



**NOAA NESDIS
CENTER for SATELLITE APPLICATIONS
and RESEARCH**

DOCUMENT GUIDELINE

**DG-7.1
PRELIMINARY DESIGN DOCUMENT
GUIDELINE
Version 3.0**

NOAA NESDIS STAR

DOCUMENT GUIDELINE

DG-7.1

Version: 3.0

Date: October 1, 2009

TITLE: Preliminary Design Document Guideline

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TITLE: DG-7.1: PRELIMINARY DESIGN DOCUMENT GUIDELINE VERSION 3.0

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PRELIMINARY DESIGN DOCUMENT GUIDELINE VERSION HISTORY SUMMARY

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2.0	Revised by Ken Jensen (Raytheon Information Solutions) for version 2.	All	10/26/2007
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LIST OF ACRONYMS

ATBD	Algorithm Theoretical Basis Document
CICS	Cooperative Institute for Climate Studies
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIOSS	Cooperative Institute for Oceanographic Satellite Studies
CIRA	Cooperative Institute for Research in the Atmosphere
CL	Check List
CLI	Check List Item
CM/DM	Configuration Management/Data Management
CREST	Cooperative Remote Sensing and Technology Center
DG	Document Guideline
DPP	Development Project Plan
EPL	Enterprise Product Lifecycle
IPT	Integrated Product Team
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
OCD	Operations Concept Document
PAR	Process Asset Repository
PBR	Project Baseline Report
PDD	Preliminary Design Document
PDR	Preliminary Design Review
PG	Process Guideline
PRD	Project Requirements Document
PRG	Peer Review Guideline
PRR	Project Requirements Review
PRRR	Project Requirements Review Report

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QA	Quality Assurance
RAD	Requirements Allocation Document
SG	Stakeholder Guideline
SOW	Statement Of Work
STAR	Center for Satellite Applications and Research
SWA	Software Architecture Document
TBD	To Be Determined
TD	Training Document
TG	Task Guideline
VVP	Verification and Validation Plan

1. INTRODUCTION

The NOAA/NESDIS Center for Satellite Applications and Research (STAR) develops a diverse spectrum of complex, often interrelated, environmental algorithms and software systems. These systems are developed through extensive research programs, and transitioned from research to operations when a sufficient level of maturity and end-user acceptance is achieved. Progress is often iterative, with subsequent deliveries providing additional robustness and functionality. Development and deployment is distributed, involving STAR, the Cooperative Institutes (CICS, CIMSS, CIOSS, CIRA, CREST) distributed throughout the US, multiple support contractors, and NESDIS Operations.

NESDIS/STAR is implementing an increased level of process maturity to support the exchange of these software systems from one location or platform to another. The Preliminary Design Document (PDD), a Microsoft PowerPoint file, is one component of this process.

1.1. Objective

The objective of this Document Guideline (DG) is to provide STAR standards for the PDD. The intended users of this DG are the personnel assigned by the Development Lead to the task of creating a PDD for the project.

1.2. The Preliminary Design Document

The PDD is the presentation document for a project's Preliminary Design Review (PDR)¹. The PDR is an important milestone of each project's product lifecycle.

The PDD should build on the Project Requirements Document (PRD), adding preliminary design, updating the status of the requirements and requirements allocation, and updating the status of actions from the Project Requirements Review (PRR). It should accomplish the following objectives:

- » Identify relevant stakeholders and document their involvement according to the project plan.
- » Identify requirements changes since PRR
- » Identify a set of alternative solutions for meeting the requirements

¹ Refer to the STAR EPL Process Guidelines (PG-1 and PG-1.A) for a description of the STAR EPL gates and reviews.

- » Provide an updated allocation of product requirements to product components for each alternative solution
- » Identify a single selected solution, including a rationale for the selection in accordance with standard selection criteria
- » Provide the description of the product that supports the development phase of the product lifecycle
- » Include the definition of the required design configuration
- » Provide all applicable technical data for the set of alternative solutions, including:
 - Operations concept
 - Theoretical Basis
 - Preliminary design software architecture
 - Performance requirements, quality assurance (QA) procedures, test data requirements
 - Verification and validation plans
- » Identify and evaluate risks. Provide risk mitigation plans.
- » Document the closing of all action items since PRR. Make recommendations for open actions and new actions.

The intended target audience is the PDR reviewers. Typically, the PDD is prepared by the project's development team under the direction of the Development Lead.

The PDD should be developed as a Microsoft PowerPoint document. Upon approval, the approved version of the PDD may be converted to an Adobe pdf file for storage in the project artifact repository.

1.3. Background

This DG defines standards and guidelines for producing a PDD. It contains all information needed for a project's development team to produce a PDD that enables the PDR reviewers to confirm that the project is in compliance with all PDR requirements.

1.4. Benefits

A PDD developed in accordance with the standards in this DG enables the PDR reviewers to confirm that the project is in compliance with all PDR requirements. It is therefore a requirement that a PDD be developed in accordance with the guidelines in this document before obtaining PDR approval. The PDD will be reviewed at the PDR to determine whether a project proceeds to the Detailed Design step of the Design phase of the STAR Enterprise Product Lifecycle (EPL)².

1.5. Overview

This DG contains the following sections:

Section 1.0 -	Introduction
Section 2.0 -	References
Section 3.0 -	Standard Sections
Section 4.0 -	Section Guidelines
Appendix A -	Template File

² A description of the STAR EPL can be found in STAR EPL process asset PG-1 (c.f. Section 2 of this document).

