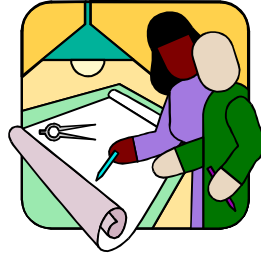


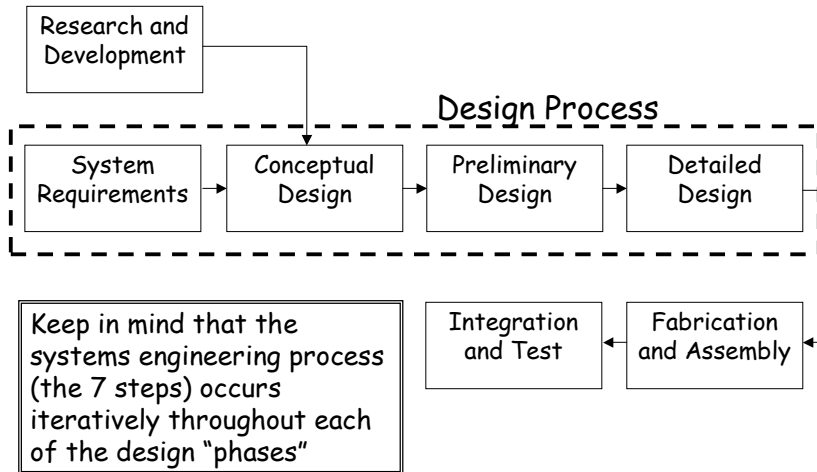
Design Phases



And ... Design Reviews

Another View of the Design Process

Pisacane and Moore, *Fundamentals of Space Systems*,
Oxford University Press, 1994, Ch. 1



Design Phases: Objectives and Tools

Design Phase	Objective	Tools
Conceptual	Explore tentative general possibilities	Calculators, basic formulas, backs of envelopes
Preliminary	Define and assess main parameters	Computer programs, approximate models
Detailed	Produce a documented set of performance predictions and detailed working drawings for the construction of a prototype	Experiment, test, canned computer codes

Conceptual Design

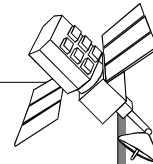


- Description of operational scenarios
- Preferred system configuration
- Organizational responsibilities
- System schedule
- Cost estimate
- Description of each subsystem
- Anticipated performance of each subsystem
- Identification of major components
- Risk analysis and risk reduction plan
- Initial major make-or-buy decisions
- Initial specifications of long-lead procurements
- Subsystem schedules and costs
- Subsystem specifications
- Interface control documents
- Safety
- Mission operations
- Test and evaluation
- Spares and maintenance
- Configuration control requirements

Preliminary Design

- Begins with baseline design developed in Conceptual Design Phase
- Refined synthesis, analysis, optimization lead to changes in requirements, mission, configuration
- Performance expectations, schedules, and costs are refined

Preliminary Design



- Refined requirements
- Refined mission description and operation
- System specifications and configuration
- System schedule and cost
- Anticipated system performance
- Preliminary design of each subsystem
- Expected performance of each subsystem
- Preliminary reliability assessment
- Make-or-buy decisions
- Specs of long-lead components
- Preliminary parts lists
- Subsystem schedules and costs
- Outline of documents: Safety, Mission operations, Test and Evaluation, Spares and maintenance
- Completed documents: Interface Control Document

Detailed Design

- Final specs for each subsystem - should not have changed much from preliminary design
- Descriptions of subsystems include components and parts
- Verification of design
- Determination of design margins

Detailed Design



- Final subsystem specifications
 - Detailed design of subsystems with drawings
 - Final specs of components and parts
 - Identification of any special handling
 - Schedules and costs
 - Completion and detailed analyses and test hardware and software
 - Subsystem T&E reports
 - Reliability assessment
 - Anticipated overall system performance
-
- Completed documents: Safety, Mission ops, T&E

Design Reviews

- Provide independent and critical assessment
- Identify issues and resolve them off-line
- Assure that interfaces are well understood
- Promote communication among participants
- Formalize and document accomplishments
- Promote confidence in accomplishments
- Signify that a particular accomplishment is completed
- Formalize the expected date of the accomplishment
- *Costs are not addressed at design reviews.*

Engineering Reviews

- Needs review
- Requirements review
- Design reviews

- COncceptual DR
- Preliminary DR
- Critical DR



These 3 Design Reviews are typically the most important reviews in a project

- Fabrication feasibility review
- Design release review
- Integration readiness review
- Preenvironment test review
- Flight readiness review
- Flight operations review
- Special reviews (safety, etc.)

Successful Design Reviews

- Purpose of the review is well understood
- Date is known far enough in advance for all to prepare
- An agenda allowing sufficient time is established
- Documentation is clear, concise, distributed in advance
- Dry run is held
- Presenters are prepared
- Reviewers are knowledgeable and independent
- Chairperson controls the meeting
- Action items identified --- solutions are not attempted
- Proceedings and action items are documented
- Action items are satisfied in writing
- *Costs are not addressed*

Typical Agenda



- | | |
|--|--|
| <ul style="list-style-type: none"> • Purpose and conduct of review • Resolution of prior action items • Mission and system needs • Mission and system overview • System-level requirements • Reliability and quality assurance • Payload review <ul style="list-style-type: none"> - Instrument No. 1 - ... - Instrument No. N • Spacecraft review <ul style="list-style-type: none"> - Mechanical and structure - Tracking and orbit det. - Guidance and propulsion | <ul style="list-style-type: none"> • Spacecraft review (cont.) <ul style="list-style-type: none"> - Attitude det. & control - Thermal - Power - Comm. and data handling - Flight processors, s/w • Ground support equipment • Integration and test • Electromagnetic compat. • Safety • Launch site operations • Mission operations • Documentation • Action items identified |
|--|--|

Gantt Chart for Spacecraft Design

