NOAA NESDIS
CENTER for SATELLITE APPLICATIONS and RESEARCH

DOCUMENT GUIDELINE

DG-6.2
REQUIREMENTS ALLOCATION DOCUMENT GUIDELINE

Version 3.0

NOAA NESDIS STAR

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TITLE: DG-6.2: REQUIREMENTS ALLOCATION DOCUMENT GUIDELINE VERSION 3.0

AUTHORS:

Ken Jensen (Raytheon Information Solutions)

REQUIREMENTS ALLOCATION DOCUMENT GUIDELINE
VERSION HISTORY SUMMARY

Version	Description	Revised Sections	Date
1.0	**No version 1.0**		
2.0	New Document Guideline (DG-9.5) adapted from CMMI guidelines by Ken Jensen (Raytheon Information Solutions)	New Document	10/12/2007
3.0	Renamed DG-6.2 and revised by Ken Jensen (RIS) for version 3		

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LIST OF ACRONYMS

CDR	Critical Design Review
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
CMMI	Capability Maturity Model Integration
CREST	Cooperative Remote Sensing and Technology Center
DG	Document Guideline
DPP	Development Project Plan
EPL	Enterprise Product Lifecycle
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
OCD	Operations Concept Document
PAR	Process Asset Repository
PDR	Preliminary Design Review
PG	Process Guideline
PRG	Peer Review Guideline
PRR	Project Requirements Review
QA	Quality Assurance
RAD	Requirements Allocation Document
RAS	Requirements Allocation Sheet
RHTM	Requirements Horizontal Traceability Matrix
RNM	Requirements/Needs Matrix
RVTM	Requirements Vertical Traceability Matrix
SG	Stakeholder Guideline
SPSRB	Satellite Products and Services Review Board
STAR	Center for Satellite Applications and Research
TD	Training Document
VVP	Verification and Validation Plan

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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 Requirements Allocation Document (RAD) is one component of this process.

1.1. Objective

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

1.2. The Requirements Allocation Document

The RAD contains the basic and derived requirements for the work products and the allocation of the requirements to system components and product components.

Three versions of the RAD are produced during the Design phase of the STAR Enterprise Product Lifecycle (EPL)[1]

RAD v1r0, produced for the Project Requirements Review (PRR)[2], should establish the project requirements, provide a requirements analysis sufficient to allow for comprehensive review and approval of the requirements, and provide a preliminary allocation of requirements to system and product components.

RAD v1r1 is a planned revision for the Preliminary Design Review (PDR). It adds to v1r0 by updating the allocation of requirements to system and product components, based on the maturing of solutions and design since PRR.

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[1] For a description of the STAR EPL, refer to the STAR EPL Process Guidelines (PG-1 and PG-1.A).

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

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RAD v1r2 is a planned revision for the Critical Design Review (CDR). It adds to v1r1 by updating the allocation of requirements to system and product components, based on the maturing of solutions and design since PDR.

Additional RAD revisions may be made during the Build phase of the EPL, primarily to document changes to requirements and requirements allocation that may occur as the result of code development and testing.

A separate RAD is produced for each distinct project in the STAR Enterprise.

The intended target audiences are customers, product users, requirements reviewers, design reviewers and project managers. Typically, the RAD is prepared by the project's development team, under the direction of the Development Lead and in consultation with quality assurance (QA) personnel and the primary customers and users.

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

1.3. Background

This DG defines guidelines for producing a RAD. This DG has been adapted from Capability Maturity Model Integration (CMMI) guidelines (CMMI-DEV-v1.2, 2006). It has been tailored to fit the STAR EPL process.

1.4. Benefits

A RAD developed in accordance with the standards in this DG assists the development team to provide necessary QA of the products and product components. It is therefore a requirement that a RAD be developed in accordance with the guidelines in this document. The RAD will be reviewed at the PRR, PDR and CDR to determine whether a project proceeds to the next step of the STAR EPL.

