

How Rapid is Rapid Prototyping?

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☛ **Summary of ESPADON**

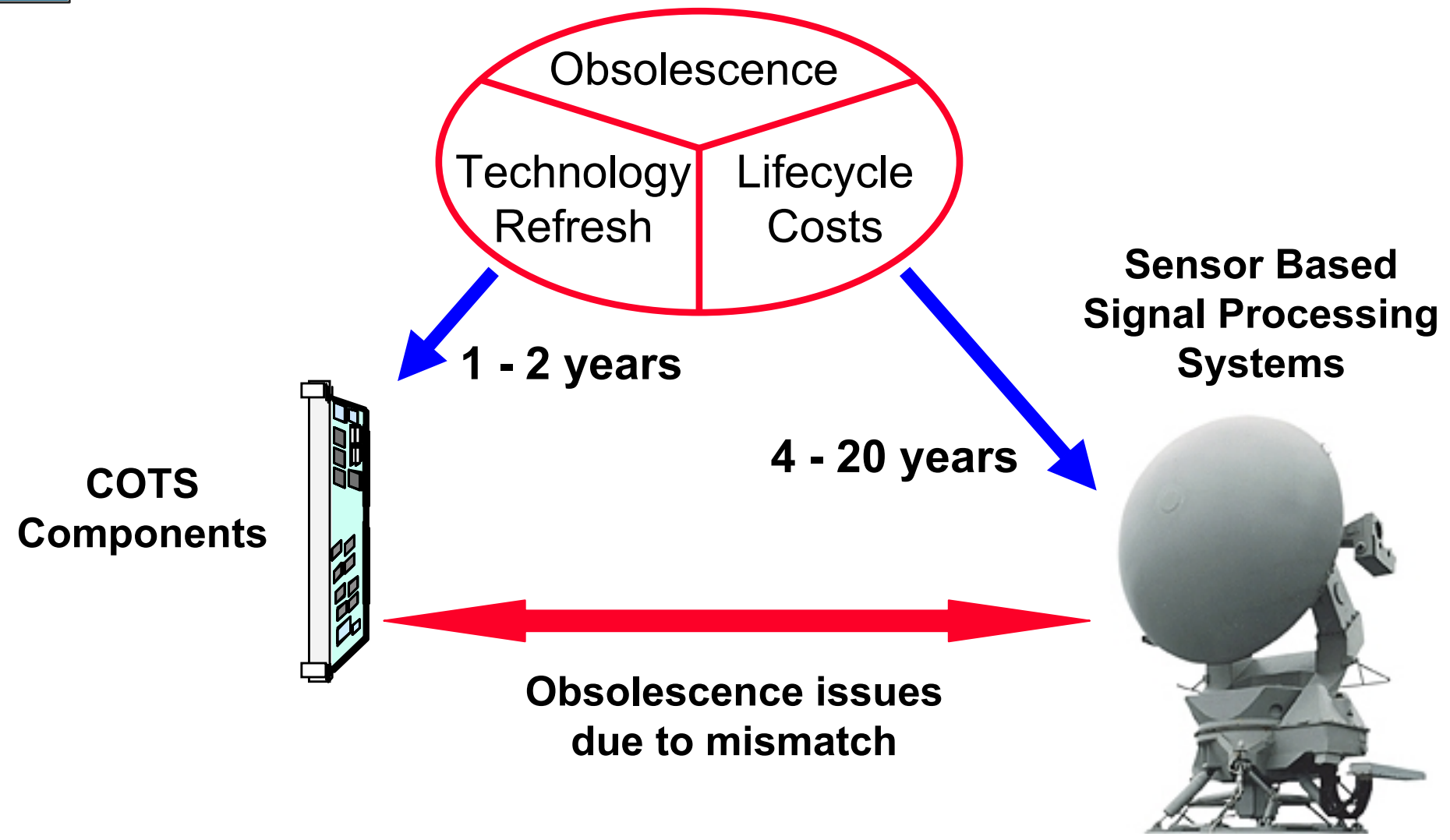
- Methodology
- Rapid Prototyping Design Flow
- Rapid Prototyping Design Environment

☛ **Benchmarks**

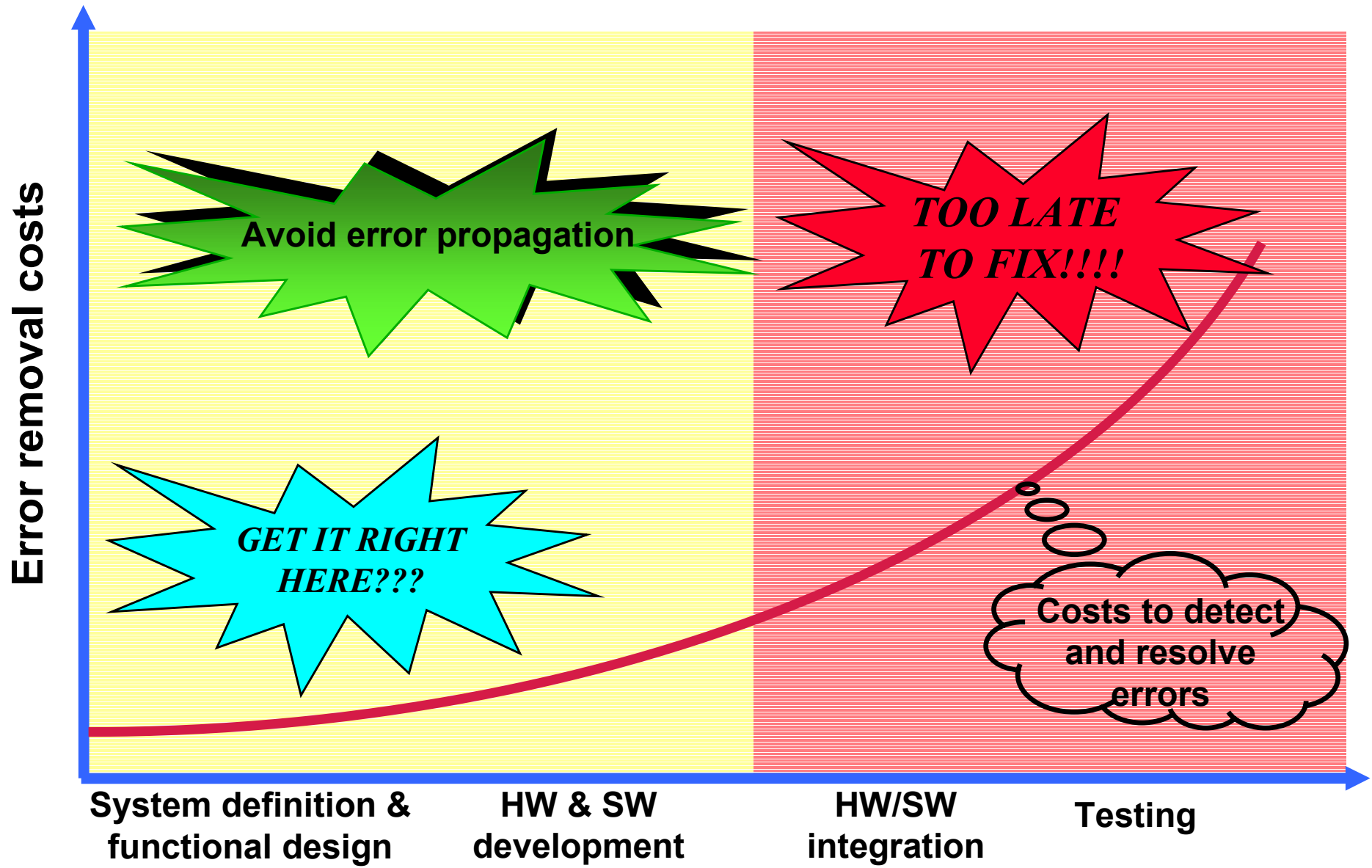
- Overview
 - *Objectives, Metrics, Applications*
- Radar Benchmark
 - *Overview and Metrics*
- Sonar Benchmark
 - *Overview and Metrics*
- Productivity Improvements

