25th anniversary
annual INCOSE
international symposium
Seattle, WA
July 13 - 16, 2015

Making Systems Engineering Work for Very Small Enterprises

(or all you need to know about Deployment Packages and Tools)

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Presented by Ronald (Ron) Houde

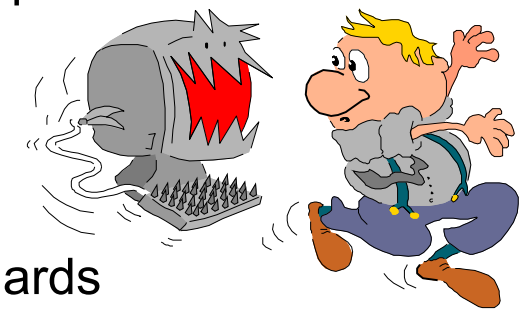
Outline

- Importance of Very Small Entities (VSEs)*
- ISO/IEC 29110 Standards for VSEs
- Systems Engineering Profiles for VSEs
- Systems Engineering Deployment Packages (DPs)
  - Focus on Requirements Engineering DP
- Systems Engineering Training for VSEs
- Next Steps

Very Small Entity
Enterprise, organization, project or department of up to 25 people

Context

- Most VSEs
  - Cannot afford resources
    - Nb. of employees, expertise, cost and time
  - Don't see net benefit developing/documenting processes
- Implementing process from standards
  - Has an inherent level of complexity
  - Resources and expertise required to
    - select out of existing and applicable standards
    - appropriate processes
    - adapt/tailor them to the VSE context and needs
- Result: VSE processes are often improvised
  - Depend on expertise/experience of key team member
  - Not documented
  - When key member(s) leaves, most of knowledge and expertise may vanish



ISO Working Group 24

Mandate:
Standardize
- Processes
- Supporting tools and
- Supporting technologies

for engineering of software products systems.

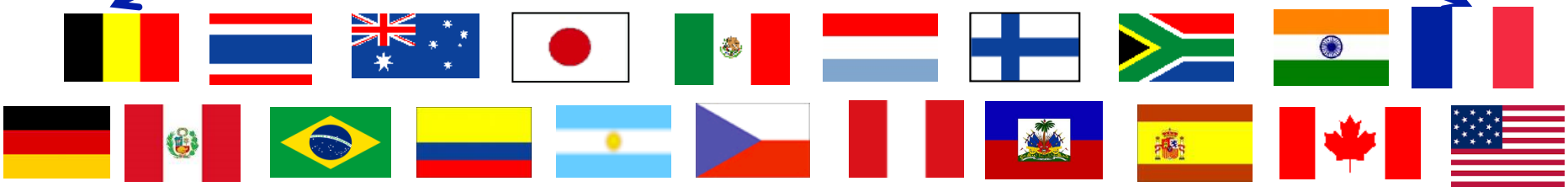
ISO JTC1 IEC
INFORMATION TECHNOLOGY STANDARDS
Joint Committee