1.5. Overview

This DG contains the following sections:

Section 1.0 - Introduction
Section 2.0 - References
Section 3.0 - Standard Table of Contents
Section 4.0 - Section Guidelines

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Appendix A -   Examples
Appendix B -   Templates

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2. REFERENCE DOCUMENTS

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-6: Project Requirements Review Guidelines are the guidelines for the PRR. It is useful for the developer of RAD v1.0 to understand what the reviewers will expect when reviewing the RAD.

CL-6: Project Requirements Review Check List is the check list for the PRR. It is useful for the developer of RAD v1.0 to understand the specific Check List Items (CLI) that the reviewers of the RAD will be required to approve.

PRG-7: Preliminary Design Review Guidelines are the guidelines for the PDR. It is useful for the developer of RAD v1.1 to understand what the reviewers will expect when reviewing the RAD.

CL-7: Preliminary Design Review Check List is the check list for the PDR. It is useful for the developer of RAD v1.1 to understand the specific CLI that the reviewers of the RAD will be required to approve.

PRG-8.1: Critical Design Review Guidelines are the guidelines for the CDR. It is useful for the developer of RAD v1.2 to understand what the reviewers will expect when reviewing the RAD.

CL-8.1: Critical Design Review Check List is the check list for the CDR. It is useful for the developer of RAD v1.2 to understand the specific CLI that the reviewers of the RAD will be required to approve.

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DG-0.1: STAR Document Style Guideline is a STAR EPL Document Guideline (DG) that provides STAR standards for the style and appearance of STAR documents developed as Microsoft Word files

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

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

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

TG-6: STAR EPL Project Requirements Task Guidelines provides a description of standard tasks for process step 6, during which RAD v1.0 is developed.

TG-7: STAR EPL Preliminary Design Task Guidelines provides a description of standard tasks for process step 7, during which RAD v1.1 is developed.

TG-8: STAR EPL Detailed Design Task Guidelines provides a description of standard tasks for process step 8, during which RAD v1.2 is developed.

TD-9: Project Requirements is a STAR EPL Training Document (TD) that provides a description of recommended procedures for requirements identification, analysis, allocation, quality assurance, documentation and management.

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  2.2   Stakeholders

  2.3   Requirements

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    2.3.2   Basic Requirement 2.0

    ………………………………….

    2.3.N   Basic Requirement N.0

3.0   REQUIREMENTS ANALYSIS

  3.1   Basic Requirement 1.0

    3.1.1   Derived Requirement 1.1

    3.1.2   Derived Requirement 1.2

    …………………………………….

    3.1.M   Derived Requirement 1.M

  3.2   Basic Requirement 2.0

    3.2.1   Derived Requirement 2.1

    3.2.2   Derived Requirement 2.2

    ………………………………….

    3.1.M   Derived Requirement 2.M

    ………………………………..

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3.N   Basic Requirement N.0

     3.N.1 Derived Requirement 3.1

     3.N.2 Derived Requirement 3.2

     ………………………………….

     3.N.M Derived Requirement 3.M

4.0   REQUIREMENTS ALLOCATION

4.1   Basic Requirement 1.0

     4.1.1 Derived Requirement 1.1

     4.1.2 Derived Requirement 1.2

     ………………………………….

     3.1.M Derived Requirement 1.M

4.2   Basic Requirement 2.0

     4.2.1 Derived Requirement 2.1

     4.2.2 Derived Requirement 2.2

     ………………………………….

     3.1.M Derived Requirement 2.M

………………………………….

4.N   Basic Requirement N.0

     4.N.1 Derived Requirement 3.1

     4.N.2 Derived Requirement 3.2

     ………………………………….

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5.0   REQUIREMENTS QUALITY ASSURANCE

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4. SECTION GUIDELINES

This section contains the STAR guidelines for each section of the RAD.

The RAD should follow the STAR standard for style and appearance, as stated in DG-0.1.

4.1. Table of Contents

The Table of Contents can be inserted by using Word's Insert → Reference → Index and Tables → Table of Contents function or by pasting the Table of Contents from this DG into your document and updating it for the section headers you make for your document. Use a page break if necessary to ensure that the Table of Contents appears at the top of a page.