☛ **Conclusions**

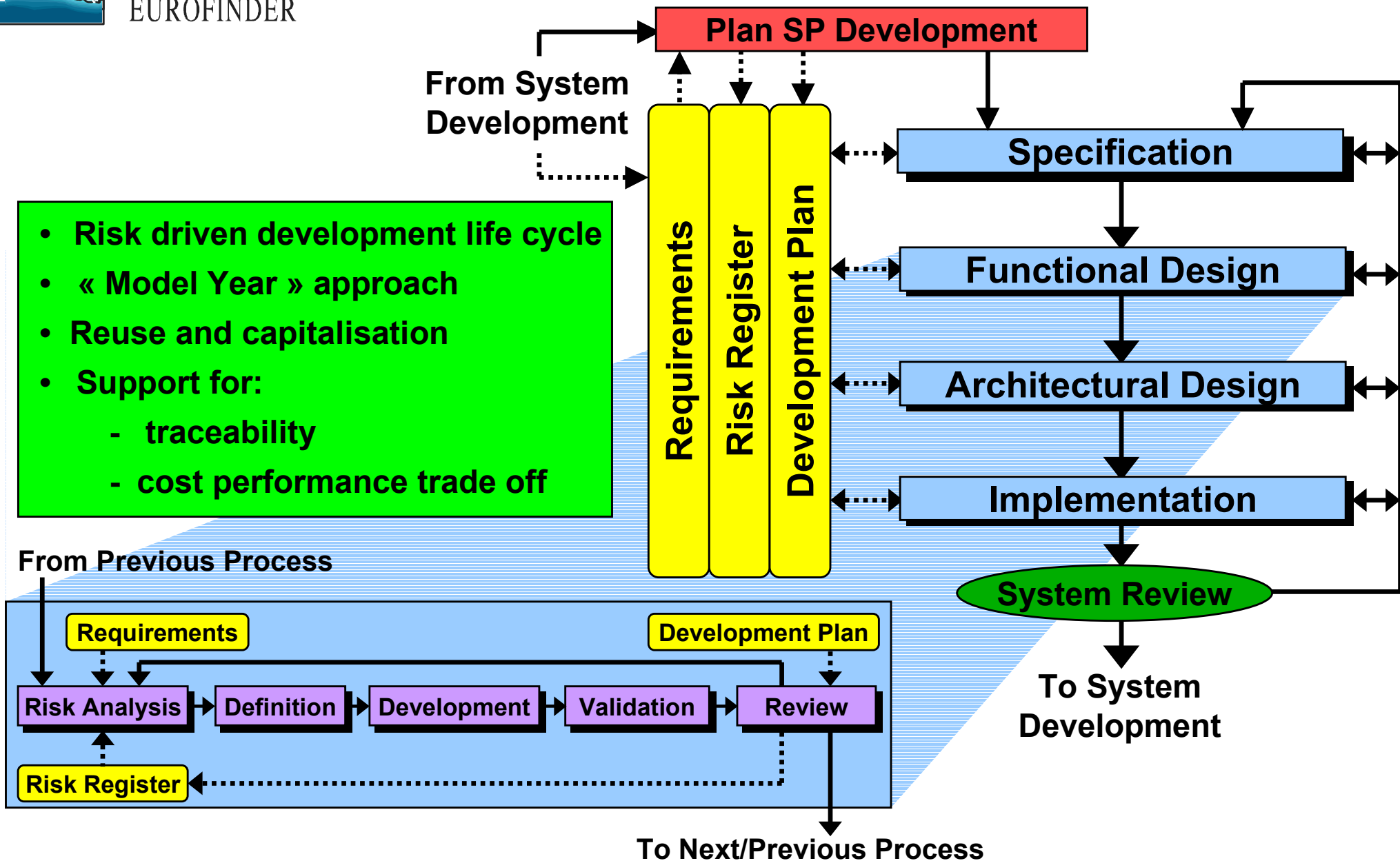
The Problem



Current design methods inappropriate for cost-effective and efficient management of the two.

