AGENDA

- Introduction
- Software Engineering Process
- Systems Engineering Process
- Management of Change
- Lessons Learned
- Next Steps
- Conclusion
APPLICATION DOMAINS AT OA

- Weapon Systems
- Command & Control
- Communication & Intelligence
- Training & Simulation
- Instrumentation & Test

EMBEDDED & REAL-TIME SOFTWARE

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Slide 3

Need for Assessment Fall 92

Preparation for Assessment Winter 93

Assessment Spring 93

Formulation of Recommendations and Action Plan summer and Fall 93

Implementation of Action Plan (Process Def.) Winter 94

Pilot Projects 1995

Institutionalization 1996

Re-Assessment 1996

Senior Management Commitment Fall 92

VISION96 SYMPOSIUM

Slide 4
MOTIVATION & STRATEGY

- Motivation
  - Software Engineering is business strategic and a core competence for Oerlikon Aerospace

- Strategy
  - Base our process engineering on the Software Engineering Institute Capability Maturity Model
  - Use the results of the Spring 93 assessment
  - Put in place SEI level 2 and 3 practices
  - Re-assess in 1996
  - Institutionalize level 3 practices

MANAGEMENT COMMITMENT

- Establishment of a Software Engineering Working Group (SEPG) of 8 members

- Budget Approved for:
  - Training
  - Assessment
  - SEPG Activities
OUR APPROACH TO PROCESS ENGINEERING

- Define a Software Process and bring it under management control.
- Support the Process with engineering methods appropriate to the application.
- Support the process and engineering methods with automated tools integrated into a consistent environment.
- Educate personnel to design and select, and train them to use these processes, methods, and tools.

ASSESSMENT

- Software Process Assessment performed by Certified Assessors

Assessment Team:

- Applied Software Engineering Center
- Process Inc.
- Members of SEPG
- Representative of Customer
**ASSESSMENT PARTICIPANTS**

- Middle Managers (8)
  - Software Engineering
  - Sub-System Engineering
  - System Engineering
  - System Test
  - Configuration Management
  - Quality Assurance
- Project Leaders (4)
- Practitioners (17)
  - Configuration Management
  - Quality Assurance
  - Design, Code and Unit Test
  - Requirements Management

**ACTION PLAN PREPARATION**

- Action Planning Workshop
  - Three-Day Session (June)
  - Piloted by a Consultant (T. Kasse of ISPI)
  - Topics
    - Review of Findings and Recommendations
    - Mini Tutorial on Level 2 and 3 Key Process Areas
    - Preparation of Action Plan Guidance Document on Requirements Management
- Follow-up Activities
  - Weekly Sessions of SEPG
  - Review of Guidance Documents (7) with consultant (Aug.)
  - Review of Proposed Charters
    - Steering Committee
    - Software Engineering Process Group
    - Working Groups
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

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WELL-DEFINED PROCESS

- **A Well-Defined Process is one with documented, consistent and complete:**
  - Policies, Standards and Procedures
  - Inputs and Outputs
  - Entry and Exit Criteria
  - Activities
  - Specified Roles
  - Measurements
  - Templates and Checklists
**Process Notation: ETVX**

- **Inputs**
- **Activities**
- **Outputs**

**Previous Step**

<table>
<thead>
<tr>
<th>Entry Criteria</th>
<th>Measurements</th>
<th>Exit Criteria</th>
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**Next Step**

**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

■ 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
I 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

TO SPP 200

I VIEW OF THIRD LEVEL OF THE PLANNING AND TRACKING PROCESS

- SPP-110 Inputs:
  - RFP/SOW/SOR
  - Project WBS/OBS
  - Historical Data
  - SDP Outputs (RTM)
  - Procedure for Estimates
  - Cost Data
  - Assumptions
  - Resource Availability
- SPP-110 Measures:
  - Effort
- SPP-110 Exit Criteria:
  - Approved project WBS/OBS
  - Proposal leader and functional management approval

- SPP-120 Outputs:
  - Assumptions for Estimates
  - Updated Historical Database
  - Estimates
  - Schedule
  - List of Alternatives

- SPP-130
PROCESS ASSET LIBRARY - 1

- Repository of Process Artifacts:
  - Process Definition Process
  - Process Descriptions
  - Policy
  - Forms and Templates
  - Examples of Documents Produced
  - Business Cases
  - Proposal
  - Software Development Plan
  - Software Specifications
  - Tailored Processes
  - Lessons Learned
  - Versions History
  - Process Owner Identification
  - Charter of SEPG
  - Training Material

PROCESS ASSET LIBRARY - 2

- Repository of Process Artifacts:
  - Quality Data (Results of Inspections, Defects per Phase)
  - QA Reports and Corrective Actions
  - List of Software Tools and Version
  - Historical Data (e.g. Project Estimates, Calibrating Data for Size and Costs Estimations)
  - Software Methodologies Documentation
  - Tailoring Guidelines
  - Improvement Process
**SW ENGINEERING PROCESS GUIDEBOOK**

