Development and Integration of Engineering Processes at Oerlikon Aerospace

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AGENDA

- Introduction
- Software Engineering Process Development
- Systems Engineering Process Development
- Integration of Engineering Processes
- Management of Change
- Lessons Learned
- Next Steps
- Conclusion
Development and Integration of Engineering Processes

Systems Integrator

- Laser-Guided Missile Air Defence System
- 40 Systems Engineers
- 40 Software Engineers

APPLICATION DOMAINS AT OA

- Command & Control
- Communication & Intelligence
- Sensors and Weapon Systems
- Training & Simulation
- Instrumentation & Test
- Consoles
OUR APPROACH TO PROCESS ENGINEERING 1

- Stimulus for Improvement
- Set Context & Establish Sponsorship
- Establish Improvement Infrastructure
- Appraise & Characterize Current Practice
- Develop Recommendations & Document Phase Results
- Set Strategy & Priorities
- Establish Process Action Teams
- Plan Actions
- Plan, Execute, & Track Installation
- Define Processes & Measures
- Plan & Execute Pilots
- Symbolizing
- Schedule & Complete
- Report & Communicate
- Revise Organizational Approach
- Document & Analyze Lessons
- Learning
- Acting

Initiating

Diagnosing

Establishing

OUR APPROACH TO PROCESS ENGINEERING 2

1. Define a Process and bring it under management control.
2. Support the Process with engineering Methods appropriate to the application.
3. Support the process and engineering methods with automated Tools integrated into a consistent environment.
4. Train personnel to use these Processes, Methods, and Tools.
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SOFTWARE ENGINEERING PROCESS

Strategy
- Software Engineering is a Core Competence at Oerlikon
- Base our process on the Software Engineering Institute’s Capability Maturity Model for Software
- Use the results of the Winter 97 formal Assessment
- Put in place SEI level 3 and 4 practices
- Re-assess in late 1998 early 1999

PROCESS DEFINITION STEPS - 1
- Review the Findings of the Assessment
- Introduction to the Capability Maturity Model (CMM)
- Preparation of a Plan by the Working Group
- Brainstorm on current strengths and weaknesses
- Understand the Current Process
- Compare the Current Process with the CMM
- Describe first level process steps (Top View)
- Describe second level of the process using notation
- Describe/Update, if necessary, third level components:
  - Procedures
  - Users’ Guides
  - Checklists
**PROCESS DEFINITION STEPS - 2**

- Review Process Steps (CMM)
- Select a Pilot Project
- Brief Participants
- Monitor the Pilot
- Modify the Process
- Institutionalize the Process
  - Modify, if necessary, policies and procedures
  - Develop the Training Material
  - Train all users (technical and others) of the Process
  - Monitor the utilization of the Process
  - Measure the Process and Products
  - Improve the Process

**GUIDANCE DOCUMENT FOR WORKING GROUPS**

- **Content**
  - Goal
  - Scope and Complexity
  - Expected Involvement of the Organization
    - Process Owner
    - Key Players
  - Facilitator
  - Suggested Implementation Steps
  - Risk Issues
  - Reasonable Timetable for Implementation
  - Effort Commitment
  - Reference Documents
n VIEW OF FIRST LEVEL OF THE PLANNING AND TRACKING PROCESS

- Software Project Planning Process for Proposal (including Negotiation Phase)
- Software Project Planning Process (after Contract Award)
- Software Project Tracking Process

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n VIEW OF SECOND LEVEL OF THE PLANNING AND TRACKING PROCESS

- SPP-100 PLAN THE PROPOSAL ACTIVITIES
- SPP-110 GENERATE PROJECT WBS/OBS
- SPP-120 PREPARE PROJECT ESTIMATES AND SCHEDULE
- SPP-130 PERFORM RISK ASSESSMENT/ABATEMENT
- SPP-140 PREPARE PROPOSAL
- SPP-150 REVIEW PROPOSAL, RISK ANALYSIS, ESTIMATES AND SCHEDULE
- SPP-160 CONDUCT PROPOSAL LESSONS LEARNED REVIEW