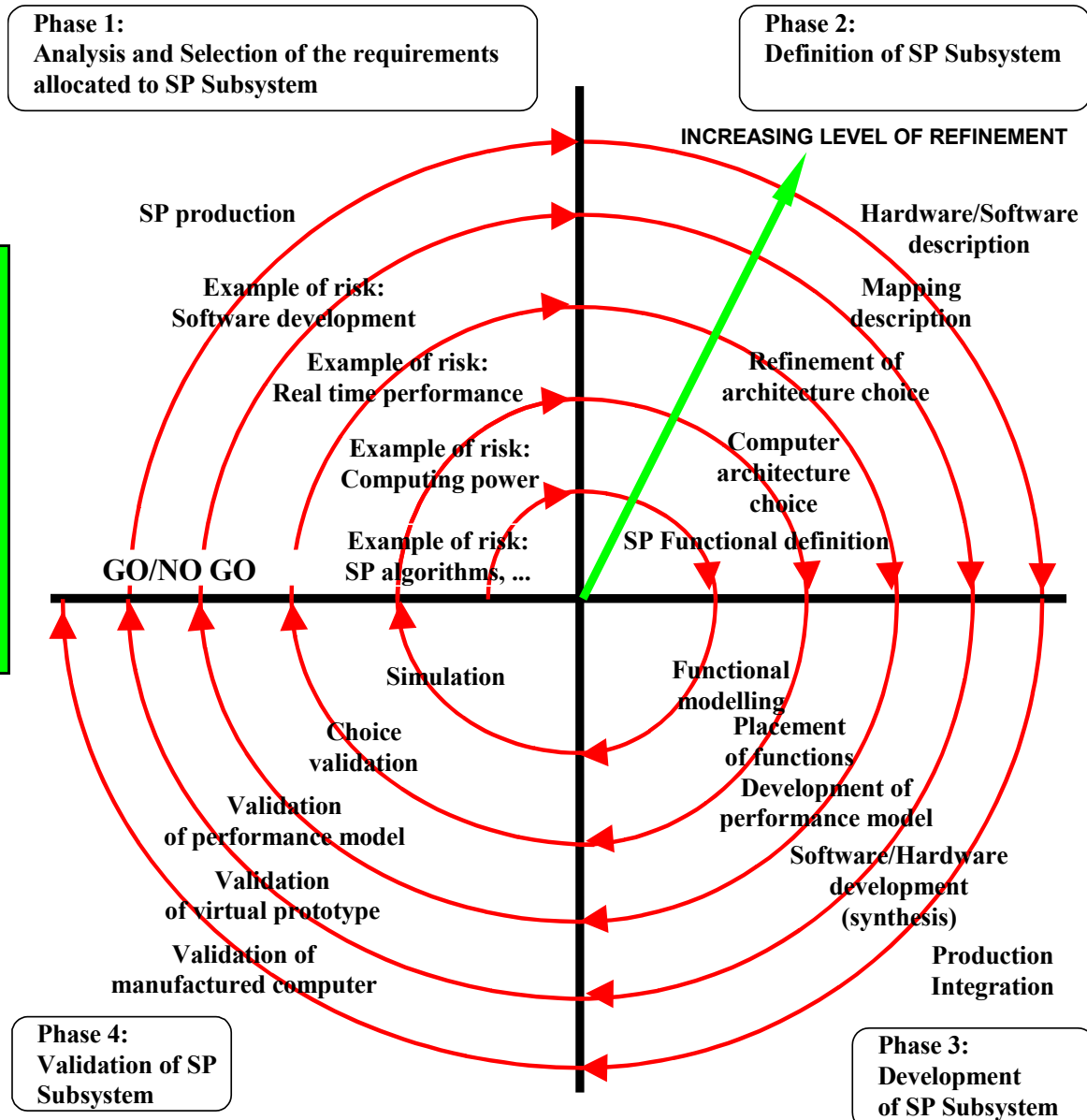


The ESPADON Methodology



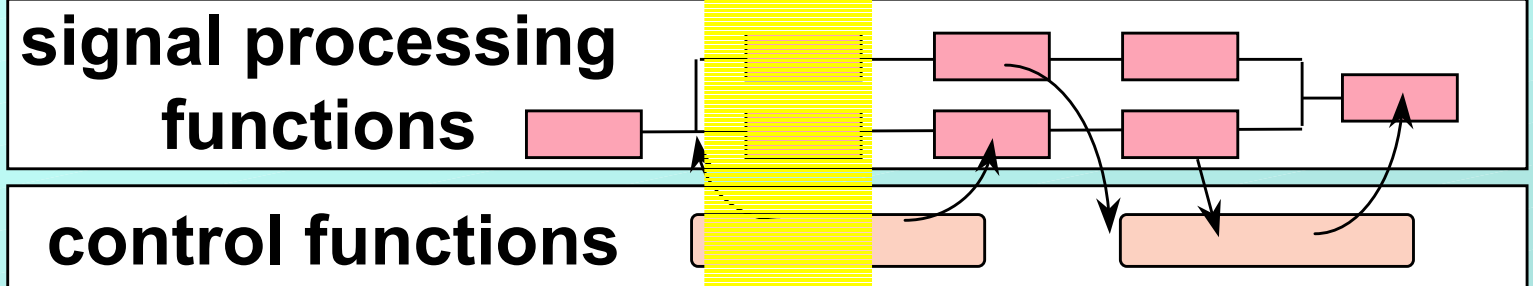
Spiral Model Representation

- Risk driven development life cycle
- « Model Year » approach
- Reuse and capitalisation
- Support for:
 - traceability
 - cost performance trade off

