NAOMI Working Definitions of CoDR, PDR and CDR

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1. Introduction

There is not a formal universally agreed definition for each of these terms. For the purpose of the AO programme the following give some guidelines as to what level of design is expected for each of the stages Preliminary Design (PD), Critical Design (CD). These descriptions are by no means exhaustive but indicate the spirit of the meanings which should be adopted for each phase .

The definition of 'system' in this document can refer to a relatively complex sub-system of a full project (examples: the integrated mechanical and optical components; the control, visualisation and real-time software) and to the full project itself. Thus sub-systems of significant complexity and/or critical functionality may have their own Co, P and C designs. For sub-systems, 'full system requirements' may be substituted for 'scientific requirements'

1.1 Conceptual Design

1) A basic scientific requirements document must be available before or as part of the Conceptual Design stage.
2) The function of the CoD is to demonstrate that it is likely that there is at least one way of producing a system which meets these broad scientific requirements.
3) The design need not be shown to be optimised in terms of cost, scientific performance or other parameters which need detailed investigation. Therefore although the CoD must demonstrate a design whose functionality meets the scientific requirements, the design details need only be at the level of describing sub-components and their functions, indicating the way in which the sub-components are inter-dependent and would function together to provide the full required system.
4) There may be areas identified (and probably some remaining unidentified!) which have some technical or cost risk. There should be some indication that for any such identified areas there is a reasonable chance of success in overcoming the technical difficulties or excessive high cost.
5) Although the CoD need only demonstrate one possible solution, it may present options for sub-components (or possibly the whole system), especially in areas where one or more options involve extra technical risk or cost.

1.2 Preliminary design.

1) A detailed scientific requirements and operational requirements/constraints document must be available before or as part of the Preliminary Design.

2) The prime function of the preliminary design is to describe the way in which the full system is most likely to be built to meet these detailed requirements. Therefore where appropriate it should describe a full layout meeting the scientific requirements and environmental requirements.

3) The space envelope for all sub-components is described, with preferably a high level design for each sub-component (examples: mounting shape and size, number of filters in a wheel, requirement for accuracy of linear translations and rotations, location of bearings and shafts, range of movement of slides, what is mechanised and what is manual, approximate expected power dissipation, general plan for cabling routes). Full design of components is not required at this stage.

4) The last sentence above notwithstanding, it may be appropriate to have done quite detailed design or other appropriate investigation of components which are still viewed to be of high technical risk, to ensure that there is a good probability of their implementation being feasible at acceptable cost.

5) By this stage there must have been reasonable exploration of cost implications of the proposed design so that the likely cost envelope is known to <10%. An awareness of the major cost drivers is essential. Likewise a good estimate of the timescale and route to completion should exist.

6) The project should be able to show how it has remained open to ideas for alternatives producing the full or sub- system(s) which may prove more cost effective or scientifically advantageous. It is not necessary (or possible) to demonstrate that all possible avenues for improvement have been explored (they won't have been!).

7) Areas with unresolved problems may remain, but there should be high expectation that the problems are tractable within the cost and timescale estimates.

8) Where options existed at the CoD stage, the preferred option should be indicated and justified at the PD stage.

9) Work areas which can be tested significantly before construction, by modelling or simulations, should be indicated and the nature and scope of the modelling described.

1.3 Critical Design

1) The prime function of the Critical Design is to describe in full detail how the system will be built and is the final hurdle which needs to be overcome before construction is started. In practice a sub-system may pass a CDR and 'cut metal' before all sub-system CDRs are completed, but this still entails risk and should not be done without good reason.

2) Full designs for individual components shall exist.

3) An updated full costing based on building, testing and commissioning the proposed designs must be available.

4) Where possible and appropriate, models demonstrating the system and sub-components in operation should be made (examples: showing precise calibration and alignment procedures including the nature and detectability of individual adjustments; dummy software procedures emulating mechanism control, real-time control).

5) Detailed cost and timelines to completion, management plans, intended resource locations must be described.

1.4 System Design Reviews

System Preliminary and Critical Design Reviews are NAOMI system-wide reviews which will take place after completion of the corresponding subsystem design reviews. They are a much simpler alternative to holding a full-blown system-wide PDR and CDR and provide assurance of system design self-consistency with much reduced elapsed time. They essentially consist of summary presentations of the subsystem PDRs (or CDRs) and an analysis/review of their consistency. The nature of the NAOMI subsystem divisions is such that this can be accomplished by testing rather low-order and sparse subsystem compliance and interface matrices covering electrical/cabling, mechanical/space, optical, electronics and software. Where there is an interface control document (ICD) covering an issue this will be reviewed at the same time.

The normal system engineering function of ensuring that image quality and thermal dissipation budgets are being met will also be reported on at the time of the review. The system design reviews will also be the occasion to review drafts of the Integration, Testing and Commissioning Plan. An early draft will be available at the time of the SPDR and a more developed version by the SCDR.

The review documentation will consist of the ICDs with the subsystem review documents as background reference material. Each member of the review team will take on the responsibility for soliciting and collating input from all the other reviewers on one or more elements of the compliance matrices (reviewing the ICD where appropriate). The group leaders will then provide a report on each compliance element, either signing off or recommending actions.