↓

Sub committee (SC) 7

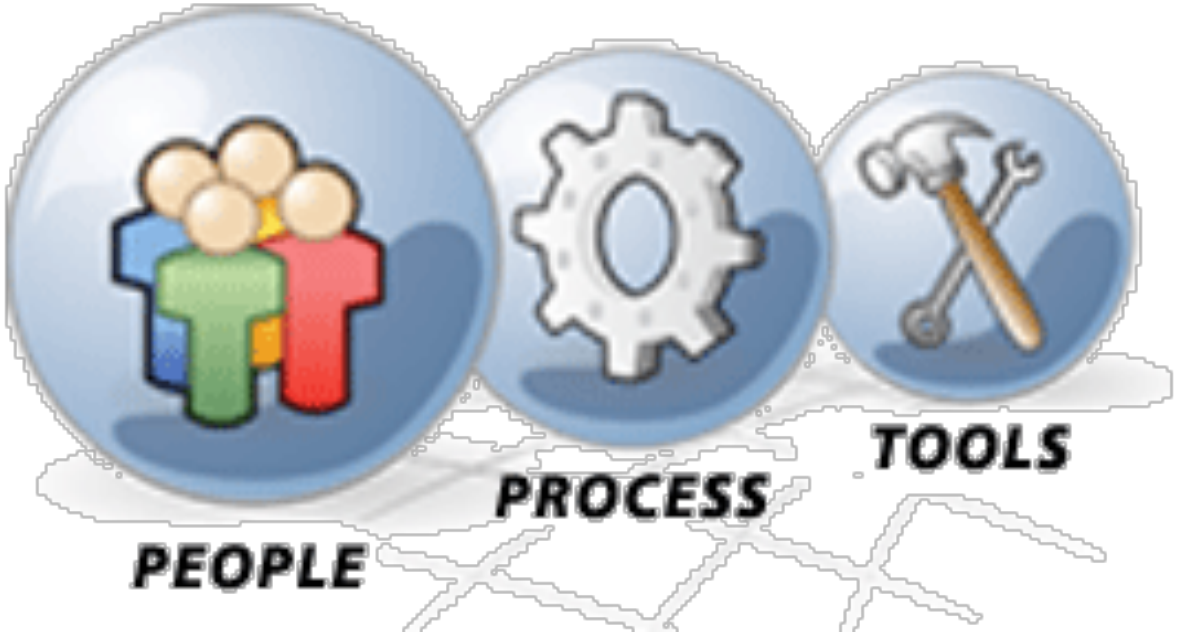
↓

Working Group (WG) 24

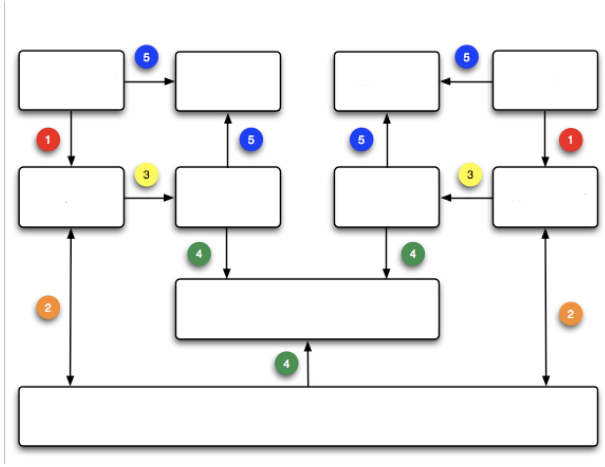


INCOSE
AFIS Association Française d'Ingénierie Système
IEEE

The 3 pieces of the puzzle



PIECE #1: THE PROCESS

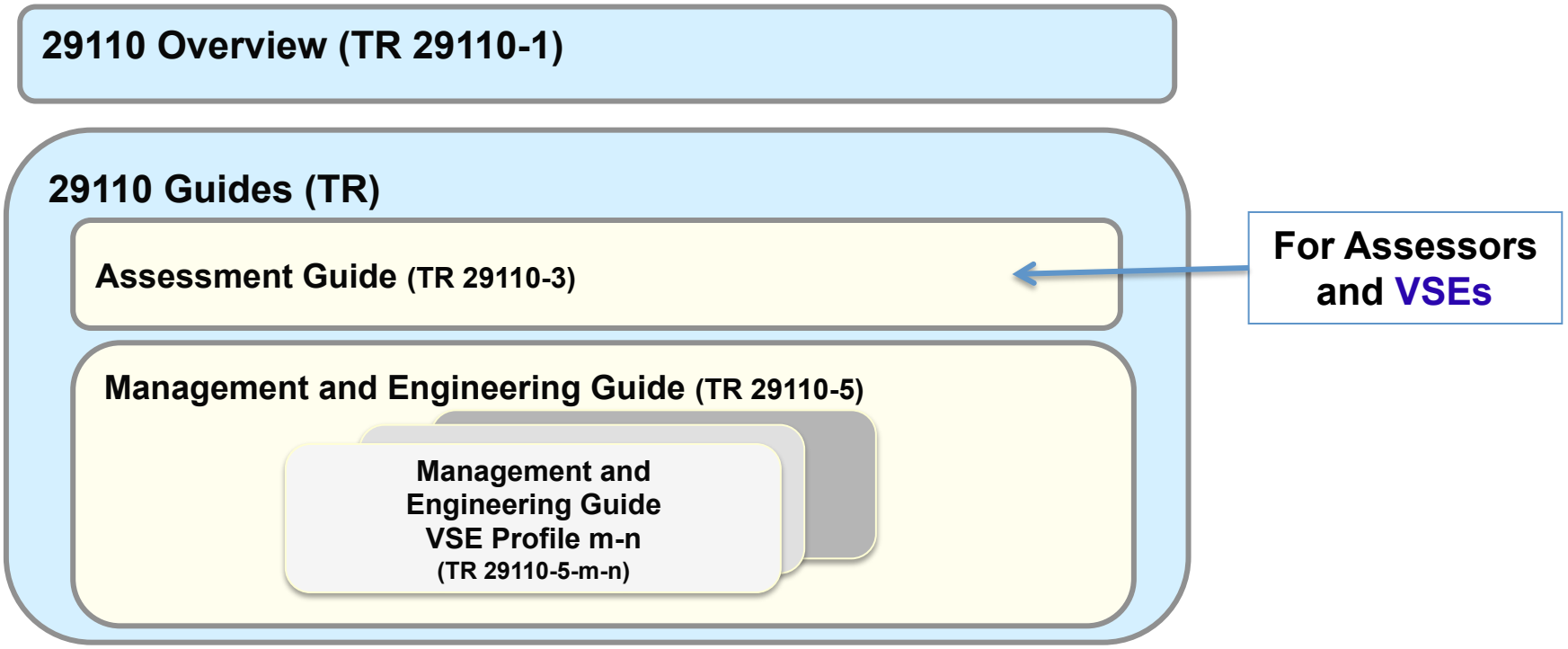


Generic* Profile Group

- **Entry** - Targets VSEs typically developing 6 person-month projects or start-ups;
