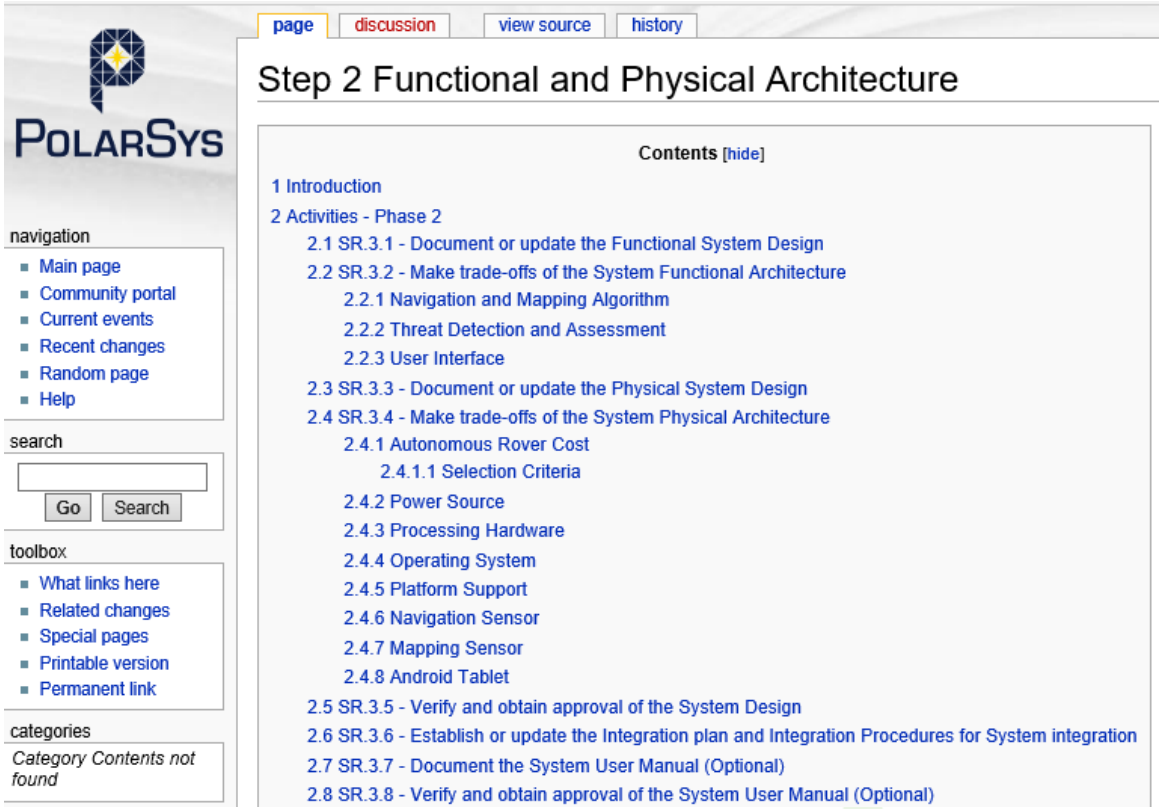
State Machine Diagram



Requirements Traceability



System Architecture Activities



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Step 2 Functional and Physical Architecture