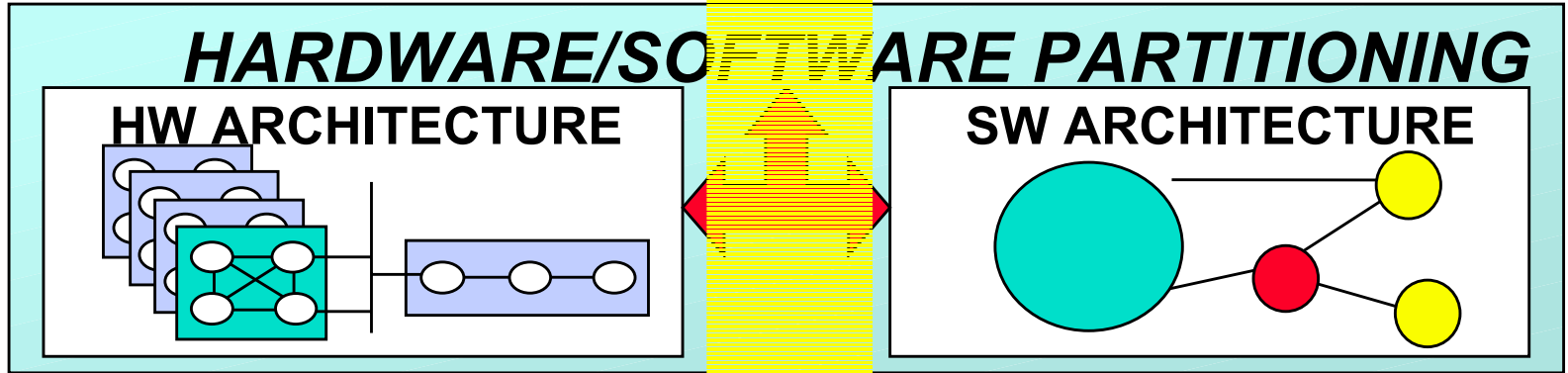


R.P. Development Process: Outline

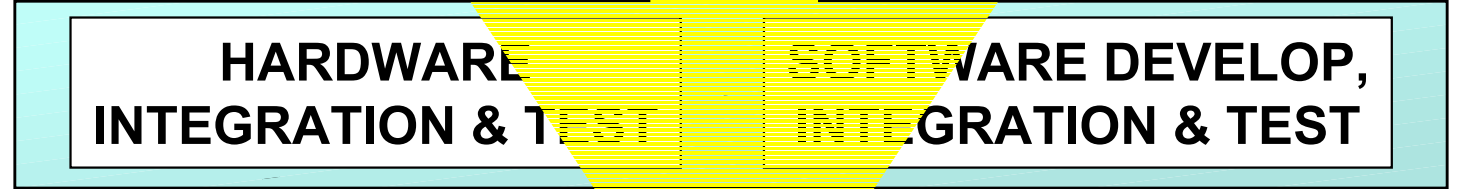
FUNCTIONAL DESIGN



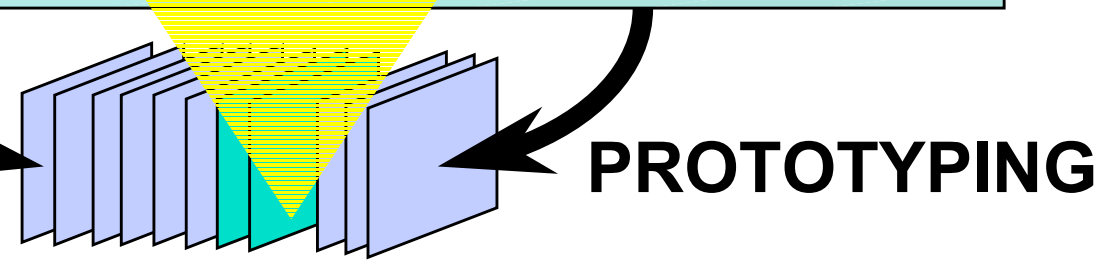
ARCHITECTURAL DESIGN



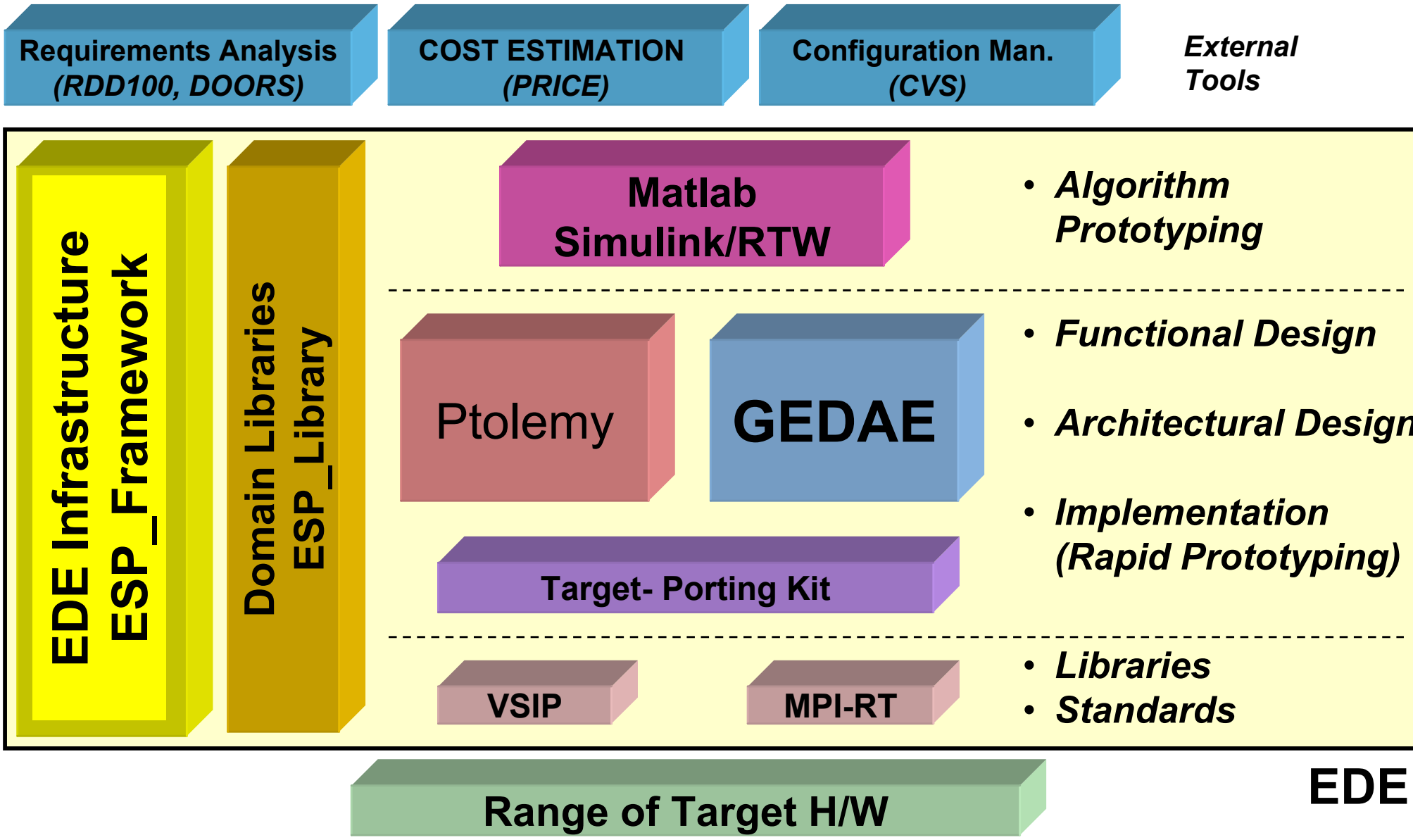
DEVELOPMENT



- CUSTOM HW or SW**
- REUSED HW or SW**
- COTS**
- AUTO GEN CODE**



EDE Tools Selected - Rapid Prototyping



• Objectives *(using representative Signal Processing Apps)*

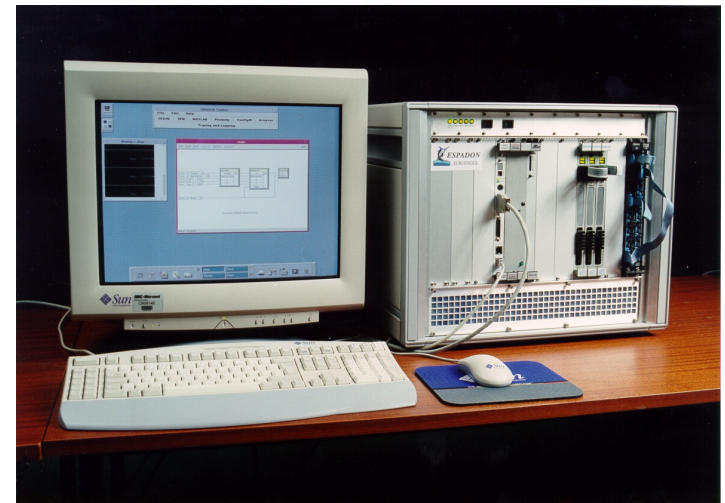
- Evaluate and demonstrate ESPADON Design Process

• Metrics

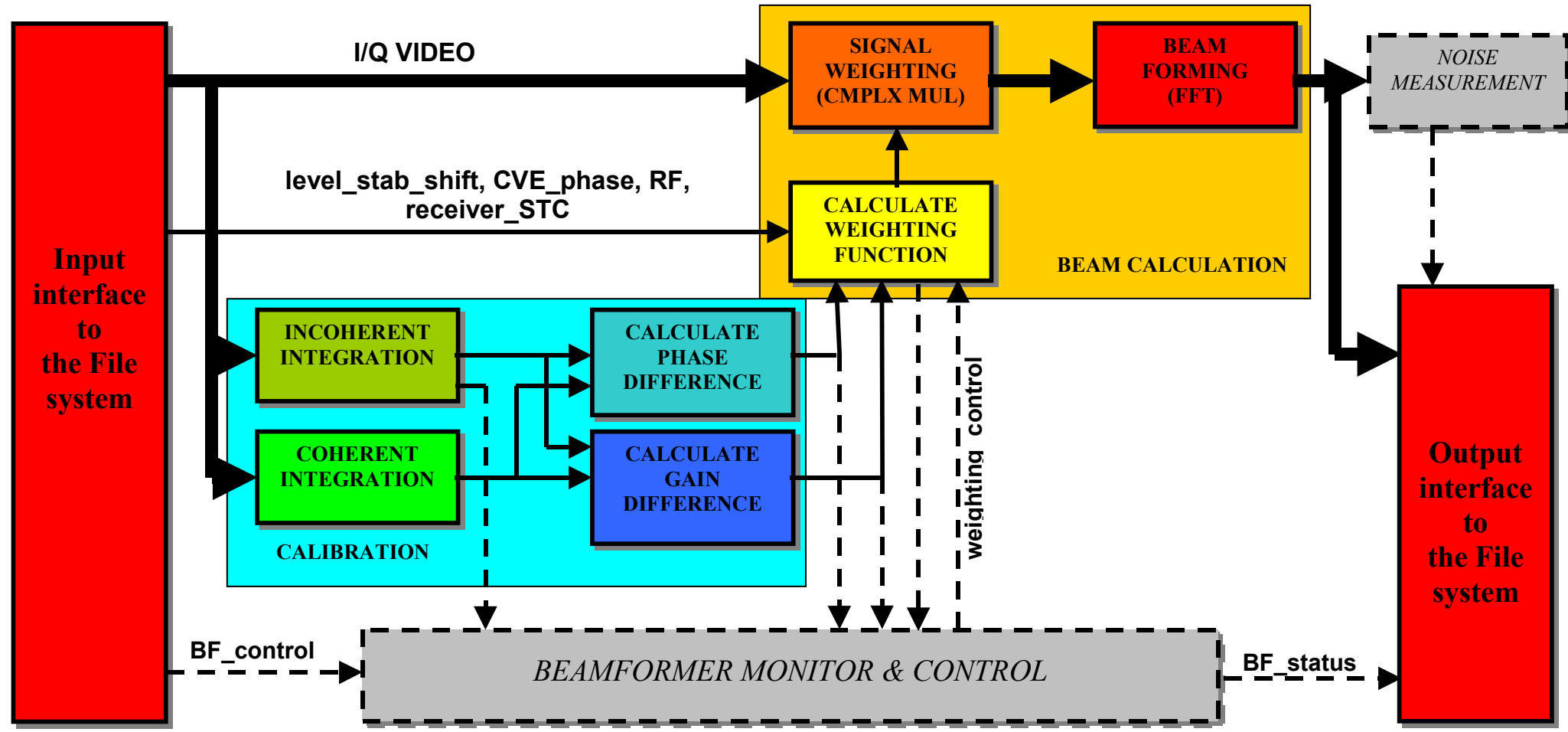
- Measure performance w.r.t. project goals:
 - *product lifecycle cost/time, improvement of product quality*
- Categorisation:
 - *Principal and supporting metrics*
 - *Tool-oriented process metrics*
 - *Application Complexity metrics*
 - *Product complexity metrics*
 - *Product Performance metrics*