- **Basic** - Targets VSEs developing only one project at a time;
- **Intermediate** – Targets VSEs developing multiple projects with more than one team;
- **Advanced** – Targets VSEs which want to sustain and grow as an independent competitive software development business.

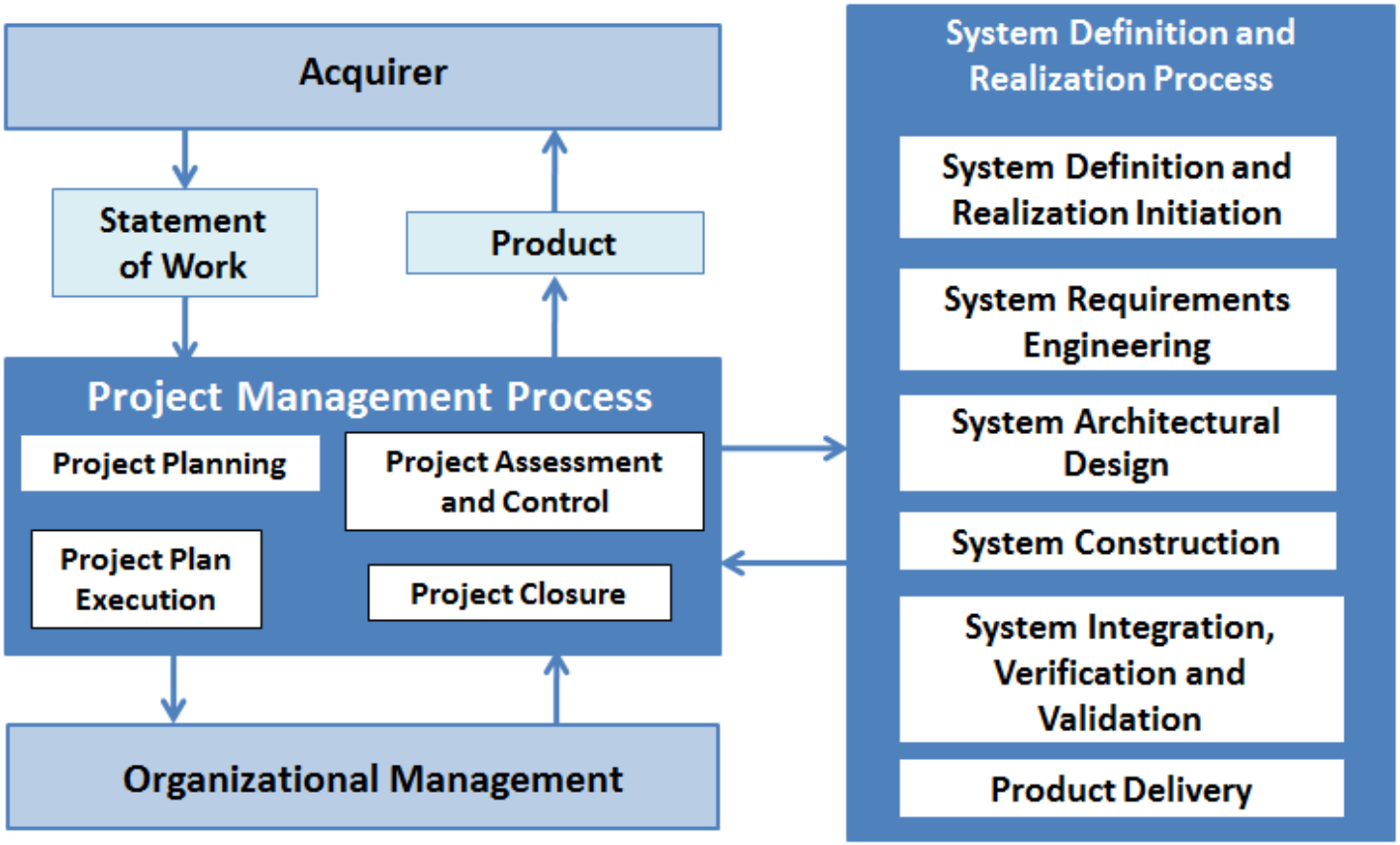
* Target: non-critical systems/software developers