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Functional Architecture BDD

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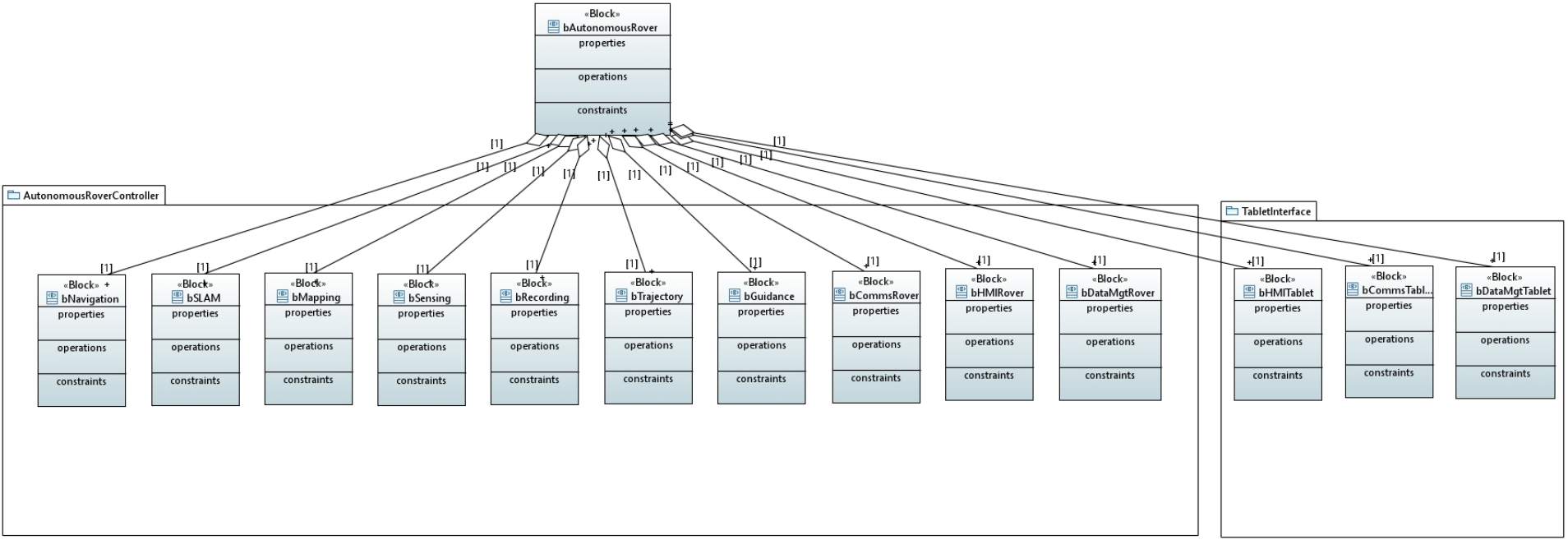
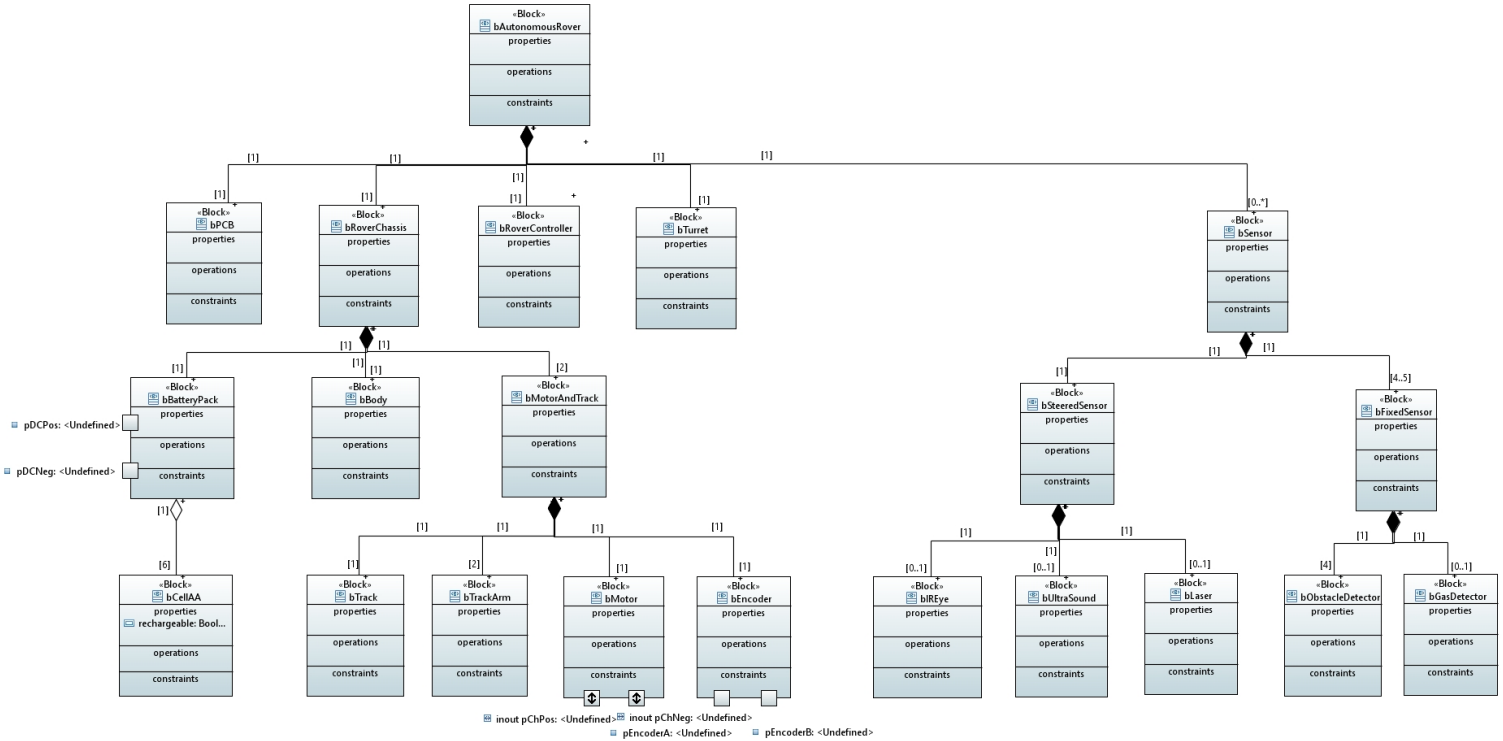