4.2. List of Figures

A List of Figures should be provided after the Table of Contents. A page break should be used if necessary to ensure that the List of Figures appears at the top of a page. To create a List of Figures, use Word's Insert → Reference → Index and Tables → Table of Figures function, selecting the "Table of Figures" Style. Alternatively, the List of Figures can be created by pasting the List of Figures for this DG into your document.

Figures should be created by using Word's Insert → Picture → From File function or Word's Insert → Object function. Figures should be numbered X.Y, where X is the main section number where the figure resides and Y = 1,N is the ordered number of the figure in the section. Figure captions should have Arial bold 12 point font, should be center justified, and should have a "Table of Figures" Style. A Figure Caption template is provided in Appendix B of this DG.

4.3. List of Tables

A List of Tables should be provided after the List of Figures. The List of Tables can appear on the same page as the List of Figures, with three blank lines separating them, provided both lists can fit on the same page. If both lists cannot fit on the same page, a page break should be used to ensure that the List of Tables appears at the top of a page.

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To create a List of Tables, use Word's Insert → Reference → Index and Tables → Table of Figures function, selecting the "Table - Header" Style. Alternatively, the List of Tables can be created by pasting the List of Tables for this DG into your document.

Tables should be created with the Table → Insert → Table function. Tables should be numbered X.Y, where X is the main section number where the table resides and Y = 1,N is the ordered number of the table in the section. Table titles should have Arial bold 12 point font, should be center justified, and should have a "Table - Header" Style. A Table Title template is provided in Appendix B of this DG. Table text should have Arial regular 10 point font.

4.4. List of Acronyms

The use of acronyms is encouraged. A two word or longer name for an item (e.g., Development Project Plan) should be given an acronym (e.g., DPP) if the name is used more than once in the document. A List of Acronyms should be provided after the List of Tables. The List of Acronyms should be in alphanumeric order. Use the List of Acronyms in this DG as a template. A page break should be used if necessary to ensure that the List of Acronyms appears at the top of a page.

4.5. Section 1 – Introduction

The RAD shall include an Introduction Section. This section shall include

- A well-defined purpose and function for the document
- Specific intended user(s)
- How the intended user(s) should use the document
- A responsible entity for generating the document
- A responsible entity for review/approval of the document
- A responsible entity for storage, accessibility, and dissemination
- A brief overview of the contents of each main section

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4.6. Section 2 – Requirements Identification

Requirements Identification is a process of turning the operations concept into a specific set of requirements on the product processing system. Subsections should include Requirements Identification Overview, Stakeholders, and Requirements.

- The subsection for Requirements Identification Overview should provide an overview of the process used by the development team for identifying and characterizing the project's basic and derived requirements. Follow the guidelines in STAR EPL Training Document TD-9 (Requirements Development).

- The subsection for Stakeholders should identify all stakeholders in the requirements identification process and document their involvement in the process.

- The subsection for Requirements should list and describe each basic requirement and its derived requirements.
    - Requirements should be numbered with the STAR EPL standard numbering convention. The basic requirements should be numbered 1.0, 2.0, etc. The derived requirements that flow from basic requirements 1.0 should be numbered 1.1, 1.2, etc. If the number of basic requirements is smaller than 10, use a separate subsection for each basic requirement and main bullets for each of its derived requirements. If the number of basic requirements is 10 or greater, use a common subsection for all requirements with main bullets for each basic requirement and sub-bullets for each derived requirement.
    - For each basic requirement:
        - Note whether it is a product requirement or a system requirement. Product requirements include requirements on product content, performance, operational production (e.g. timeliness), and end use. System requirements include system component characteristics (e.g. security, portability), interfaces and dependencies (e.g. code, test data, production environments and platforms). The RAD should identify each of these types of requirements or explain why a given type of requirement is not applicable.
        - Note whether it is an operational requirement or a functional requirement. Operational requirements state "under what conditions" a function must be available or performable and address how the product will serve the users. Functional requirements address what the

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product must do to satisfy the operational requirements and define the necessary tasks, actions, or activities that must be accomplished.