ISO/IEC 29110 for VSEs



Obtained approval from ISO to make TRs available at no cost

Systems Engineering Basic Profile



ISO 29110 – Systems Engineering Profile

- Applies ISO/IEC 15288 in context of VSEs
  - Simplified Communications
  - Reduced Formalism
- Pre-tailored for VSEs
- Equivalence
  - Basic Profile => CMMI Level 2
  - Intermediate Profile => CMMI Level 3

System Definition & Realization Tasks

Role	Task	Input Product	Output Products
PJM WT	**SR.2.2** Verify the *Stakeholders Requirements Specification* with PJM Obtain Work Team agreement on the *Stakeholder Requirements Specification*	*Stakeholder Requirements Specification [initiated]*	*Verification Report* *Stakeholder Requirements Specification [verified]*

System Definition & Realization Roles

Role	Abbreviation	Competency
Systems Engineer	SYS	• Knowledge and experience eliciting, specifying and analysing the requirements. • Knowledge in designing user interfaces and ergonomic criteria. • Knowledge of the revision techniques. • Knowledge of the requirements authoring. • Knowledge of the business domain • Experience on system development, integration, operation and maintenance • Experience on the system development and maintenance.
Work Team	WT	• Knowledge and experience according to their roles on the project: SYS, DES, DEV, IVV. • Knowledge on the standards used by the Acquirer and/or by the VSE.

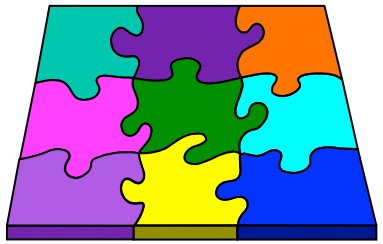
System Definition & Realization Products

Name	Description	Source
Change Request	Identifies a System, or documentation problem or desired improvement, and requests modifications. It may have the following characteristics: • Identifies purpose of change • Identifies request status • Identifies requester contact information • Impacted system(s), system element(s) • Impacted IVV facilities • Impact to operations of existing system(s) defined • Impact to associated documentation defined • Criticality of the request, date needed The applicable statuses are: submitted, evaluated, approved, rejected, postponed	System Definition and Realization Project Management