Physical Architecture BDD



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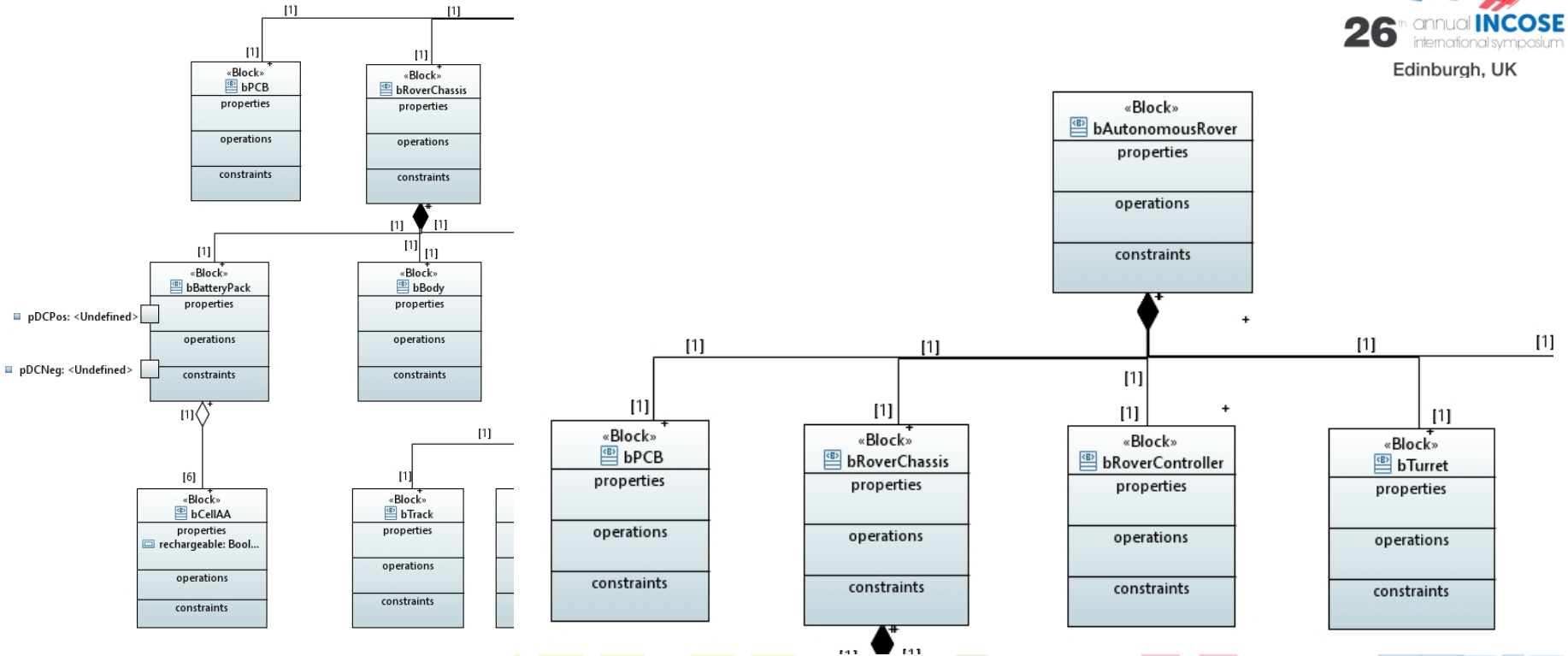
Autonomous Rover BDD Highlights