- Explain the requirement driver, typically a customer/user need or expectation, as documented in the project's Operations Concept Document (OCD).

- Document the agreement of stakeholders, particularly the customers and users.

- List each derived requirement. For each derived requirement:

  - Note whether it is a product requirement or a system requirement

  - Note whether it is an operational requirement or a functional requirement.

  - Document the agreement of stakeholders, particularly the customers and users.

  - Provide a brief descriptive analysis of the requirement. This analysis should serve the purpose of raising any interpretation issues and any risks. For those requirements that need a more extensive analysis, refer to reader to Section 3.

o Summarize the requirements identification in a Requirements/Needs Matrix (RNM). The RNM links each basic requirement identified in this subsection to a specific customer/user need or expectation documented in the OCD. The RNM can be created as a table or imported from a Microsoft Excel spreadsheet to a Microsoft Word Object. TD-9 explains how to create a RNM.

4.7. Section 3 – Requirements Analysis

For those requirements that need a more extensive analysis than was provided in Section 2, provide the needed analysis. Requirements analysis provides the basis for the approval, allocation and validation of requirements. There should be a separate subsection for each basic requirement. In each subsection, do the following for the basic requirement and relevant derived requirements:

- Note any relevant analysis that was performed prior to the Design phase, primarily with respect to NESDIS mission and strategic plan. This should be reflected in the Development Project Plan (DPP) and Gate 3 Review report.

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- Provide a technical analysis. The customer requirements may be expressed in the customer's terms and may be non-technical descriptions. The product requirements are the expression of these requirements in technical terms that can be used for design decisions. TD-9 explains how to perform a technical analysis of customer requirements.

- Provide a functional analysis. Functional analysis is the description of what a product processing system is intended to do. The purpose is to identify, describe, and relate the functions a system (or subsystem) must perform in order to fulfill its goals and objectives. The definition of functionality can include actions, sequence, inputs, outputs, or other information that communicates the manner in which a product will be produced and used. TD-9 explains how to perform a functional analysis of requirements.

- Provide a quantitative analysis of performance requirements. Performance requirements must be specific and quantitative. Analysis should strike a balance between customer needs and expectations, whether quantitative or qualitative, and anticipated constraints. Consider cost, schedule and technical constraints. Consider the importance of the product performance to the NESDIS strategic and mission goals. Quantitative analysis of performance requirements may require testing of the performance of solutions, and therefore may need to be extended into the Build phase (steps 9-11) of the STAR EPL. In that case, the versions of the RAD developed during the Design phase (RAD v1r0, v1r1, and v1r2) should explicitly state that the quantitative analysis of the performance requirements is provisional. This provisional status should be noted as a project risk. Refer to TD-9 for additional discussion of quantitative analysis of performance requirements.

- Note potential effects of the requirements on the project plan.
  Identify and evaluate risks associated with the requirement. The STAR EPL risk management process is based on quantitative risk assessment. The Probability of a risk occurring is rated on a scale of 0 (0% probability) to 10 (100% probability). The Severity of a risk occurring is rated on a scale of 1 to 10. The product of Probability and Severity produces a Risk Score on a scale of 0 – 100. Risks are categorized by applying thresholds to the Risk Score. The standard thresholds are:

    o Risk Score = 0 (NONE)

    o Risk Score = 1 – 19 (LOW)

    o Risk Score = 20 – 39 (MEDIUM)

    o Risk Score = 40 – 100 (HIGH)

Each revision of the RAD should update the status of risks that were documented in the previous RAD version.

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4.8. Section 4 – Requirements Allocation

Describe the allocation of requirements to system and product components. Requirements allocation includes the allocation of requirements to functions, the allocation of functions to operational modes, and the allocation of requirements and functions to system architecture items (including configuration items). There should be a separate subsection for each basic requirement. In each subsection, do the following for each basic requirement and its derived requirements:

- List each system or product component that is designed to satisfy the requirement.

- If the component is designed to fully satisfy the requirement, explain how this will be done.