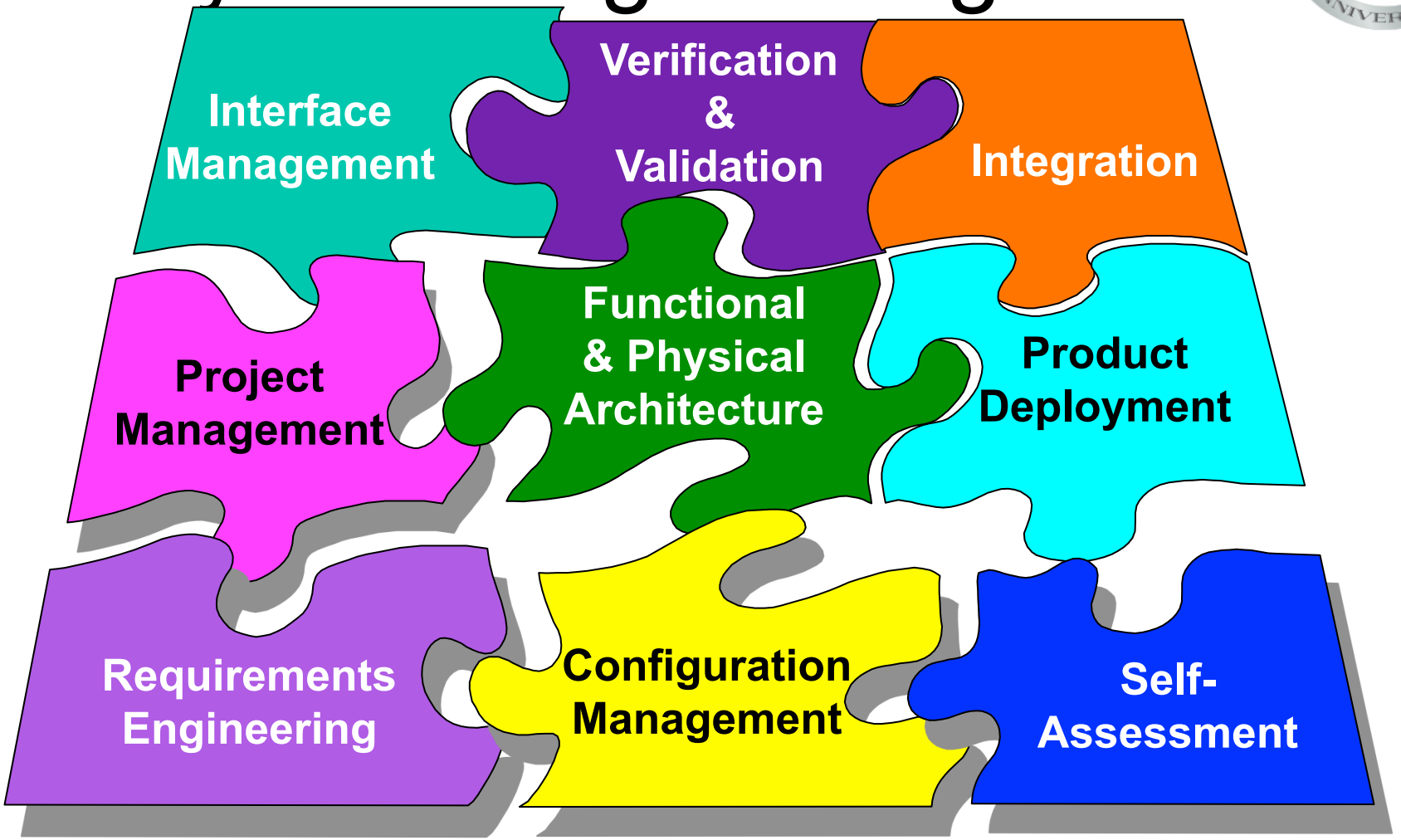
PIECE #2 – THE TOOLS

Deployment Packages

- Set 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
- Each DP is authored/edited by at least 2 persons