2. REFERENCE DOCUMENTS

Preliminary Design Document Guideline Appendix is a STAR EPL process asset (DG-7.1.A) that is intended to be an Appendix to DG-7.1 (this document). It contains Microsoft PowerPoint slide templates for the PDD slides described in DG-7.1. This document will be available to approved users in a STAR EPL process asset repository (PAR).

PRD: Project Requirements Document is an artifact for the PRR. It is a Microsoft PowerPoint file that contains the PRR presentation slides. It is often convenient for the PDD developer to adopt or adapt these slides for inclusion in the PDD. This document will be available to approved users in a project artifact repository.

DPP: Development Project Plan is an artifact for the CDR. It should include the project plan, schedule, and resources, identify stakeholders, identify PDR entry and exit criteria, provide the PDR Check List Items (CLI), and include the project objectives, tasks, milestones, stakeholders, and schedule. This information will be useful for the PDD developer in completing Section 1 of the PDD. This document should be made available to the approved users in a project artifact repository. The PDD developers should check with the Development Lead and STAR CM/DM to determine the latest approved version of the DPP. If a DPP update is being developed concurrently with the PDD, the PDD developers should consult with the DPP developers to ensure consistency of information in the PDD and the DPP.

PRRR: Project Requirements Review Report is an artifact for the PDR. It is the reviewer's report from the PRR. This information will be useful for the PDD developer in completing Section 2 of the PDD. This document will be available to approved users in a project artifact repository.

OCD: Operations Concept Document is an artifact for the PDR. It contains the timeline scenarios for product operation and user interaction for the project algorithm. This information will be useful for the PDD developer in completing Section 3 of the PDD. This document will be available to approved users in a project artifact repository. This version of the OCD may be developed in parallel with the PDD. In that case, the PDD developers should be in contact with the OCD developers to ensure that changes since PRR are captured in the PDD.

RAD: Requirements Allocation Document is an artifact for the PDR. It contains the basic and derived requirements for the work products and the allocation of the requirements to

system components and product components. This information will be useful for the PDD developer in completing Sections 4 and 8 of the PDD. This document will be available to approved users in a project artifact repository. This version of the Requirements Allocation Document (RAD) may be developed in parallel with the PDD. In that case, the PDD developers should be in contact with the RAD developers to ensure that changes since PRR are captured in the PDD.

ATBD: Algorithm Theoretical Basis Document is an artifact for the PDR. It contains the requirements and theoretical basis for the project algorithm. This information will be useful for the PDD developer in completing Section 5 of the PDD. This document will be available to approved users in a project artifact repository. This version of the Algorithm Theoretical Basis Document (ATBD) may be developed in parallel with the PDD. In that case, the PDD developers should be in contact with the ATBD developers to ensure that changes since are captured in the PDD.

SWA: Software Architecture Document is an artifact for the PDR. It contains the software architecture and data flows for the project algorithm. This information will be useful for the PDD developer in completing Section 6 of the PDD. This document will be available to approved users in a project artifact repository. This version of the Software Architecture Document (SWA) may be developed in parallel with the PDD. In that case, the PDD developer should be in contact with the SWA developers to ensure that changes since PRR are captured in the PDD.

PBR: Project Baseline Report is an artifact for the PDR. It provides a listing of all items in the project's baseline. This information will be useful for the PDD developer in providing pointers to the project artifacts. This document will be available to approved users in a project artifact repository. This version of the Project Baseline Report (PBR) will include all of the other PDR artifacts, and therefore should be the last PDR artifact to be finalized. The PDD developer should be in contact with the PBR developer to obtain the correct pointers to the project artifacts prior to the finalization of the PBR.

VVP: Verification and Validation Plan is an artifact for the PDR. It describes the work products to be verified and validated, the requirements for each selected work product and the verification and validation methods for each selected work product. This information will be useful for the PDD developer in completing Section 7 of the PDD. This document will be available to approved users in a project artifact repository. This version of the Verification and Validation Plan (VVP) may be developed in parallel with the PDD. In that case, the PDD developers should be in contact with the VVP developers to ensure that changes since PRR are captured in the PDD.

All of the following references are STAR EPL process assets that are accessible in a STAR EPL Process Asset Repository (PAR) on the STAR web site:

http://www.star.nesdis.noaa.gov/star/EPL_index.php.

PG-1: STAR EPL Process Guideline provides the definitive description of the standard set of processes of the STAR EPL.

PG-1.A: STAR EPL Process Guideline Appendix, an appendix to PG-1, is a Microsoft Excel file that contains the STAR EPL process matrix (Stakeholder/Process Step matrix), listings of the process assets and standard artifacts, descriptions of process gates and reviews, and descriptions of stakeholder roles and functions.

PRG-7: Preliminary Design Review Guidelines are the guidelines for the PDR. It is useful for the PDD developers to understand what the reviewers will expect when reviewing the PDD.

SG-13: STAR EPL Development Lead Guidelines provides a description of standard tasks for Development Leads, including development of the PDD.

SG-14: STAR EPL Development Scientist Guidelines provides a description of standard tasks for Development Scientists, including development of the PDD.

SG-15: STAR EPL Development Tester Guidelines provides a description of standard tasks for Development Testers, including development of the PDD.

SG-16: STAR EPL Development Programmer Guidelines provides a description of standard tasks for Development Programmers, including development of the PDD.

TG-7: STAR EPL Preliminary Design Task Guidelines provides a description of standard tasks for process step 7, during which the PDD is developed.