After Contract Award

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VIEW OF THIRD LEVEL

STEP 120 - Prepare Estimates and Schedule

**Inputs**
- RFP/SOW/SOR
- Project WBS/OBS
- Historical Data
- SDP Outputs (RTM)
- Procedure for Estimates
- Assumptions
- Resource Availability

**Outputs**
- Assumptions for Estimates
- Updated Historical Database
- Estimates
- Schedule
- List of Alternatives

**Measures**
- Entry Criteria
- Exit Criteria
- Effort
- SPP-130

**SPP-110**
- Proposal leader and functional Management approval

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**Systems Engineering Process**

**Need for Assessment**
- Fall 95

**Senior Management Commitment**
- Fall 95

**Self-Assessment**
- Fall 95

**Action Plan**
- Winter 96

**Process Definition**
- Technical Steps Spring 96
- Management Steps Fall 96

**Final Process and Training**
- Summer 97

**Pilot Projects**
- 1997

**Self-Assessment**
- Winter 98

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**SYSTEMS ENGINEERING PROCESS**

**Strategy**
- Systems Engineering is a core competence at Oerlikon
- Base our process engineering on the Systems Engineering Capability Maturity Model, GSEP and ISSEP
- Use the results of the Fall 95 Self-assessment
- Put in place level 2 and 3 Practices
- Formal assessment in Winter 1998
## SYSTEMS ENG.- CMM PROCESS AREAS

- Define Organization's SE Process
- Manage SE Support Environment
- Provide Ongoing Skills and Knowledge
- Understand Customer Needs
- Evolve System Architecture
- Define Technical Activities of the SE Process
- Define Management Activities of the SE Process
- Use Beta Version of Process in Pilot Projects
- Revise Process, Train Practitioners, and Deploy in Organization
- Ensure Quality
- Manage Product Line Evolution
- Integrate Disciplines
- Integrate System
- Manage Configurations
- Coordinate with Suppliers
- Manage Risk
- Manage Technical Effort
- Plan Technical Effort
- Monitor/Control Technical Effort
- Analyze Candidate Solutions
- Verify & Validate System
- Improve Organization's SE Processes
- Ensure Quality
- Manage Configurations
- Coordinate with Suppliers
- Manage Risk
- Manage Technical Effort
- Plan Technical Effort
- Monitor/Control Technical Effort
- Analyze Candidate Solutions
- Verify & Validate System
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- Ensure Quality
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- Coordinate with Suppliers
- Manage Risk
- Manage Technical Effort
- Plan Technical Effort
- Monitor/Control Technical Effort
- Analyze Candidate Solutions
- Verify & Validate System

### DEVELOPMENT STEPS of SYSTEMS ENGINEERING PROCESS

1. Establish One Multi-Disciplined Working Group
   - Systems Engineers and Sub-Systems Engineers
   - Software Engineers
   - Quality Assurance Representative
   - Software Engineering Process Group Members
2. Use SE-CMM, GSEP and ISSEP as frameworks
3. Define Technical Activities of the SE Process
4. Define Management Activities of the SE Process
5. Use Beta Version of Process in Pilot Projects
6. Revise Process, Train Practitioners, and Deploy in Organization
7. Formal Assessment of Systems Engineering Process
**SYSTEMS ENG. PROCESS WORKING GROUP: SECONDARY TASKS**

- Identify Process and Product Metrics
- Identify Methods, Practices and Tools
- Prepare an Estimation Guideline
- Monitor Interfaces with Software Eng. Process
- Monitor Compliance With ISO 9001 Requirements
- Develop a Systems Engineering Glossary
- Establish a Systems Eng. Process Asset Library
- Develop Training Material

**MANAGEMENT ACTIVITIES OF GSEP**

Management Development Effort

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STEP 120 - Analyze Risk

- Perform Risk Analysis (SEP 121)
- Review Risk Analysis (SEP 122)
- Plan Risk Aversion (SEP 123)
- Commit to Strategies (SEP 124)

STEP 123 - Plan Risk Aversion

- Establish... Estimate... Recommend...
- Risk Management Plan (D)