System Engineering DPs



DPs made available at no cost on Internet

Requirements Engineering DP

- Background and Reference Material
  - Why Requirements Engineering is Important
  - Characteristics or Good Requirements
    - ISO/IEC/IEEE 29148:2011
    - INCOSE Systems Engineering Handbook
    - INCOSE Guide for Writing Requirements
- Definitions
- Processes, Activities, Tasks, Steps, Roles and Products/Artefacts
  - Adds one further level of decomposition
- Templates
  - System Requirements Specification (SyRS)
- Checklists
  - Requirements Checklist
  - Specification Checklist
- Tools
  - Requirements Management Tool
  - Requirements Traceability Tool

Task/Steps Example

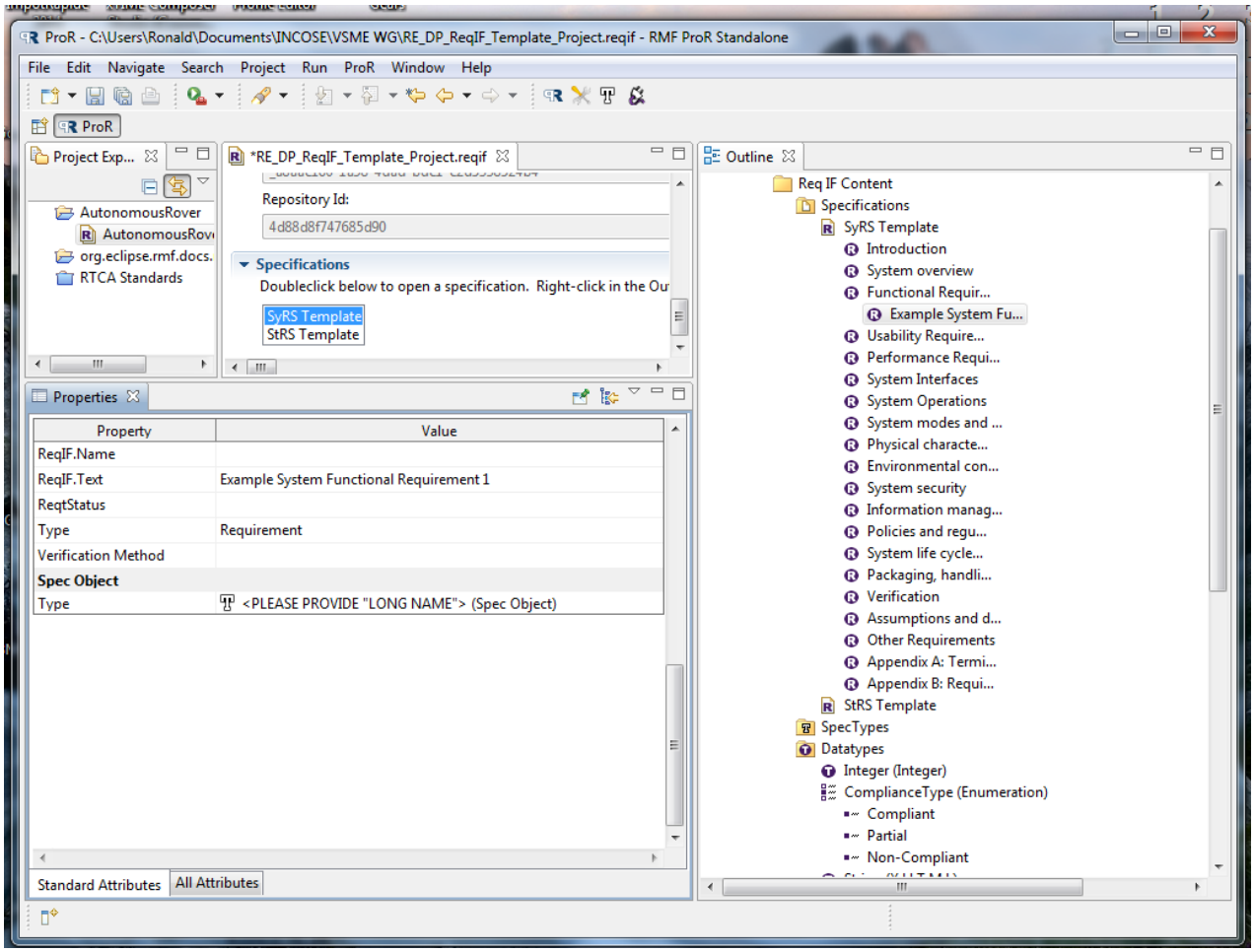
Task: SR.2.1 - Elicit Acquirer and other Stakeholders requirements and analyze system context