• Applications

- Applied to both a Sonar and Radar Beamformer Applications
- Implemented on Mercury, “Europro” and SKY platforms
 - *demonstrates independence of methodology / target*

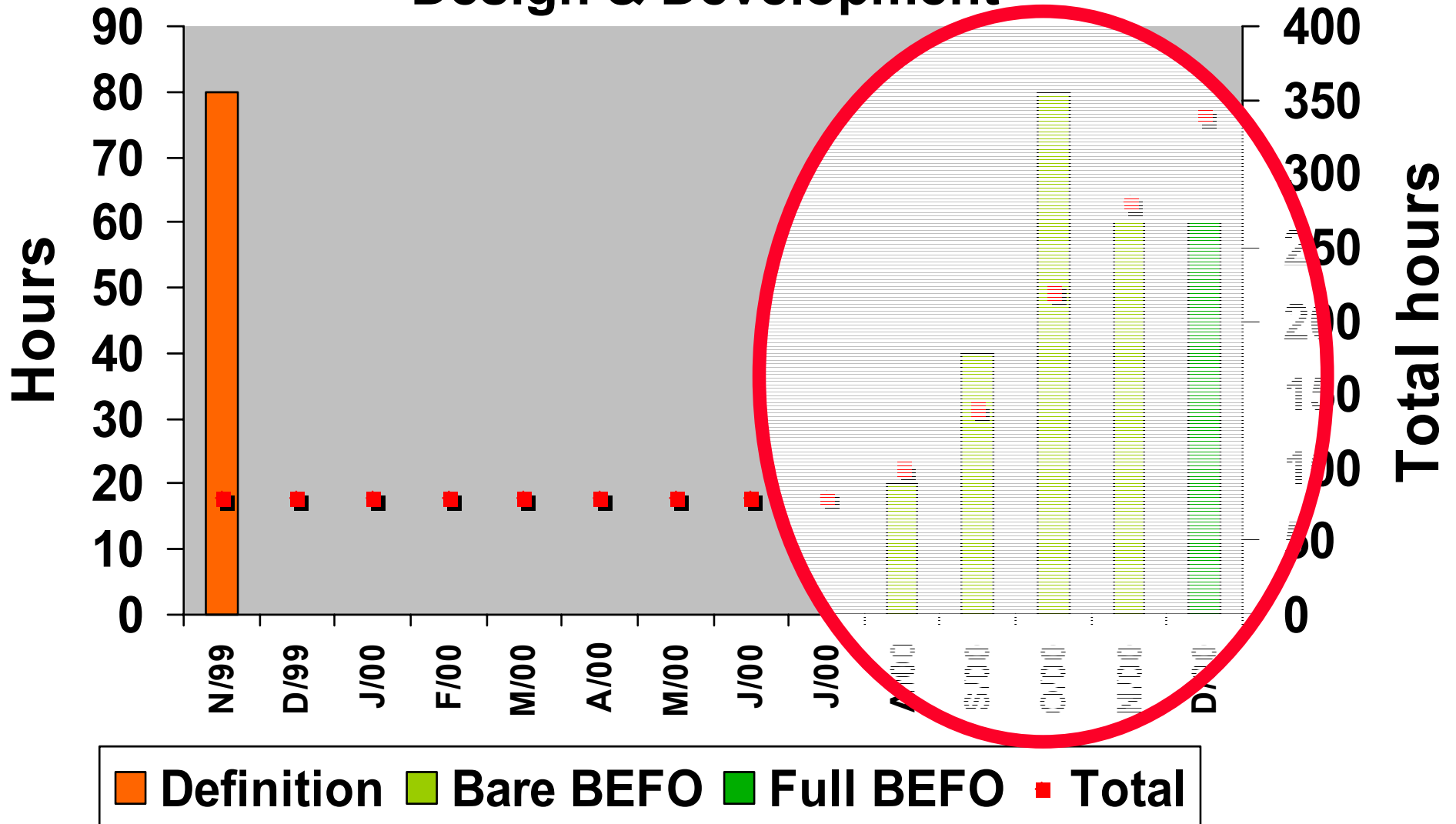


BEAMFORMER FUNCTIONAL DIAGRAM

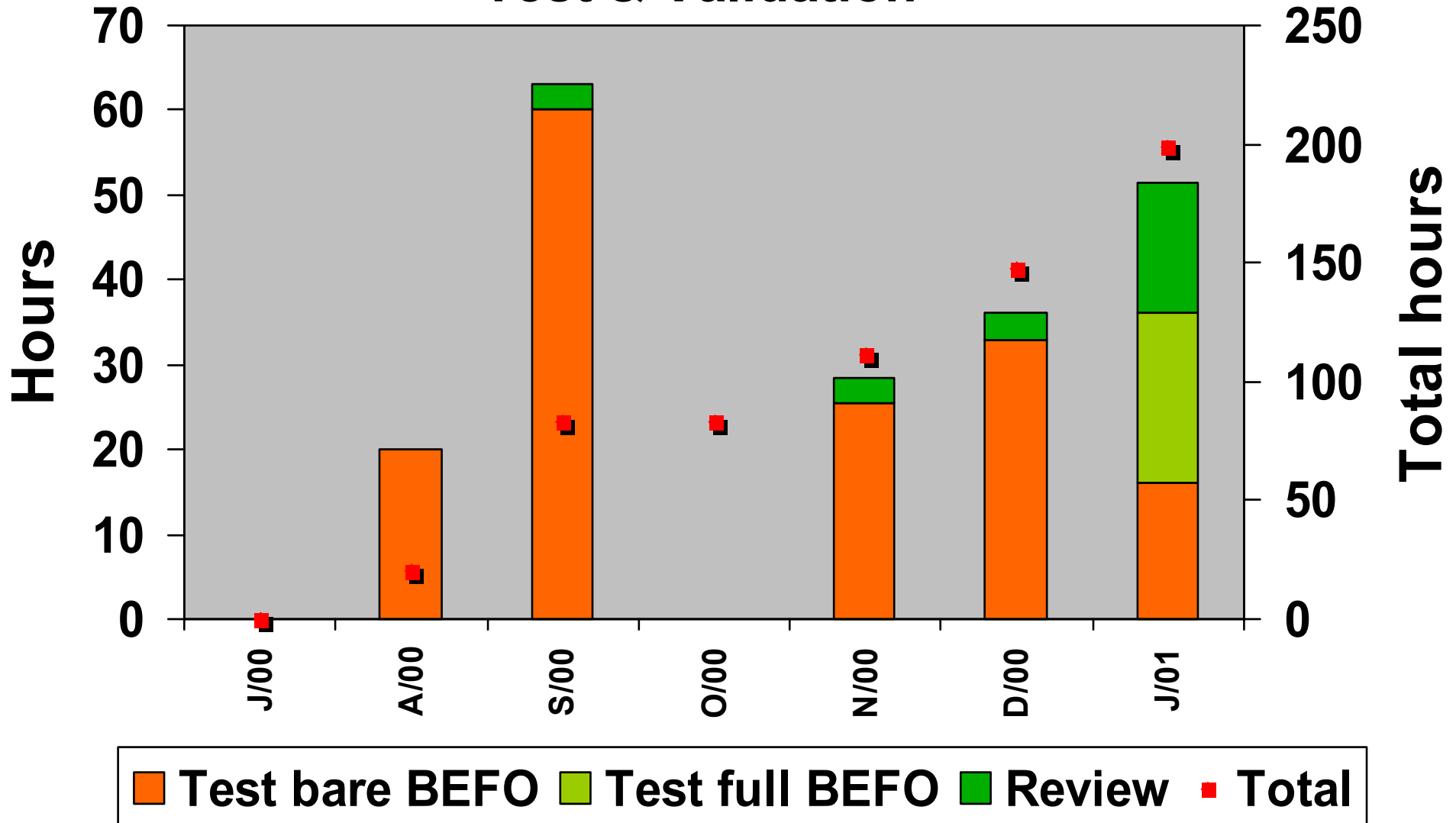


- Dashed lines and blocks were not implemented.