3. STANDARD SECTIONS

The PDD slides are organized into sections. The standards sections are:

1.0 INTRODUCTION

- 1.1 Development Project Plan
- 1.2 Project Objectives
- 1.3 Project Stakeholders
- 1.4 Project Timeline
- 1.5 Project Plan Changes
- 1.6 Stakeholder Involvement
- 1.7 PDR Guidelines and Check List
- 1.8 PDR Report
- 1.9 Review Objectives

2.0 PRR REPORT

- 2.1 PRR Report
- 2.2 PDR Entry Criteria
- 2.3 PDR Exit Criteria

3.0 OPERATIONS CONCEPT

- 3.1 Operations Concept Overview
- 3.2 Customer/User Needs
- 3.3 Customer/User Expectations
- 3.4 Operational Scenario

4.0 REQUIREMENTS

- 4.1 Requirements Development Process
- 4.2 Requirements Documentation
- 4.3 New Requirements Since PRR

- 4.4 Requirements Changes Since PRR
- 5.0 ALGORITHM THEORETICAL BASIS
 - 5.1 Algorithm Theoretical Basis
 - 5.2 PDR Algorithm
 - 5.3 Algorithm Objectives
 - 5.4 Sensor Inputs
 - 5.5 Ancillary Inputs
 - 5.6 Retrieval Strategy
 - 5.7 Processing Outline
 - 5.8 Physical Description
 - 5.9 Mathematical Description
 - 5.10 Algorithm Output
 - 5.11 Performance Estimates
 - 5.12 Practical Considerations
- 6.0 SOFTWARE ARCHITECTURE AND INTERFACES
 - 6.1 Software Architecture Overview
 - 6.2 Software Architecture Layers
 - 6.3 Software Architecture Documentation
 - 6.4 Solution 1 - PDR Software Architecture
 - 6.5 Solution 2 - PDR Software Architecture
 -
 - 6.N+3 Solution N - PDR Software Architecture
- 7.0 QUALITY ASSURANCE
 - 7.1 Quality Assurance
 - 7.2 Configuration Management
 - 7.3 Verification and Validation Overview
 - 7.4 Verification Plan

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7.5 Validation Plan

8.0 REQUIREMENTS ALLOCATION

8.1 Requirements Allocation Overview

8.2 Requirements Allocation Changes

9.0 RISKS AND ACTIONS

9.1 PRR Risks and Actions

9.2 New Risks and Actions

9.3 Risk Summary

10.0 SUMMARY AND CONCLUSIONS

10.1 Review Objectives Status

10.2 Issues, Actions and Risks

10.3 Next Step – Detailed Design

10.4 Open Discussion

4. SECTION GUIDELINES

This section contains the STAR guidelines for each section of the PDD. PDD developers will benefit greatly from using the slide templates contained in the “STAR_DG-7.1.A_PDD_v3r0.ppt” file, hereafter referred to as DG-7.1.A. DG-7.1.A is considered to be an Appendix to this document.

Note that the slides in DG-7.1.A include figures, tables, and bulleted text. All figures, tables and bulleted text should be adopted as they appear in these slides, except for text between delimiters, like this:

<Text>

Text between delimiters consists of guidelines. The PDD developer should replace this text with appropriate text, as suggested by the guidelines.

4.1. Slide Master

It is recommended, but not required, that PDD developers use the Slide Master from DG-7.1.A as the Slide Master for the PDD. A development team may wish to tailor its Slide Master. For example, a different slide background color that has been established as a “team color” may be used. Whether or not the Slide Master is tailored, the slide master shall include the STAR logo in the upper left corner of the slide, following the Slide Master in DG-7.1.A. The STAR logo should be identical to the Picture on the cover page of this document. Another example of tailoring is to add organization logos to the upper right corner of the slide, if the development team is non-STAR (e.g. a Cooperative Institute or Contractor). The Slide Master for DG-7.1.A includes the Raytheon logo as an example. This should be replaced by the appropriate logos, or no logo if the development team consists of STAR personnel.

4.2. Title Slide

The first slide shall be a Title Slide, labeled "Title Slide" ³ in DG-7.1.A. The Title Slide shall include the Project and/or Product Name⁴ and the Preparer's Names and Organizations.

4.3. Review Agenda Slide

The second slide shall be a *Review Agenda Slide*, labeled "Review Agenda Slide" in DG-7.1.A. The Review Agenda Slide shall list each section of the presentation, the scheduled time interval for the presentation of the section, and the name of the presenter(s) for that section. It is not required that the locations of the Break and Lunch periods be exactly where they are indicated in this slide. The development team should tailor its schedule to fit the contents of each section. If the scope of a project's PDR requires a review that extends for more than one day, each day's agenda should be presented on separate slides, as shown on slides labeled "Review Agenda Slide Alternative – Day 1" and "Review Agenda Slide Alternative – Day 2" in DG-7.1.A.

4.4. Section 1 – Introduction

The PDD shall include an Introduction Section. This section shall include:

- A setup slide, labeled 7 ("Section 1 Setup Slide" in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 1 highlighted, as shown.
- A Section Title slide, labeled "Slide 1.0" in DG-7.1.A.
- Section 1.1: *Development Project Plan*, labeled "Section 1.1" in DG-7.1.A, introduces the Development Project Plan (DPP), a standard STAR EPL artifact for the PDR. Provide a pointer to the project's DPP and to the DPP Document Guideline (DG-5.1).
- Section 1.2: *Project Objectives*, labeled "Section 1.2" in DG-7.1.A. These should be derived from customer needs and expectations and should have been captured in

³ The slide templates in DG-7.1.A are labeled in text boxes located in one of the lower corners of each slide.