Objectives:	The objective of this activity is to clearly define the scope of the project and elicit customer and stakeholder requirements source requirement material.
Rationale:	It is important to clearly define the project scope (boundaries), identify all sources of requirements and to identify key requirements of the future system with the stakeholders to avoid problems like forgotten key functionalities/characteristics or requirements creep.
Roles:	Systems Engineer
	Project Manager
Artefacts:	Source/Customer/Stakeholder Requirements Document(s) placed under configuration control
Steps:	1. Identify stakeholders
	2. Collect information about the project and application domain.
	3. Define project's scope
	4. Identify and capture stakeholders' source requirements
	5. Structure and prioritize Stakeholders' requirements documents/materials
Step Description:	***Step 1. Identify Stakeholders*** The Systems Engineer, with the assistance of the Project Manager and the Acquirer, identifies and establishes contact with the project's stakeholders. This can occur in a single meeting, a series of meeting or through individual, one-on-one meetings. Example of Stakeholders Final users or final users representative Community of users Customers or customers representative Executive board Regulatory agencies (national, regional, local)

SE/RE Tools

- VSEs cannot afford « Big League » toolchain
- Desktop Office Applications can only go so far
  - MS-Office, OpenOffice, etc.
- May need compatibility/exchange mechanism with « Big League » tools
- Suggested approach is Eclipse-based toolchain
  - Polarsys (www.polarsys.org)
    - Eclipse sponsored
    - 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/proposals/capella

RE Project Template in Eclipse RMF/ProR



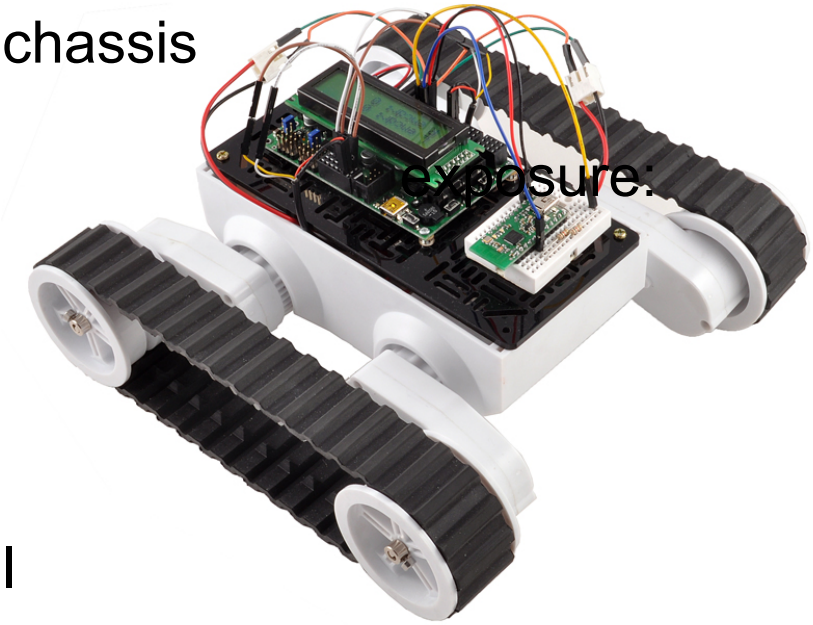
PIECE #3 – THE PEOPLE

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
    - 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; and
  - collect sensor data.
- Uses Dagu Electronics Rover 5 chassis
  - 2 DC Motors with encoders
- Multi-specialty development
  - Electronics
  - Microcontrollers
  - Printed Circuit Board
  - Mechanical
  - Software
- Supports training activities for all Deployment Packages



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
- "Out-of-the-Box" turnkey approach
- Work in Progress
- Released for use do far
  - Generic Profile Group
    - Basic Profile, 1st of 4
      - RE Deployment Package

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/
- 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
Obrigado
Thank You
Köszönöm
Tack
Спасибо
Dank
Gracias
谢谢
Merci
Seé
ありがとう