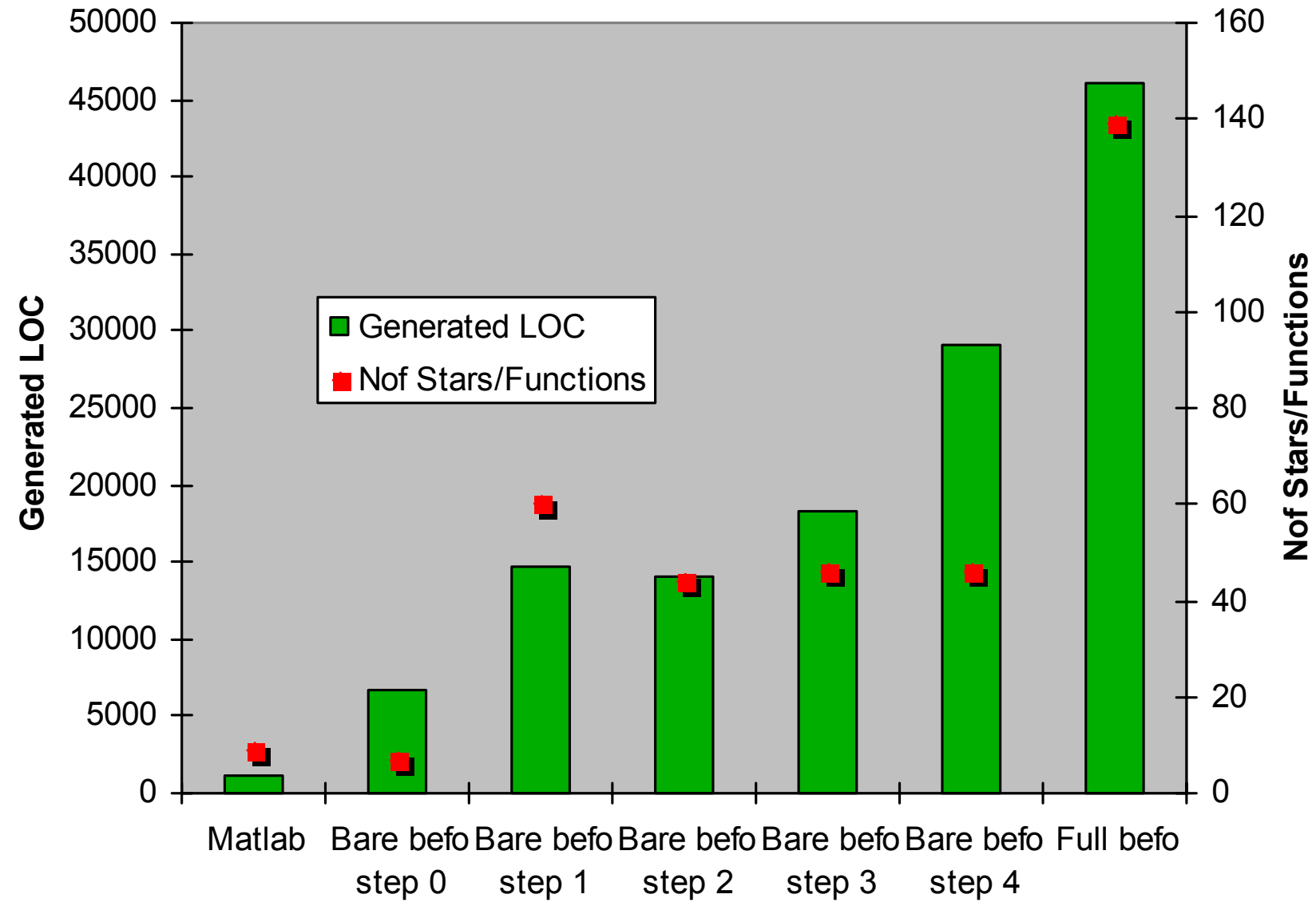
Design & Development



Test & Validation

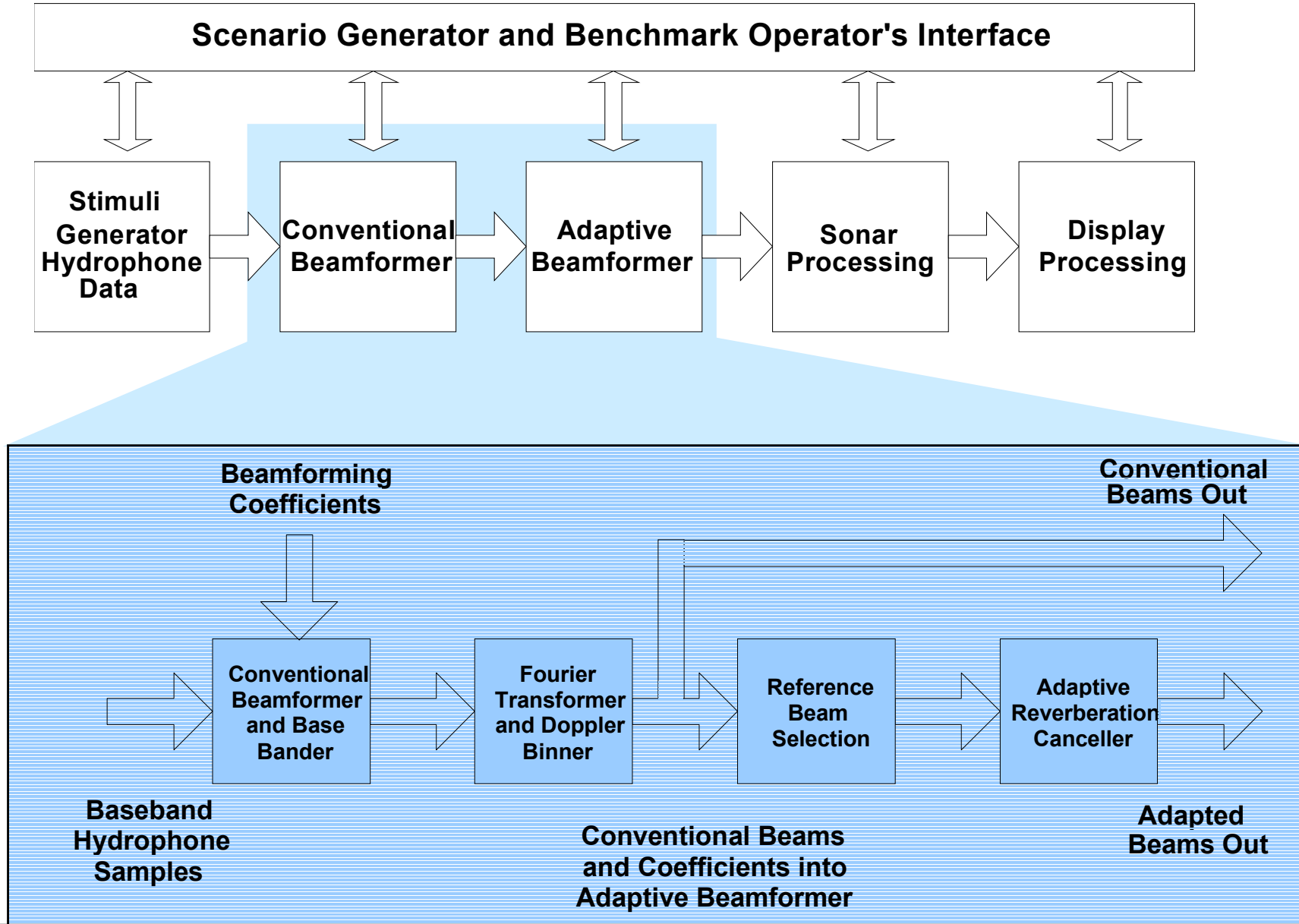


Radar - Design Complexity

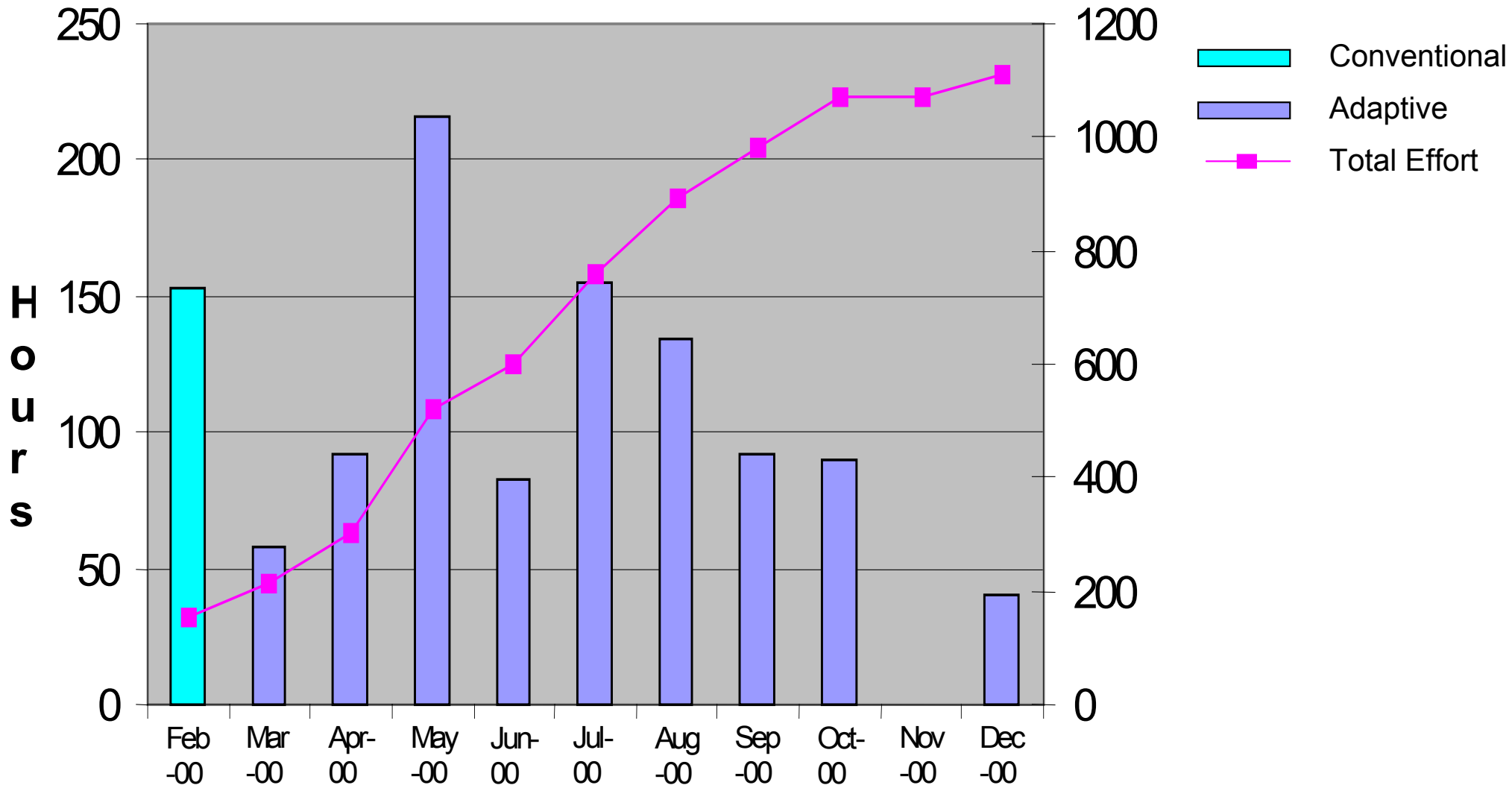




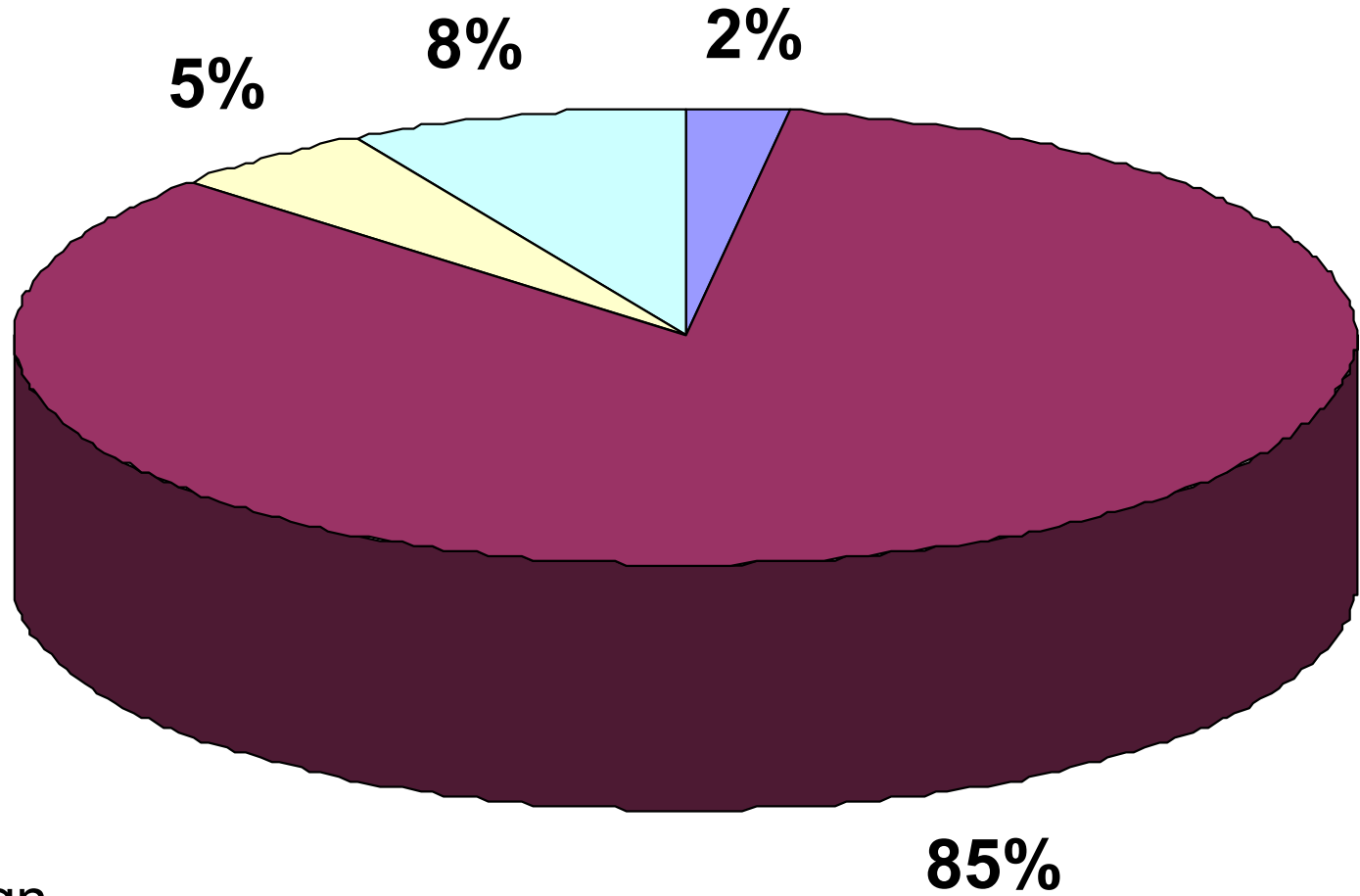
Sonar benchmark



Sonar - Effort

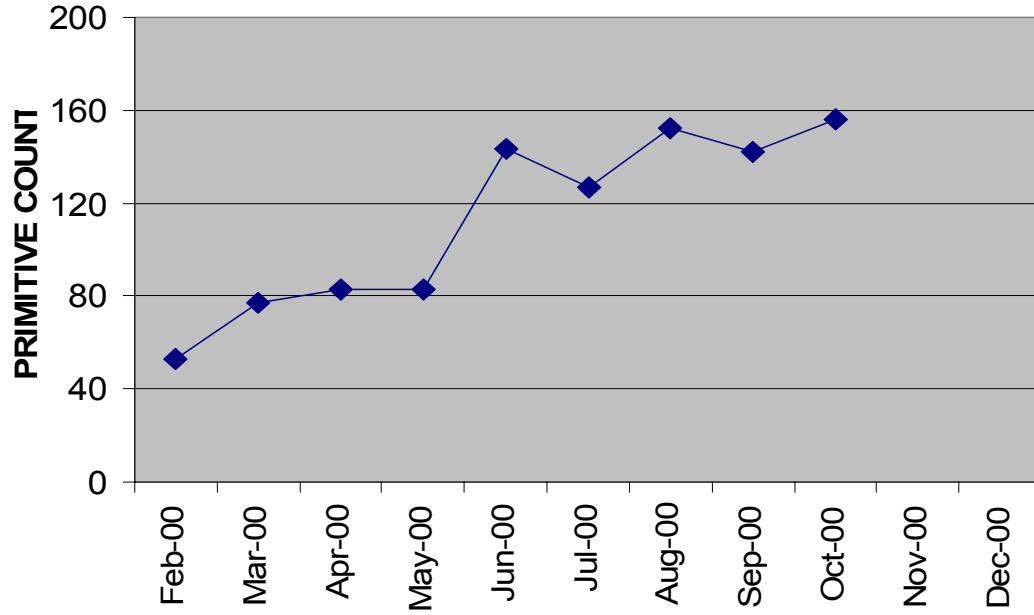


Sonar - Effort



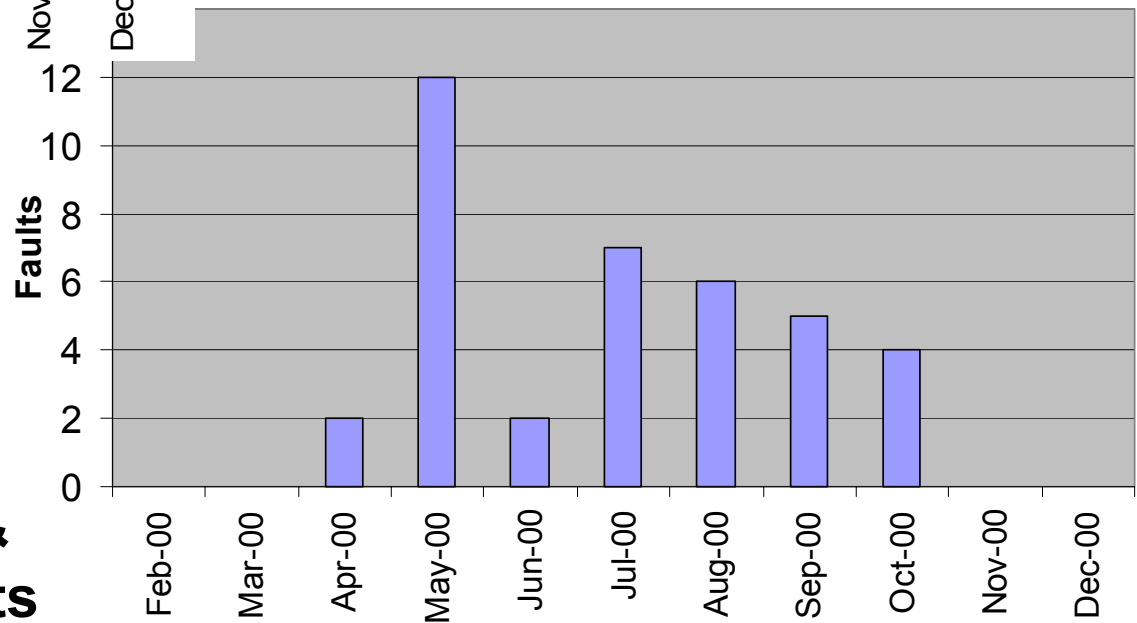
- Specification
- Planning
- Functional Design
- Architecture Design

Sonar - Complexity (Adaptive)



Number of Developed GEDAE Primitives

Number of Design & Implementation Faults



☛ With respect to existing developments/estimates

☛ Radar

- *Improvement Factor 1.4*