⁴ In the slide templates, unspecified (generic) fields are indicated by the <generic name> convention. The PDD developer should fill these in with the appropriate information specific to the project's PDR.

the project's Statement of Work (SOW). Match the main bullets of this slide to the main sections of the SOW. One level of sub-bullets can be used at the discretion of the development team. These would add some high-level information typically derived from the explanatory text in each section of the SOW.

- Section 1.3: *Project Stakeholders*, labeled "Section 1.3" in DG-7.1.A. Identify relevant stakeholder roles and personnel. Each distinct stakeholder role should be listed as a main bullet. Stakeholder roles are identified in the "Stakeholders" sheet of STAR EPL process asset PG-1.A. Stakeholders should be named when known. There may be more than one name for a stakeholder role. Unspecified stakeholders should be identified by role with a TBD. The ensemble of roles and named personnel constitutes the Integrated Product Team (IPT). Sub-bullets can be used to add a high-level description of the tasks expected for a given stakeholder. The level of detail of these descriptions is at the discretion of the development team, but should be sufficient to give the reviewers a good sense of the IPT. The development team may prefer to present the stakeholder information as a table. See "Section 1.3 – Table Alternative" in DG-7.1.A as an example. A project organization chart is recommended. This chart should include all stakeholders that have been identified in this section. See "Section 1.3 – Option" in DG-7.1.A as an example.
- Section 1.4: *Project Timeline*, labeled "Section 1.4" in DG-7.1.A, should include a listing of project milestones and a schedule of tasks leading up to the milestones. Milestones should include the project reviews (with the PDR highlighted) and associated review dates. The STAR EPL standard reviews are shown in Section 1.4 of DG-7.1.A. Refer to the DPP for the project-specific reviews. Milestones may also include key deliveries (e.g. pre-operational code). See "Section 1.4" in DG-7.1.A for an example. Show the project plan as an object or objects taken from a Microsoft Project file of the project plan. Use superimposed text boxes to highlight notable accomplishments leading up to PDR. Note the PDR milestone. See "Section 1.4" in DG-7.1.A for an example. Use more than one slide if necessary to make the objects visually presentable. For example, the project timeline could be partitioned into the major STAR EPL phases. See "Section 1.4 – Timeline Partition" in DG-7.1.A for an example.
- Section 1.5: *Changes To Project Plan*, labeled "Section 1.5" in DG-7.1.A. Describe any changes to the project plan – objectives, stakeholders, tasks, schedule and milestones – that have occurred since the PRR. Use multiple slides as necessary for clarity. If there have been no changes, state this.

- Section 1.6: *Stakeholder Involvement*, labeled “Section 1.6” in DG-7.1.A. Document the involvement of the stakeholders according to the project plan. Use a bullet for each type of stakeholder: Project Planners, Development Team, QA and Test, Configuration Management/Data Management (CM/DM), Customers and/or Users, Operations. Sub-bullets should describe the involvement in a way that shows the project plan is being followed.
- Section 1.7: *PDR Guidelines and Check List*, labeled “Section 1.7 Alternative 1” in DG-7.1.A. This section provides the reviewers with pointers to the PDR Peer Review Guidelines (PRG-7) and PDR Check List that they will need to prepare for and dispose of the review. Use Alternative 1 or Alternative 2, depending on whether the standard PDR Check List (CL-7) is to be used (Alternative 1) or a tailored Check List has been documented in the DPP (Alternative 2).
- Section 1.8: *PDR Report*, labeled “Section 1.8” in DG-7.1.A. This section provides the reviewers with pointers to the PDR Report Document Guidelines (DG-7.2) that they will need to produce the PDR Report.
- Section 1.9: *Review Objectives*, labeled “Section 1.9” in DG-7.1.A should provide a clear presentation of the Review Objectives. These should include STAR EPL standard objectives for a PDR and may include project-unique objectives at the discretion of the development team. Refer to the DPP to determine this. The review objectives should correspond to the major sections of the review (c.f. Section 3 of this DG). Match the main bullets of this slide to the main sections. One level of sub-bullets can be used at the discretion of the development team. These would add some high-level descriptive information.

4.5. Section 2 – PRR Report

The PDD shall include a PRR Report Section. This section shall include:

- A setup slide, labeled “Section 2 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 2 highlighted, as shown in Section DG-7.1.A..
- A Section Title slide, labeled “Slide 2.0” in DG-7.1.A.