- If the component is designed to partially satisfy the requirement, explain how the set of allocated components working together will fully satisfy the requirement.

- Summarize the requirements allocations in a Requirements Allocation Sheet (RAS). The RAS can be created as a table or imported from a Microsoft Excel spreadsheet to a Microsoft Word Object. TD-9 explains how to create a RAS.

4.9. Section 5 – Requirements Quality Assurance

Describe the tools, methods and activities planned for providing QA of the requirements. There should be subsections for Requirements Traceability, Requirements Tracking, and Requirements Validation.

- The subsection for Requirements Traceability should describe the plan for establishing and maintaining the relationships between requirements. TD-9 provides guidelines for tracing requirements.

    o Requirements Traceability includes vertical traceability from the basic requirement to its lower level derived requirements and from the lower level requirements back to their source. Most of this should be established for PRR and documented in RAD v1r0. Provide a Requirements Vertical Traceability Matrix (RVTM) that summarizes the two-way vertical traceability from each basic requirement to its derived requirements. TD-9 explains how to create a RVTM.

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o Requirements Traceability includes traceability from a requirement to its allocation of functions, objects, people, processes, and work products. Some of this may be established for PRR and documented in RAD v1r0, but it is expected that RAD v1r1 and v1r2 will provide substantial upgrades as the design matures for PDR and CDR.

o Requirements Traceability includes horizontal traceability from function to function and across interfaces of the functional architecture. Most of this should be established for CDR and documented in RAD v1r2. Provide a Requirements Horizontal Traceability Matrix (RHTM) that summarizes the traceability from function to function and across interfaces. TD-9 explains how to create a RHTM.

• The subsection for Requirements Tracking should describe the plan for monitoring the status of the requirements and their allocation to ensure that the integrity of the requirements allocation is preserved as the solutions, design and implementation matures through the Design and Build phases of the STAR EPL. Identify project stakeholders who will play a role in requirements tracking and how they will do this. Demonstrate that the requirements tracking plan follows STAR standards for requirements tracking. TD-9 provides guidelines for tracking requirements. RAD v1r1 and v1r2 should include a report on the status of requirements tracking.

• The subsection for Requirements Validation should describe the plan for validating the requirements. Requirements validation is concerned with ensuring that the requirements and requirements allocation provide a satisfactory balance between customer/user needs and expectations, NESDIS mission goals, technical feasibility, the available resources and external constraints. It is addressed in the project's Verification and Validation Plan (VVP). The RAD developer should consult with the VVP developer, and should include relevant material from the VVP in this subsection. At PRR (RAD v1r0 and VVP v1r0), validation of requirements should be mature. At PDR (RAD v1r1 and VVP v1r1), requirements allocation has typically been substantially upgraded by the preliminary design. At CDR (RAD v1r2 and VVP v1r2), requirements allocation has typically been upgraded by the detailed design. Demonstrate that the requirements validation plan follows STAR standards for requirements validation.

4.10. Section 6 – List of References

This section should consist of a List of References that includes all references cited in the document. Include all references deemed useful by the Product Team. References should be listed in alphabetical order. References that begin with an author list should begin with the last name of the lead author. A template is provided in Appendix B.

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APPENDIX A - EXAMPLES

An example of a RAD that follows the STAR standards and guidelines will be developed and placed in the STAR EPL PAR.

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APPENDIX B - TEMPLATES

This appendix contains templates for specific pages and sections of the RAD.

