

An Overview of the WMKO Development Phases

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INTRODUCTION

This document provides a brief description of the objectives and deliverables for each of the development phases in the new instrument development process at WMKO.

THE DEVELOPMENT PROCESS

The overall development process is summarized in Figure 1.

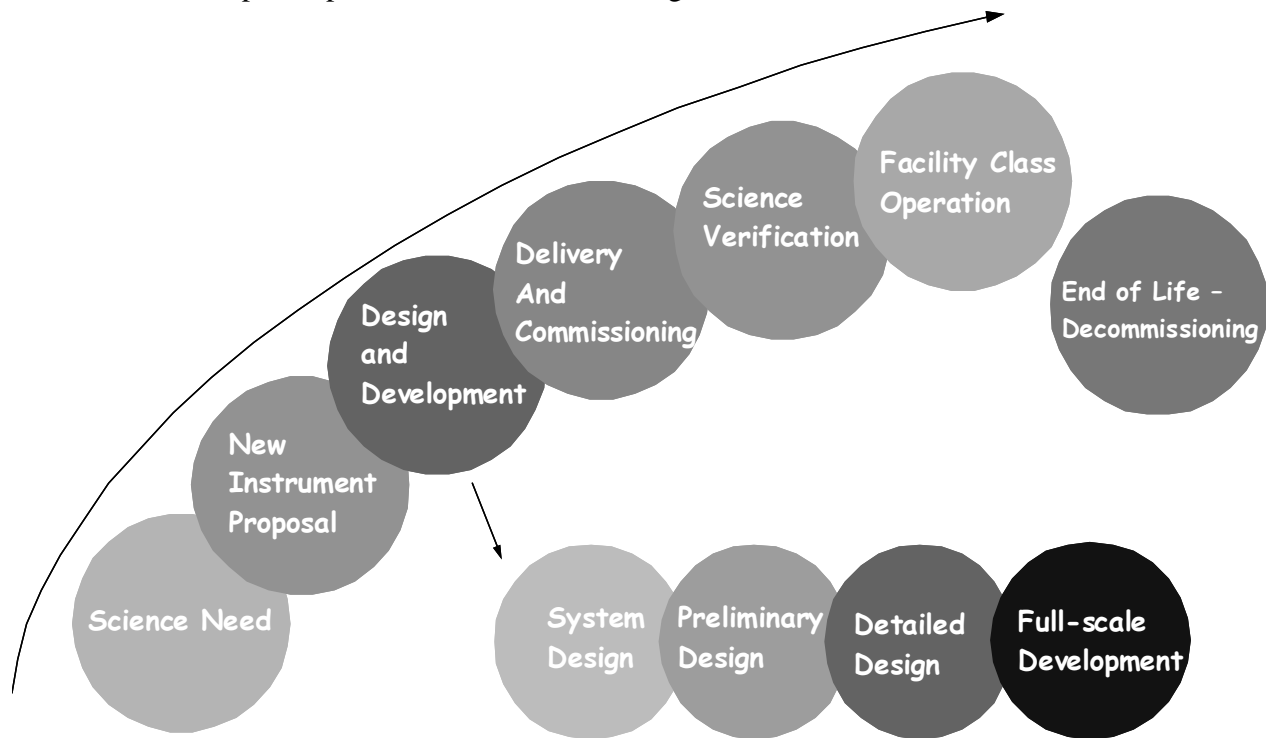


Figure 1: The WMKO Development Process

The design and development phase is composed of three design phases: system design, preliminary design and detailed design, followed by the full-scale development phase. The design phases have heritage in MIL-STD-499A, but our process tailors the design phases to address our unique needs that result from the necessity for the prototype to be the product. This tailoring is also driven by a tendency in our past practice to under emphasize the early design phases. This has led to cost overruns and functional problems later in the development and operational phases. A second emphasis is to promote an increase in the level of systems engineering employed in the design process.



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The full-scale development phase has been referred to as “assembly and test”, “fabrication and test” or with various other labels. We use the term full-scale development to include all of the steps leading to a complete system, including fabrication, assembly, integration and test. The term is also useful to emphasize that this is the final decision point for commitment to completion of the project.

For each phase the WBS, project plan and schedule should address specific top-level objectives. The objectives and key deliverables for the design and development phases and subsequent phases, are described in the next sections.

Design and Development

- System Design:

The principal objective of system design is to establish a design approach that meets the scientific and user requirements established for the system. System design will establish a discipline integrated engineering plan for the proposed design, understand the technical risks, explore trade-offs, and determine estimates for performance and cost to completion.

The key deliverables from the system design phase are a System Requirements Document, a Systems Engineering Management Plan, a System Design Manual and a System Design report.

If abbreviations are required this is the “SD” phase and the system design review is the “SDR”.

- Preliminary Design:

The preliminary design phase has two primary objectives. The first objective is to deliver documented designs for each system, sub-system and component, hardware or software, of sufficient detail to establish through inspection and analysis the feasibility of the proposed design, and the likelihood that the design will meet the requirements. The second objective is to present the project plan to completion, including a detailed schedule and budget.