- Section 2.1: *Project Requirements Review Report (PRRR)*, labeled “Section 2.1” in DG-7.1.A. The first bullet should be a pointer to the PRRR, so that reviewers can obtain access to it. The remainder of the slide should be as shown.
- Section 2.2: *PDR Entry Criteria*, labeled “Section 2.2” in DG-7.1.A. This section lists the PDR entry criteria. Present as bullets. Use multiple slides as necessary for clarity. The PDR entry criteria should have been established at the PRR and documented in the PRRR.
 - Section 2.2 of DG-7.1.A shows the standard STAR EPL entry criteria for the PDR. These should be used if the standard PDR entry criteria, documented in STAR EPL Check List CL-7, are used. If the entry criteria for a particular project have been tailored, revise these slides as necessary to capture the tailored entry criteria. Refer to the DPP Appendix C to determine this.
 - If applicable, list PDR entry criteria that are non-standard (added or revised from the standard set of entry criteria in STAR EPL Check List CL-7), explain the deviation, provide a rationale, and assess the risk, usually by reference to a risk # to be discussed in Section 9. Follow the instructions in Section 2.2 of DG-7.1.A.
 - If applicable, list any standard entry criteria that have been waived for this PDR, provide a rationale, and assess the risk, usually by reference to a risk # to be discussed in Section 9. Follow the instructions in Section 2.2 of DG-7.1.A.
- Section 2.3: *PDR Exit Criteria*, labeled “Section 2.3” in DG-7.1.A. This section lists the PDR exit criteria. Present as bullets. Use multiple slides as necessary for clarity. The PDR exit criteria should have been established at the PRR and documented in the PRRR.
 - Section 2.3 of DG-7.1.A shows the standard STAR EPL exit criteria for the PDR. These should be used if the standard PDR exit criteria, documented in STAR EPL Check List CL-7, are used. If the exit criteria for a particular project have been tailored, revise these slides as necessary to capture the tailored exit criteria. Refer to the DPP Appendix C to determine this.
 - If applicable, list PDR exit criteria that are non-standard (added or revised from the standard set of exit criteria in STAR EPL Check List CL-7), explain the deviation, provide a rationale, and assess the risk, usually by reference to a risk # to be discussed in Section 9. Follow the instructions in Section 2.3 of DG-7.1.A.

- If applicable, list any standard exit criteria that have been waived for this PDR, provide a rationale, and assess the risk, usually by reference to a risk # to be discussed in Section 9. Follow the instructions in Section 2.3 of DG-7.1.A.

4.6. Section 3 – Operations Concept

The PDD shall include an Operations Concept Section. Most of the content for this section should either be adopted from the PRD, with updates to address any changes since PRR, or obtained directly from OCD v1r1. This section shall include:

- A setup slide, labeled “Section 3 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 3 highlighted, as shown.
- A Section Title slide, labeled “Slide 3.0” in DG-7.1.A.
- Section 3.1: *Operations Concept* labeled “Section 3.1” in DG-7.1.A. Present an overview of what the operations concept is. Use the DG-7.1.A Section 3.1 slide templates as is, without tailoring. Introduce the Operations Concept Document (OCD).
- Section 3.2: *Customer/User Needs*, labeled “Section 3.2” in DG-7.1.A. Explain why the products are being produced. Itemize customer/user needs. Refer to a customer ConOps document, if one exists. If a customer ConOps does not exist, explain how customer/user needs were determined. Use text, figures, tables from the OCD. Use multiple slides as necessary for clarity.
- Section 3.3: *Customer/User Expectations*, labeled “Section 3.3” in DG-7.1.A. Explain how the products will be used, Itemize customer/user expectations. Refer to a customer ConOps document, if one exists. If a customer ConOps does not exist, explain how customer/user expectations were determined. Use text, figures, tables from the OCD. Use multiple slides as necessary for clarity.
- Section 3.4: *Operational Scenario*, labeled “Section 3.4” in DG-7.1.A. Explain how the products should be produced. Describe the production environments that are available for the product lifecycle, including development, transition, operations and delivery. Describe production scenarios, consistent with the level of detail in the customer's concept of operations, the production environment constraints, and

operator needs and expectations. Use text, figures, tables from the OCD. Use multiple slides as necessary for clarity.

4.7. Section 4 – Requirements

The PDD shall include a Requirements Section. This section shall include:

- A setup slide, labeled 48 (“Section 4 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 4 highlighted, as shown.
- A Section Title slide, labeled 49 (“Slide 4.0” in DG-7.1.A.
- Section 4.1: *Requirements Development Process*, labeled “Section 4.1” in DG-7.1.A. These slides illustrate the iterative development of the requirements during the Design phase of the STAR EPL process (“Section 4.1 - Figure 1” and “Section 4.2 – Figure 2” of DG-7.1.A), thereby providing a context for the remainder of the PDR. It is recommended that the presenter use the graphic depiction of the iterative (spiral) development of requirements and requirements allocation. Note the similarity to the figure in Section 8.1 of DG-7.1.A. The essence of “Section 4.1 - Figure 2” is that the development of Solutions, Design, Requirements, and Requirements Allocation occurs iteratively in a closed loop with continual feedback between the four. The placement of the four components of the Design phase is meant to show that Requirements (Section 4) drive the Solutions and Design (Sections 5 – 7), which in turn develop the Requirements Allocation (Section 8). The connection between Requirements Allocation and Requirements is caused by the need to maintain consistency between the two.
- Section 4.2: *Requirements Documentation*, labeled “Section 4.2” in DG-7.1.A. This section introduces the Requirements Allocation Document (RAD) and provides a pointer to the project RAD.
- Section 4.3: *New Requirements Since PRR*, labeled “Section 4.3” in DG-7.1.A. This section describes each new requirement since PRR in sufficient detail to allow the reviewers to determine the proper disposition of the new requirement. Follow the instructions in Section 4.3 of DG-7.1.A.
- Section 4.4: *Requirements Changes Since PRR*, labeled 55 (“Section 4.4” in DG-7.1.A. This section describes each changed requirement since PRR in sufficient

detail to allow the reviewers to determine the proper disposition of the changed requirement. Follow the instructions in Section 4.4 of DG-7.1.A.

