



# S&C Software Engineering

# Overview



- Basic approach
  - Use SKA System Engineering Management Plan (SEMP) as the basis
  - Add as needed for software engineering



- LOFAR
  - The LOFAR Software Engineering Practices are for the large part derived from the LOFAR System Engineering Practice similarly to the recommendation here for SKA.
- MeerKAT
  - Software and computing specialisations have been added to the MeerKAT SEMP so the SDP obeys the SEMP.

# Software engineering in other projects



- ALMA
  - ALMA documented software engineering practices are quite standard and contain no significant aspects not covered by the SEMP
- LSST
  - Well-defined Software Development Management Plan.
  - Draws on ESA Guide to Software Project Management with some variations.

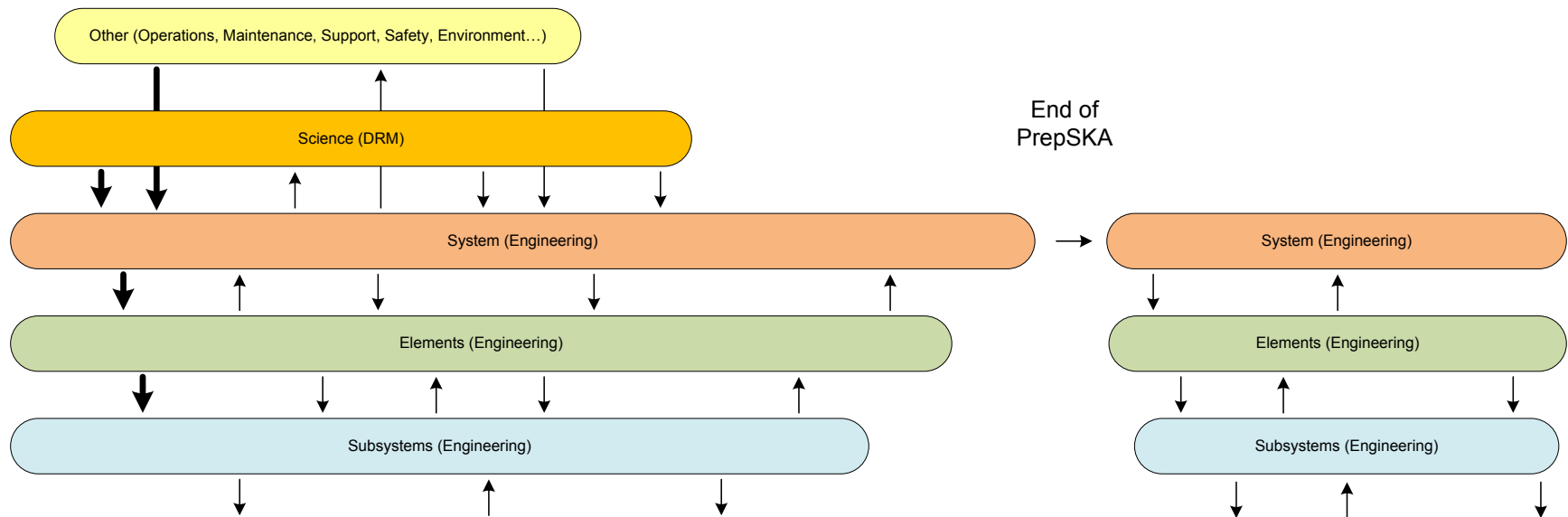


- ASKAP
  - Science case, science requirements, analysis, architecture, subsystem CoDR's, PDR's, CDR's, and PRR
  - Consensus was to keep mode space limited
  - Project Scientist understood the computing and the Computing lead understood the science

# SEMP Iterative Process



- Use of an iterative or spiral process is very common in software engineering.