- *Significant development of Ptolemy tool*
- *Real-time performance met (primarily latency)*

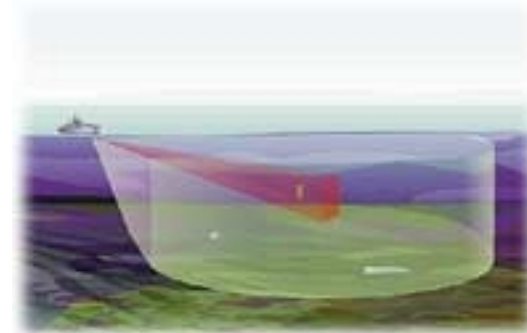
☛ Sonar

• Conventional Beamformer

- *Improvement Factor 16*
 - *Fully Understood Specification, Simple Capability Requirement*

• Adaptive Beamformer

- *Improvement Factor 2.4*
 - *Significant Algorithm Development / Test*
 - *Development of Application Capability (Specification)*
- *Design & Implementation Faults*
 - ***reduced by a factor of 7.9***



ESPADON has:

- **Defined a Methodology for SP applications**
- **Performed studies of supporting technologies**
- **Identified current best of class tools**
 - Rapid & Virtual Prototyping
- **Created a design environment**
 - integration of best of class tools
- **Proven lifecycle improvements through:**
 - Two RP benchmarking activities**
 - Sonar - improvement factors of between 2.4 and 16**
 - Radar - improvement factor of 1.4**
 - Independent benchmark (AMS) - Radar**
 - **improvement factor of 2.6**

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Useful References:

- ESPADON, <http://www.espadon.org/>
- GEDAE, <http://www.gedae.com/>
- Ptolemy, <http://ptolemy.eecs.berkeley.edu/>
- Matlab, <http://www.mathworks.co.uk/>
- VSIPL, <http://www.vsip.org/>

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