4.8. Section 5 – Algorithm Theoretical Basis

The PDD shall include an Algorithm Theoretical Basis Section. Most of the content for this section should be obtained directly from Algorithm Theoretical Basis Document (ATBD) v2r0. Refer to relevant sections of the ATBD when presenting this material. This section shall include:

- A setup slide, labeled “Section 5 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 5 highlighted, as shown.
- A Section Title slide, labeled “Slide 5.0” in DG-7.1.A.
- Section 5.1: *Algorithm Theoretical Basis*, labeled “Section 5.1” in DG-7.1.A. This section introduces the algorithm theoretical basis and the ATBD, with specific pointers to the ATBD Document Guidelines (DG-1.1) and the project’s ATBD provided as indicated.
- Section 5.2: *PDR Algorithm*, labeled “Section 5.2” in DG-7.1.A. This section describes the algorithm status at PDR, including a description of the basic approach for each alternative solution that is under consideration. If there is only one solution under consideration, a rationale should be provided for the rejection of any alternatives. Usually, this will require the solution to have a proven record of satisfying the project requirements in an operational environment. Because one of the primary objectives of a PDR is to provide information to enable a selection of a preferred solution from a set of alternatives, it is essential that a rationale for rejecting alternatives be clear and convincing.
- Section 5.3: *Algorithm Objectives*, labeled “Section 5.3” in DG-7.1.A. This section describes the objectives of the algorithm, including the intended output data products and their intended use. Show how the algorithm objectives are derived from the operations concept. The algorithm objectives should be the same for each alternative solution.
- Section 5.4: *Sensor Inputs*, labeled “Section 5.4” in DG-7.1.A. This section describes the attributes of the sensing system(s) used to supply data for the algorithm. These

are usually obtained from a Sensor Specification, which should be referred to. Often, there has been a formal presentation of sensor attributes made by the sensor development team. In that case, it may be possible to use slides from that presentation. The sensor description in this section should be at a relatively high level, but should at least provide the spatial and spectral attributes and the estimates for sensor errors.

- Section 5.5: *Ancillary Inputs*, labeled “Section 5.5” in DG-7.1.A. This section describes the attributes of all input data used by the algorithm for each alternative solution presented in Section 5.2, including ancillary data, forward models and look-up tables.
- Section 5.6: *Retrieval Strategy*, labeled “Section 5.6” in DG-7.1.A. This section describes the fundamental approach for retrieval for each alternative solution presented in Section 5.2, at a level of detail sufficient for reviewers to determine that the algorithm theoretical description in the ATBD is adequate
- Section 5.7: *Processing Outline*, labeled “Section 5.7” in DG-7.1.A. This section describes the processing outline of the retrieval algorithm for each alternative solution presented in Section 5.2. The processing outline should be at the same level of detail as the preliminary design software architecture (c.f. Section 4.9 of this DG). A process flow chart is recommended.
- Section 5.8: *Physical Description*, labeled “Section 5.8” in DG-7.1.A. This section describes the physics and associated phenomenology key to the retrieval for each alternative solution presented in Section 5.2. Note whether any part of the physical description is not based on proven algorithm heritage – in that case, evaluate the risk of new algorithm physics.
- Section 5.9: *Mathematical Description*, labeled “Section 5.9” in DG-7.1.A. This section describes the mathematics used by the retrieval for each alternative solution presented in Section 5.2, including all simplifications, approximations, and numerical methods.
- Section 5.10: *Algorithm Output*, labeled “Section 5.10” in DG-7.1.A. This section describes the algorithm output, mapping output characteristics to product requirements. The algorithm output should be the same for each alternative solution.

- Section 5.11: *Performance Estimates*, labeled “Section 5.11” in DG-7.1.A. This section describes, to the extent possible at the PDR stage of development, the predicted algorithm performance and quality of the products derived from analysis and tests with simulated and/or proxy test data. Note verification methods and assumptions, referring to the Quality Assurance section of this presentation (Section 7) and the Verification and Validation Plan (VVP). Extensive use of figures and tables from the ATBD is recommended to provide a comprehensive comparison of the alternative solutions and to identify performance risks. You may separate the alternative solutions, if there is enough difference in methods, test data, and results. Alternatively, you can compare and contrast the alternative solutions in a common presentation (e.g. a unified scatter plot of results with different colors for the data points of each solution).
- Section 5.12: *Practical Considerations*, labeled “Section 5.12” in DG-7.1.A. This section describes how the algorithm is numerically implemented for each alternative solution, including any possible issues with computationally intensive operations (e.g., large matrix inversions), and describes any important programming and procedural aspects related to implementing the numerical model into operating code for each alternative solution.

4.9. Section 6 – Software Architecture

The PDD shall include a Software Architecture Section. Most of the content for this section should be obtained directly from SWA v2r0. This section shall include:

- A setup slide, labeled “Section 6 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 6 highlighted, as shown.
- A Section Title slide, labeled “Slide 6.0” in DG-7.1.A.
- Section 6.1: *Software Architecture Overview*, labeled “Section 6.1” in DG-7.1.A. This section explains the software architecture concept and function. It is recommended that the “Section 6.1” slides in DG-7.1.A be used as is.
- Section 6.2: *Software Architecture Layers*, labeled “Section 6.2” in DG-7.1.A. This section explains the concept of layers of software architecture, focusing on the preliminary design layers (the Context-Layer and the System-Layer). Use the “Section 6.2” template slides of DG-7.1.A, without revision.