The principal activities of the preliminary design phase are design, prototyping, simulation and analysis. The key deliverables are preliminary technical specifications, a preliminary Operations Concept Document, Interface Design document(s), and a Preliminary Design report.

Because of long lead times, orders for custom optical components may need to be placed after a successful preliminary design review. This requires complete, final designs for all of the optical components that are to be ordered and a satisfactory level of design completion for the mechanical components associated with those optics.

If abbreviations are required this is the “PD” phase and the preliminary design review is the “PDR”.



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- Detailed Design:

The detailed design phase has two primary objectives. The first objective is to complete the design, fabrication and assembly documentation for the system and all components, hardware or software, and show that the final design complies with all specifications and applicable standards. The second objective is to present the project plan to completion, including a schedule and budget.

The principal activity of the detailed design phase is hardware and software design. The key deliverables are complete, final designs for all hardware components ready for fabrication or procurement release, final functional requirements for all software modules, a final Operations Concept Document, a final technical specification, a Configuration Control Plan, Interface Control Document(s) and a Detailed Design report.

If abbreviations are required this is the “DD” phase and the detailed design review is the “DDR”.

Full-Scale Development

The full-scale development phase builds the hardware, codes the software and integrates the complete system and performs laboratory testing culminating in the completion of an acceptance test plan followed by a pre-ship review.

The deliverables for the full-scale development phase are an Acceptance Test Plan, a Science Verification Plan, the complete hardware and software system with all as-built documentation, manuals, interface documents, Part I of the Acceptance Test Report and spares.

If abbreviations are required this is the “FSD” phase and the pre-ship review is the “PSR”.

Delivery and Commissioning

The objective of the delivery and commissioning phase is to install the instrument on one of the Keck telescopes, verify the correct operation of all hardware and software, perform first light observations and gather the data needed to complete part II of the Acceptance Test Plan. At the end of the commissioning process an acceptance review is held to ensure that all of the documentation, spares and procedures are in place to allow the Observatory staff to assume responsibility for operating the instrument during the remaining on-sky testing and the start of shared risk observing.

The deliverables for the delivery and commissioning phase include a report on part II of the Acceptance Test Plan and an Acceptance Review report.

This phase does not have an abbreviation. The acceptance review is the “AR”.



Science Verification

The objective of the science verification phase is to complete the testing of the complete system and verify that it delivers the required scientific capabilities and performance. The principal activities of the science verification phase are on-sky testing and shared risk observing, debugging, field modifications and updates, and completion of part II of the ATP.

The deliverables from the science verification phase are the Science Verification report, updates to any documentation required to track the changes made during the science verification phase, the Operational Readiness review report and the final project report.

If abbreviations are required this is the “SV” phase and the science verification review is the “SVR”. The operational readiness review is abbreviated “ORR”.

DOCUMENTATION PRODUCTS

In each development phase there are specific documentation products that are created. These are part of the project deliverables for each phase. The documentation products are listed by phase in Table 1. The table also shows who is responsible for preparing the documentation and provides notes to clarify certain issues related to the documentation.



W. M. KECK OBSERVATORY

Instrument Program Management

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Development Phase	Document Title	Responsibility			Notes
		Design Team	CARA	Review Committee	
System Design					
	System Design Proposal	X			
	System Requirements Document	X	X		
	Systems Engineering Management Plan	X			
	System Design Manual	X			
	System Design Report	X			
	Preliminary Design Proposal	X			Normally this is part of the SD report
	System Design Review (SDR) Report			X	
Preliminary Design					
	Preliminary Specifications	X	X		
	Preliminary Operations Concept Document	X	X		
	Interface Design Document(s)		X		
	Preliminary Design Report	X			
	Detailed Design Proposal	X			Normally this is part of the PD report
	Preliminary Design Review (PDR) Report			X	
Detailed Design					
	Approved Specifications	X	X		The PDR endorsement or modification of the preliminary specifications
	Final Operations Concept Document	X			
	Configuration Control Plan	X	X		
	Final Specifications	X	X		Final specifications represent the specifications that will drive the ATP
	Interface Control Document(s)		X		
	Design Package	X			
	Detailed Design Report	X			
	Full Scale Development Plan	X			Normally this is part of the DD report
	Detailed Design Review (DDR) Report			X	

Table 1: Development Process Documentation Products



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Development Phase	Document Title	Responsibility			Notes
		Design Team	CARA	Review Committee	
Full Scale Development					
	Acceptance Test Plan	X	X		
	Science Verification Plan	X	X		
	As-Built Drawings and Manuals	X			
	Interface Documentation		X		
	Acceptance Test Report Part 1	X	X		
	Pre-Ship Review (PSR) Report			X	
	Installation and Commissioning Plan	X	X		Normally this is part of the Acceptance Test Report
Delivery and Commissioning					
	Acceptance Test Report Part 2	X	X		
	Acceptance Review Report		X		
Science Verification					
	Science Verification Report	X	X		
	Operational Readiness Review Report		X		
	Final Project Report		X		
	Documentation Updates	X	X		

Table 1 continued: Development Process Documentation Products