Battery Charging IBD

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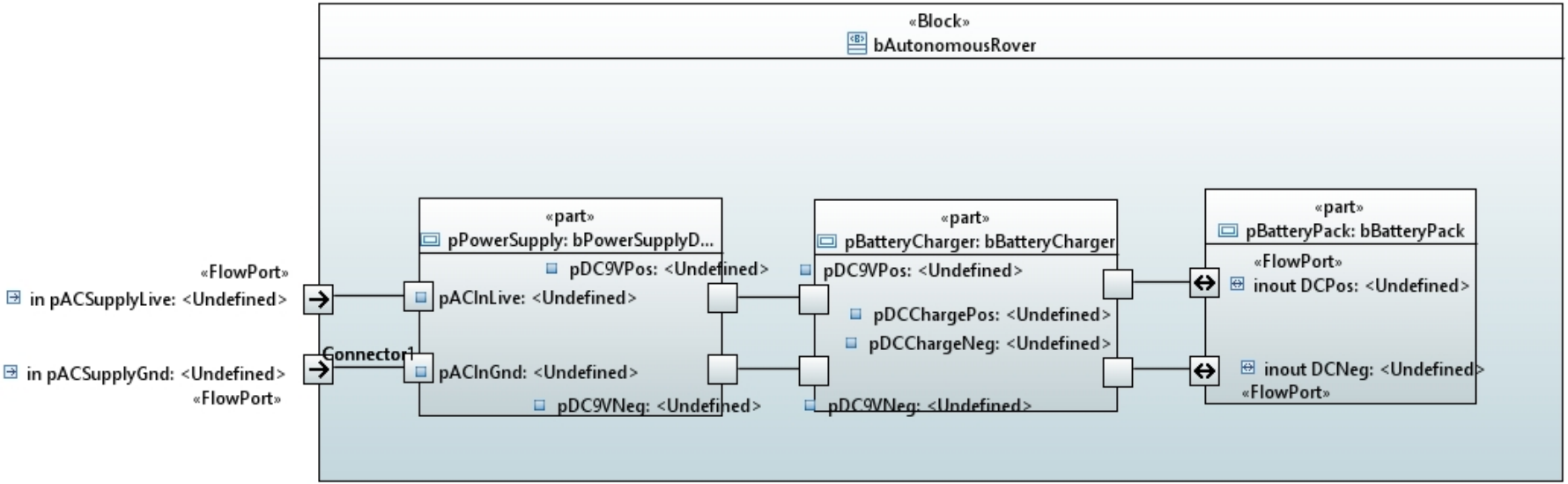

Summary

- 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

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