- Systems Eng. Folder
  - Identified Risks
  - Risk Aversion Strategies
  - Technical Risks

- Approved Identified Risks
- Cost, Schedule and Risk Aversion Strategies
TECHNICAL ACTIVITIES OF GSEP

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Integrated Systems and Software Engineering Process (ISSEP) from SPC
- Addresses the problem of large, complex systems
- Decomposes the system such that parts can be independently developed and integrated
  - System Level (includes segment and subsystem parts)
  - Configuration Items (include software and hardware parts)
  - Components

INTEGRATION OF PROCESSES
- Manage Development Effort
- System Development Plan / Status
- Increment Plan
- Estimate of the Situation
- System Context / Technical Risk
- Technical Baseline / System Status
- Define System Increment
- Develop SW Configuration Item
- Develop HW Configuration Item
- Implement (Produce) System
Integrating Supporting Processes
- Subcontractor Management in SW-CMM and Coordinate with Suppliers in SE-CMM
- Quality Assurance
- Risk Management
- Document Inspection
- Document Management

Integrating Processes: Methods and Tools
- Methods
  - Structured Analysis and Design (SADT)
  - Quality Function Deployment (QFD)
- Tools
  - CORE
  - Software through Pictures (StP)
  - RTM
ENGINEERING PROCESS ASSET LIBRARY

- Policies
- Process Descriptions
- Guides, Forms and Templates
- Examples of Documents Produced
  - Business Cases
  - Proposals
  - Engineering Plans
  - Specifications
- Tailored Processes
- Process and Product Measures
- Lessons Learned
- Charter of Process Engineering Groups
- Training Material
- Metrics (Process and Product)
- Historical Data

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**MANAGEMENT OF CHANGE**

- **Surveys:**
  - Implementation History Assessment
    - Analysis of previous implementation barriers and lessons learned
  - Culture Assessment
    - Evaluation of the fit between the Planned Change and the current Organizational Culture or Subcultures
  - Team Evaluation Questionnaire

- **Articles in Oerlikon’s Newsletter**

- **Multi-Discipline Working Groups**
  - Meeting Facilitator with each working group

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LESSONS LEARNED - 1

- Create common Vision for Mgmt and Practitioners
  - Reduce Cycle Time
  - Increase Quality and Productivity

- Develop a Process Improvement Plan
  - Link Between Project Requirements and Process Activities
  - Multi-Year Plan to show long term commitment

- Use Pilot Projects
  - Members of Pilots have a Safety Net for “mistakes”
  - Success of Pilots facilitates adoption of technologies

LESSONS LEARNED - 2

- Fix the Process not the People
  - Focusing on Process allows Practitioners to learn while using the new Process, Method or Tool.
  - Mistakes are Acceptable If we learn from them

- The Management of the “Soft Issues” are as important as the “Hard Issues”
  - it is 25% SW, 25% HW & 50% ”Peopleware”
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NEXT STEPS

- Integrating Engineering Processes with Project Management Process
- Electronic Process Asset Library on Local Area Network (INTRANET)
- Evaluation and adoption of Systems and Software Methods and Case Tools (I-CASE environment)
- Migration towards Integrated Product Teams
  - Modify Organizational Structure and clarify of Roles and Responsibilities
  - Modification to Performance Management Program (e.g. Team Based Performance)
Project Management Process

Adapted from the Project Management Institute

PMP 100
INITIATE
PROJECT ACTIVITIES

PMP 200
PLAN PROJECT ACTIVITIES

PMP 400
CONTROL PROJECT ACTIVITIES

PMP 300
EXECUTE
PROJECT ACTIVITIES

PMP 500
CLOSE PROJECT ACTIVITIES

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CONCLUSION

OUR Organization is making substantial effort to define and improve both Software and Systems.

Significant Progress in Process Improvement also implies a Cultural Change in the organization:
- A Shift From the NIH (Not Invented Here) to the NRH (Not Re-invented Here) resulting in mission-oriented teams.

Systems and Software Engineering Processes need to be defined and integrated for EFFICIENCY and EFFECTIVENESS to get the “BANG FOR THE BUCK”