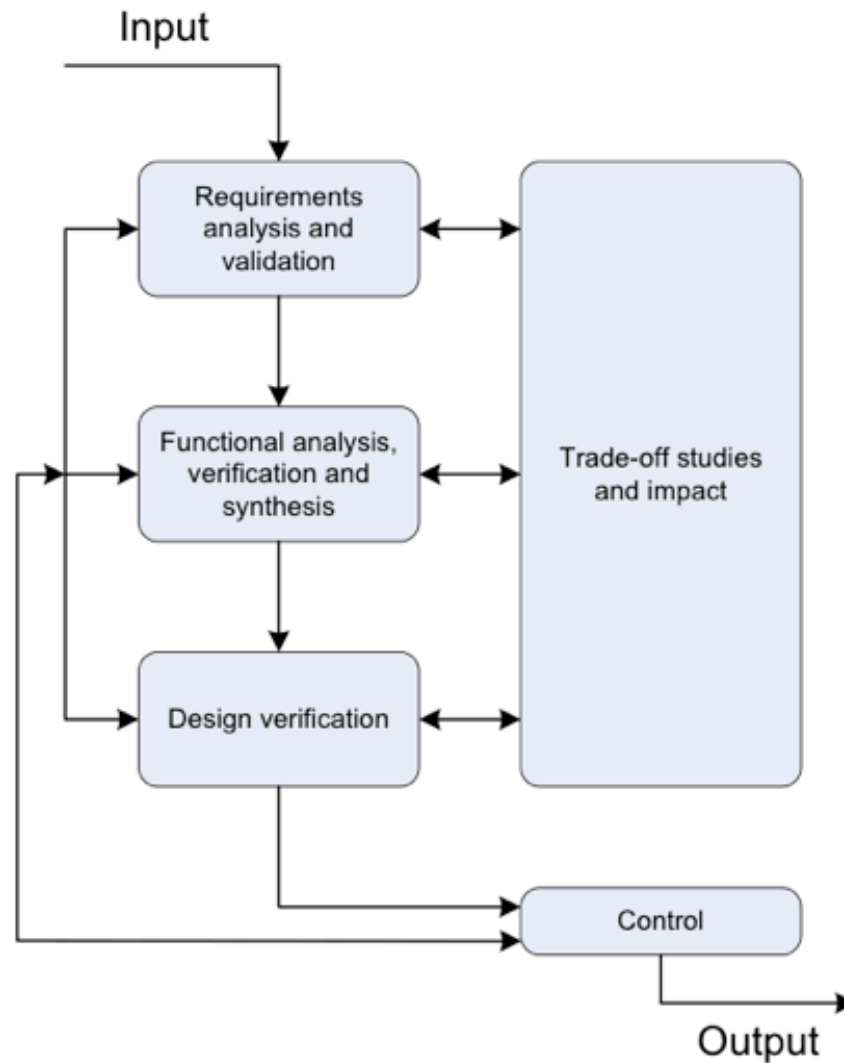
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# Required documentation



- D1. A completed and agreed to design reference mission
- D2. A completed and agreed to science operations plan
- D3. A completed and agreed to maintenance and support plan
- D4. Requirements specifications for each of the systems
- D5. Designs for the systems
- D6. Requirement specifications for all elements of the system
- D7. Designs for all elements of the system
- D8. Requirements specifications for all subsystems of the elements
- D9. Designs for all subsystems of the elements
- D10. Interface control definitions and interface designs at all levels
- D11. Results of the tests performed on the verification models
- D12. Scaling analysis (where applicable)
- D13. Deployment plan
- D14. Upgrade Plan
- D15. Fully costed user system breakdown