- The structure of software architecture composition is shown as a diagram (“Section 6.2 – Figure 1” of DG-7.1.A). In this diagram, the higher two levels are highlighted. These are the levels described in the preliminary design, as indicated in “Section 6.2 – Figure 1” of DG-7.1.A.
 - Define the interfaces between the software system and external sources and sinks, known as the “Context-Layer” architecture.
 - State the criteria for the design of interfaces, using multiple slides as necessary for clarity. Note and explain any deviations from the STAR standard criteria.
- Section 6.3: *Software Architecture Documentation*, labeled “Section 6.3” in DG-7.1.A, notes the number of alternative solutions under consideration at PDR and points to the Software Architecture Document (SWA), where the software architecture for each of these solutions is documented.
 - Section 6.4: *Solution 1 – PDR Software Architecture*, labeled “Section 6.4” in DG-7.1.A.
 - For the first alternative solution presented in Section 5.2 (Alternative Solution # 1), show all external inputs and outputs to and from the software system, including a context diagram, (“Section 6.4 – Figure 1” of DG-7.1.A shows an example), and a discussion of each interface item at a level of detail that is warranted for that item. Include a table if that adds clarity (“Section 6.4 – Table 1” of DG-7.1.A shows an example). Demonstrate that each interface meets the acceptance criteria. Follow the instructions in Section 6.4 of DG-7.1.A.
 - For Alternative Solution # 1, show the first level of decomposition to the System-Layer. Include a System-Layer data flow diagram (“Section 6.4 – Figure 2” of DG-7.1.A shows an example). Show the System-Layer data flows as a table if that adds clarity (“Section 6.4 – Table 2” of DG-7.1.A shows an example).
 - Section 6.5: *Solution 2 – PDR Software Architecture*, labeled “Section 6.5” in DG-7.1.A.
 - Present the PDR software architecture for Alternative Solution # 2, in the same way that it was presented for Alternative Solution # 1 (Section 6.4).

- Repeat for each additional alternative solution that was presented in Section 5.2.

4.10. Section 7 – Quality Assurance

The PDD shall include a Quality Assurance Section. Most of the material in this section should be adopted from the PRD, with updates to address any changes since PRR. This section shall include:

- A setup slide, labeled “Section 7 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 7 highlighted, as shown.
- A Section Title slide, labeled “Slide 7.0” in DG-7.1.A.
- Section 7.1: *Quality Assurance*, labeled “Section 7.1” in DG-7.1.A. This section introduces the concepts of process QA and product QA.
- Section 7.2: *Configuration Management*, labeled “Section 7.2” in DG-7.1.A. This section describes the Configuration Management/Data Management (CM/DM) status of the project.
 - Identify the CM/DM stakeholders for the project and verify their commitment to the plan for CM of requirements and requirements documentation. CM/DM personnel assigned to the project should be identified in the DPP.
 - Describe the CM tools that are in use for the project. This information should be in the project DPP.
 - Explain the purpose and contents of the Project Baseline Report (PBR) and provide a pointer to PBR v2r2.
- Section 7.3: *Verification and Validation Overview*, labeled “Section 7.3” in DG-7.1.A. Use the Section 7.3 slide templates of DG-7.1.A without revision.
 - Explain the concepts of verification and validation.
 - Introduce the project’s Verification and Validation Plan (VVP) and provide a pointer to VVP v1r1.
- Section 7.4: *Verification Plan*, labeled “Section 7.4” in DG-7.1.A. Follow the instructions in Section 7.4 of DG-7.1.A.

- Identify the work products to be verified and the requirements to be satisfied by each work product selected for verification. The requirements to be satisfied for selected work products are derived requirements that should be consistently documented in the VVP and the RAD.
- Describe the verification methods that will be used. The verification methods should be described in as much detail as possible and a rationale for their selection should be provided. Use figures, graphs, examples as warranted. Use multiple slides as necessary for clarity and completeness. Note which verification items will be verified with each method or combination of methods. If feasible, show a matrix obtained from the VVP.
- Discuss the inclusion of verification activities in the project plan (slide 100). These should be documented in the DPP.
 - Show the project plan with verification tasks highlighted.
 - Extract (as bullets) the verification task name, start date, end date, predecessor tasks, and successor tasks from the project plan
 - Note any adjustments in the DPP (usually, schedule and resources) that are needed to accommodate the updated verification plan. Most important: note any risk to milestone dates and impact on successor milestones.
 - This material should have been presented at the PRR. Adopt the PRD slides and update them to capture changes to the verification plan.
- Section 7.5: *Validation Plan*, labeled “Section 7.5” in DG-7.1.A. Follow the instructions in Section 7.5 of DG-7.1.A.
 - Describe the plan for the validation of products. Identify user-driven requirements on the product or products to be validated. These are typically found in the project’s basic requirements, should be documented in the RAD, and should have been discussed in Section 4 of this presentation. For each product component, describe the scope of the validation (e.g., product quality attributes, validation environments, validation campaigns). Distinguish between pre-launch and post-launch plans.
 - Describe the plan for the validation of operator needs. Identify operator needs (operations and maintenance, or O&M) to be validated. The product or product component must be maintainable and supportable in its intended operational environment. Operator needs are typically found in the project’s derived requirements, should be documented in the RAD, and should have been discussed in Section 4 of this presentation. Most operator needs will be

generic. Note which needs are specific to the project. Identify the tools and training available for O&M (e.g. Operations Manual, System Maintenance Manual, and Task Guidelines). For each operator need, describe the scope of the validation. Usually, this will consist of simulations in the operational environment by the intended O&M personnel with the actual O&M tools and training in place.