- Distributed to all affected persons (e.g. CM, QA, SE)
- Content of Guidebook is kept under CM Control:
- Each person signs for a copy
- Versions of documents are sent to owners
- Content:
  - Policy
  - Process Descriptions
  - Procedures
  - Forms and Checklists
  - Guides (e.g. Requirements Specification Guide)
  - Templates and Examples

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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
- Pilot Project Summer 96
- Process Definition Final Version Spring 97
- Proces Definition Management Steps

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**SYSTEMS ENG. SELF-ASSESSMENT: FALL 95**

- **Participants**
  - Two Engineering Managers
  - Three Systems Engineers

- **Model Used**
  - Systems Engineering Capability Maturity Model (SE-CMM)
  - SE-CMM Appraisal Method and Questionnaire

- **Process Areas addressed**
  - Engineering
  - Project
  - Organization

- **Prioritization of Effort**
  - Engineering Process Areas

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**SYSTEMS ENG.- CMM PROCESS AREAS**

- Improve Organization’s SE Processes
- Define Organization’s SE Process
- Provide Ongoing Skills and Knowledge
- Manage SE Support Environment
- Understand Customer Needs
- Manage Product Line Evolution
- Evolve System Architecture
- Integrate System
- Integrate Disciplines
- Derive & Allocate Requirements
- Analyze Candidate Solutions
- Plan Technical Effort
- Monitor/Control Technical Effort
- Manage Risk
- Coordinate with Suppliers
- Ensure Quality
- Verify & Validate System
- Manage Configurations
SYSTEMS ENGINEERING PROCESS DEVELOPMENT STEPS

- Establish One Multi-Disciplined Working Group
  - Systems Engineers
  - Software Engineers
  - Quality Assurance Representative
  - SEPG Members
- Use SE-CMM and GSEP as frameworks
- Define Technical Activities of the SE Process
- Define Management Activities of the SE Process
- Use Beta Version of Process in Pilot Projects
- Revise Process and Deploy in Organization
- Formal Assessment of Systems Engineering Process

SE PROCESS WORKING GROUP: SECONDARY TASKS

- Identification of Process and Product Metrics
- Identification of Methods and Best Practices
- Prepare Estimation Guidelines
- Monitor Interfaces with Software Eng. Process
- Compliance With ISO 9001 Requirements
- Systems Engineering Glossary
- Establish a System Eng. Process Asset Library
### MANAGEMENT ACTIVITIES OF GSEP

- **Understand Context**: System Context
  - Estimate of the Situation (Approved)
- **Analyze Risk**: Risk Management Plan (Approved)
- **Develop System Plan**: System Plan
  - (Approved)
  - (updated)
- **Implement Development**: Track Implement Development
  - Increment Plan (Approved / Updated)
  - Increment Status Report
  - Increment Status (Enacted)
- **Increment Plan**: Increment Plan
  - (Approved)
  - (Updated)

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**PROCESS NOTATION: IDEF0**

- **Controls**
  - Inputs
  - Outputs
  - Mechanisms

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**VISION96 SYMPOSIUM**

*Slide 27*

**VISION96 SYMPOSIUM**

*Slide 28*
**TECHNICAL ACTIVITIES OF GSEP**

- **Analyse Needs**
- **Define Requirements**
- **Define Functional Architecture**
- **Synthetize Allocated Architectures**
- **Evaluate Alternatives**
- **Verify and Validate Solution**

**I1** Estimate of the Situation

**I2** User Reqts.

**I3** Internal System Definition

**I4** Technical Baseline

**I5** System Definition / Process Reqts.

**O1** Increment Status

**O2** Technical Risk

**O3** System Context

**O4** Information functional hierarchy

User Specification (Identified Environments, Problems and Needs)

**System Reqts.**

- **Derive d Req.**
- **Alternative Functional Architectures**
- **Performance Requirements**
- **Alternative Allocated Architectures**

**System Solution (Preferred)**

**Evaluation Results**

**Evaluation Documentation (Baseline)**

**V & V Test Procedures**

**Verification & Validation Results**

**System Definition (Interim)**

**System Definition (Interim Updated)**

**Configuration Control / Constraints**

**Decision Data Base**

**MANAGEMENT OF CHANGE**

- **Awareness Sessions before the Assessment**

- **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

- **Articles in Oerlikon`s Newsletter**
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

- Select Pilot Projects
  - Success of Pilot Projects facilitates adoption of Processes, Methods and Tools

LESSONS LEARNED - 2

- Fix the Process not the People
  - Provide a “Safety Net” to allow Practitioners to learn while using the new Process
  - 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”
**NEXT STEPS**

- Continuous training Program for Software and Systems Engineers at Oerlikon Aerospace
- 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)

**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”**