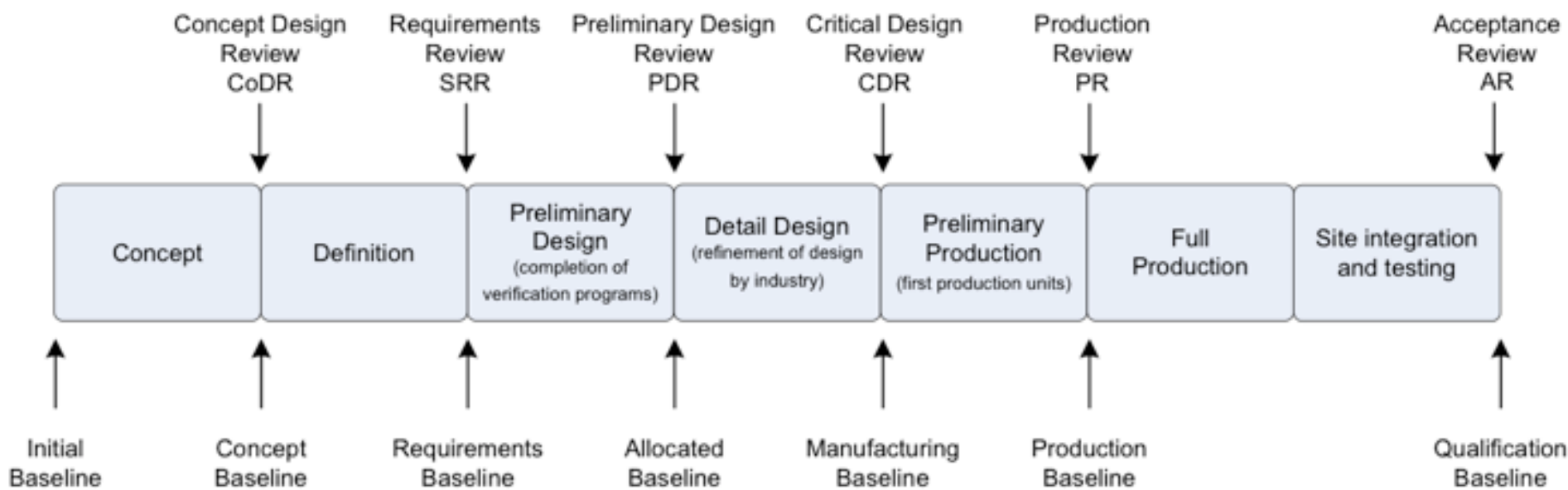
# Basic unit of SE



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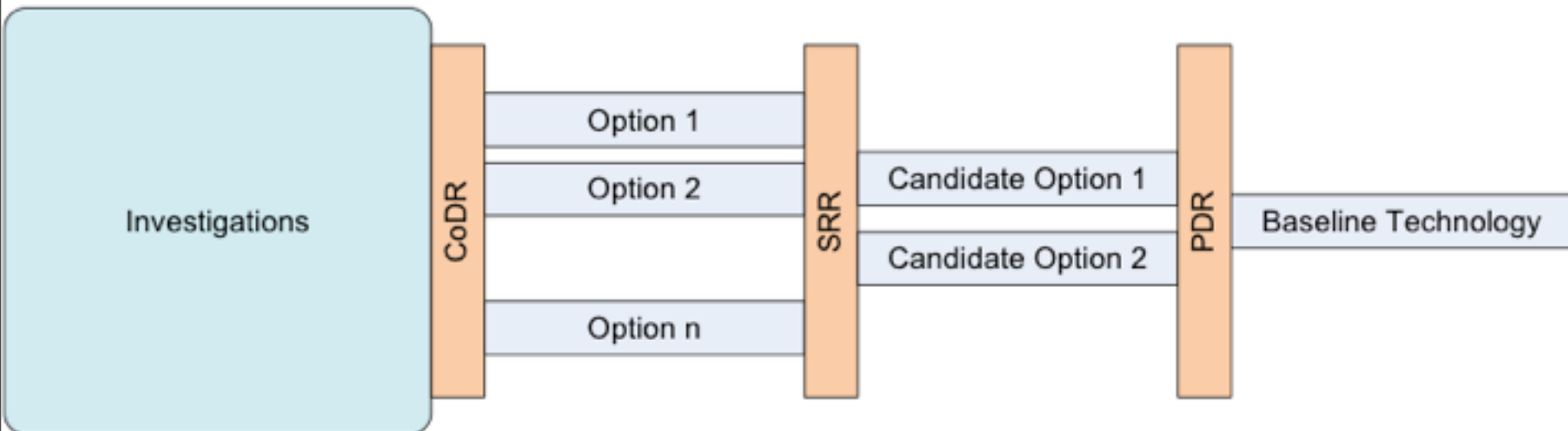


# Phasing



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# Technology options



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# Value of SEMP for SKA problems



- Novel scale of challenge
  - Telescope parameters e.g. data, geographical spread
  - Number of stakeholders
- Extra rigour in SEMP will aid all of these

# Value of SEMP for SKA problems



- Distribution of development across geography, time zones, and institutional cultures
  - Prescriptive approach aids communication across barriers i.e. documentation must exist

# Value of SEMP for SKA problems



- Immature requirements
  - Very common flaw in projects
  - Software particularly susceptible
- SEMP addresses this

# Value of SEMP for SKA problems



- Novel late-arriving instrumental concepts  
e.g. WBPSFs, AA-Mid, and PAFs
  - Can stretch or break designs
  - Extensibility definitions must be accurate



- ESA
  - Emphasis on estimation at the beginning and throughout the project
  - Accurate record keeping to determine time spent on various activities and tasks.
  - Use of metrics, such as product and process metrics, to monitor and control the project

# Recommended additions to SEMP



- Estimation of software effort at the beginning and throughout the project.
- Accurate record keeping to determine time spent on various activities and tasks. other activities is required for accurate estimation of timelines.
- Use of metrics, such as product and process metrics, to monitor and control the project.



# Development tools



- Central code repository (e.g. SVN or Redmine)
- Coding standards
- Compile-link-debug toolchain (e.g. gcc)
- Standard platforms (some variant of Linux and perhaps OS X)
- Documentation systems (e.g. doxygen, sphinx, wiki, UML diagrammer)
- Automated testing frameworks (e.g. Jenkins, Bitten)
- Release workflow and management systems
- Issue or defect tracking system (e.g. JIRA, Redmine)

# Issues



- Acceptance of tool chain
- Testing facilities
- Central or distributed code repository?

# Summary



- Adopt and (slightly) extend SEMP
- Software appropriate interpretation
- Development tool chain straightforward
- Acceptance and other cultural issues
- Central or distributed code repositories