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B.1   Cover Page Template:

In this template, <X> = 1.0 for version 1, <X> = 1.1 for version 1 revision 1, <X> = 2.0 for version 2 etc. <Project Name> should be the actual approved name of the Project.
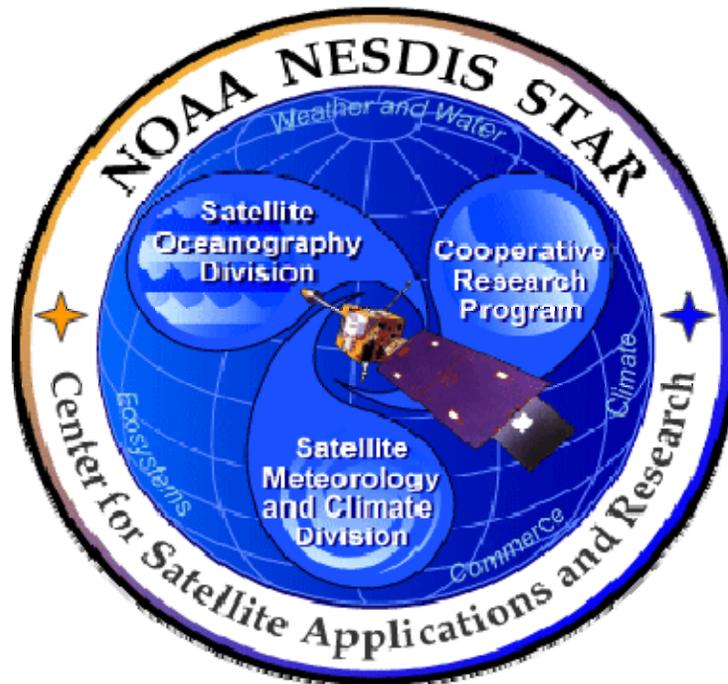
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<PROJECT NAME>
REQUIREMENTS ALLOCATION DOCUMENT
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B.2   Document Header Template:

In this template, <X> = 1.0 for version 1, <X> = 1.1 for version 1 revision 1, <X> = 2.0 for version 2 etc.

In this template, <Project Name> should be the actual approved name of the Project.

In this template, <Y> = the actual page number.

In this template, <Z> = the actual total number of pages

NOAA/NESDIS/STAR

REQUIREMENTS ALLOCATION DOCUMENT
Version: <X>
Date: <Date of Latest Signature Approval>

<Project Name>
Requirements Allocation Document

Page <Y> of <Z>

B.3   Document Cover Page Footer Template:

Hardcopy Uncontrolled

B.4   Document Footer Template:

Hardcopy Uncontrolled

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B.5 Approval Page Template:

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TITLE: <PROJECT NAME> REQUIREMENTS ALLOCATION DOCUMENT VERSION <X>

AUTHORS:

<Lead Author>

<Co-Author 1>

<Co-Author 2>

<etc.>

APPROVAL SIGNATURES:

                                                <u><Actual Signature Date></u>

    <Name of Project Development Lead>   Date

    Project Development Lead

                                                  <u><Actual Signature Date></u>

    <Name of Project Manager>   Date

    Project Manager

                                                  <u><Actual Signature Date></u>

    <Name of Agency Approver>   Date

    Agency

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B.6 Version History Page Template:

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<PROJECT NAME>
REQUIREMENTS ALLOCATION DOCUMENT
VERSION HISTORY SUMMARY

Version	Description	Revised Sections	Date
1.0	Created by <Name of Developer(s)> of <Name of Developers' Agency/Company> for Project Requirements Review.	New Document	<Actual date of Latest approval signature>
1.1	Revised by <Name of Developer(s)> of <Name of Developers' Agency/Company> for Preliminary Design Review	<applicable sections>	<Actual date of Latest approval signature>
1.2	Revised by <Name of Developer(s)> of <Name of Developers' Agency/Company> for Critical Design Review	<applicable sections>	<Actual date of Latest approval signature>
2.0	Revised by <Name of Developer(s)> of <Name of Developers' Agency/Company> for System Readiness Review	<applicable sections>	<Actual date of Latest approval signature>
2.1	[As needed] Revised by <Name of Developer(s)> of <Name of Developers' Agency/Company> to describe changes during operations	<applicable sections>	<Actual date of Latest approval signature>
2.2	Ditto	Ditto	Ditto
etc.			

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B.7   Figure Caption Template:

Figure 2.3 - <Figure caption in Arial regular 12 point font>

B.8   Table Title Template:

Table 4.5 - <Table title in Arial regular 12 point font>

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B.9   List of References Template:

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