- Describe the plan for the validation of user needs. Identify user needs (training, support, use of products) to be validated. These are typically found in the project's derived requirements, should be documented in the RAD, and should have been discussed in Section 4 of this presentation. Many user needs will be generic. Note which needs are specific to the project. Identify the tools, training, and support services available to the user (e.g. Users Manual) and the procedure for delivering these to the intended users. For each user need, describe the scope of the validation. Usually, this will consist of simulations in a user environment by the intended users and/or beta testers with the actual User tools and training in place.

4.11. Section 8 – Requirements Allocation

The PDD shall include a Requirements Allocation Section. This section shall include:

- A setup slide, labeled “Section 8 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 8 highlighted, as shown.
- A Section Title slide, labeled “Slide 8.0” in DG-7.1.A.
- Section 8.1: *Requirements Allocation Overview*, labeled “Section 8.1” in DG-7.1.A.
 - Explain how the requirements allocation is developed during the Design phase of the STAR EPL process. It is recommended that the presenter use the graphic depiction of the iterative (spiral) development of requirements and requirements allocation as shown in “Section 8.1 – Figure 1” in DG-7.1.A. Note the similarity to “Section 4.1 – Figure 2” in DG-7.1.A. The essence of “Section 8.1 – Figure 1” is that the development of Solutions, Design, Requirements, and Requirements Allocation occurs iteratively in a closed loop with continual feedback between the four. The placement of the four components of design development is meant to show that Requirements (Section 4) drive the Solutions and Design (Sections 5 – 7), which in turn develop the Requirements Allocation (Section 8). The connection between

Requirements Allocation and Requirements is caused by the need to maintain consistency between the two components.

- Section 8.2: *Requirements Allocation Changes*, labeled “Section 8.2” in DG-7.1.A.
 - List the requirements allocation changes since PRR. List and describe each change, following the instructions in Section 8.2 of DG-7.1.A.

4.12. Section 9 – Risks and Actions

The PDD shall include a Risks and Actions Section. This section shall include:

- A setup slide, labeled “Section 9 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 9 highlighted, as shown.
- A Section Title slide, labeled “Slide 9.0” in DG-7.1.A.
- Section 9.1: *PRR Risks and Actions*, labeled “Section 9.1” in DG-7.1.A.
 - A section introduction slide should note the number of risks that were identified at the PRR and that were identified after the PRR, as shown in Section 9.1 of DG-7.1.A.
 - Report the status of the first risk identified at the PRR, as shown in Section 9.1 of DG-7.1.A. Use as many slides as necessary for a clear presentation of the status of each risk.
 - Report the status of each completed action that is associated with the risk, as shown in Section 9.1 of DG-7.1.A.
 - Report the status of each open action that is associated with the risk, as shown in Section 9.1 of DG-7.1.A.
 - Repeat for each additional risk, as shown in Section 9.1 of DG-7.1.A.
- Section 9.2: *New Risks and Actions*, labeled “Section 9.2” in DG-7.1.A.
 - Report the status of each risk that has been identified since the PRR, as shown in Section 9.2 of DG-7.1.A. Use as many slides as necessary for a clear presentation of the status of each risk.
 - Report the status of each completed action that is associated with the risk, as shown in Section 9.2 of DG-7.1.A.

- Report the status of each open action that is associated with the risk, as shown in Section 9.2 of DG-7.1.A.
- Repeat for each additional risk, as shown in Section 9.1 of DG-7.1.A.
- Section 9.3: *Risk Summary*, labeled “Section 9.3” in DG-7.1.A.
 - Present a bulleted list of the risk statements for the risks that can be closed. Risks can be closed when all associated actions are closed or withdrawn. For each risk, list the associated actions that can be closed or withdrawn. Each of these should have been presented in Sections 9.1 or 9.2 as a completed or withdrawn action. Use multiple slides as necessary for clarity.
 - Present a bulleted list of the risk statements for the risks that are still open. For each risk, list the actions that must be closed to reduce the risk to an acceptable level, with closure plans and estimated closure dates.

4.13. Section 10 – Summary and Conclusions

The PDD shall include a Summary and Conclusions Section. This section shall include:

- A setup slide, labeled “Section 10 Setup Slide” in DG-7.1.A. This slide is a bulleted list of all 10 sections, with Section 10 highlighted, as shown.
- A Section Title slide, labeled “Slide 10.0” in DG-7.1.A.
- Section 10.1: *Review Objectives Status*, labeled “Section 10.1” in DG-7.1.A. This section explains how each review objective has been addressed. Follow the instructions in Section 10.1 of DG-7.1.A.
- Section 10.2: *Issues, Actions and Risks*, labeled “Section 10.2” in DG-7.1.A. List important issues, actions and risks that require attention. Use multiple slides as necessary for clarity. Use a major bullet for each item, with sub-bullets to note conclusions for that item.
- Section 10.3: *Next Step – Detailed Design*, labeled “Section 10.3” in DG-7.1.A. List recommendations for the next step after the PDR. Follow the instructions in Section 10.3 of DG-7.1.A.

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- Section 10.4: *Open Discussion*, labeled “Section 10.4” in DG-7.1.A. Announce that the review is open for free discussion. Note: If you have prepared and conducted the review in accordance with standards and if the reviewers have prepared for the review in accordance with standards, there should be no need for additional discussion.

NOAA NESDIS STAR

DOCUMENT GUIDELINE

DG-7.1

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APPENDIX A – TEMPLATE FILE

The slide templates that are referenced in this DG are available in the Microsoft PowerPoint file “STAR_DG-7.1.A_PDD_v3r0.ppt”. This file will be available to authorized users in the STAR EPL PAR.

END OF DOCUMENT