

LWS-PLAN-0005, Revision C  
Living With A Star Program

# Living With A Star Program Plan



Goddard Space Flight Center  
Greenbelt, Maryland

National Aeronautics and  
Space Administration

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## Living With A Star Program Plan Signature/Approval Page

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## Configuration Management Foreword

This document is a Living With a Star (LWS) program-controlled document. Changes to this document require prior approval of the LWS program configuration control board (CCB) chairperson. Proposed changes are to be submitted to the LWS program Configuration Management Office (CMO), along with supportive material justifying the proposed change.

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## Change History Log

<b>Revision</b>	<b>Effective Date</b>	<b>Description of Changes</b> (Reference the CCR & CCB/ERB Approval Date)
-	11/01/05	Initial Release
A	07/14/09	Update for NPR 7120.5D requirements / LWS-CCR-0019
B	11/19/14	Update LWS program plan to conform to National Aeronautics and Space Administration (NASA) Procedural Requirement (NPR) 7120.5E and other current documentation / LWS-CCR-0022
C	TBD	Updated document to align with Strategic Plan and reflect budget, schedule, and new missions. Updates include all tables/figures and the addition of Appendix C.

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# 1 PROGRAM OVERVIEW

## 1.1 Introduction

Our solar system is governed by the Sun, a main-sequence star midway through its stellar life. The Sun's influence is wielded through gravity, radiation, the solar wind, and magnetic fields as they interact with the masses, fields, and atmospheres of planetary bodies. Through the eyes of multiple spacecraft, we see our solar system as a "heliosphere," a single, interconnected system moving through interstellar space. On Earth, this interaction with our star is experienced through space weather's effects on radio and radar transmissions, electrical power grids, and spacecraft electronics~ through modifications to the ozone layer, and through climate change. The LWS program emphasizes the science necessary to understand those aspects of the Sun and Earth's space environment that affect life and society.

## 1.2 Goals and Objectives

The ultimate goal of LWS program is to provide a scientific understanding of the system that leads to predictive capability of the space environment conditions at Earth, other planetary systems, and in the interplanetary medium. LWS missions have been formulated to answer specific science questions needed to understand the linkages among the interconnected systems that impact us.

The science objectives of NASA's Heliophysics Division (HPD) and the LWS program flow down from Objective 1.1, "understand the Sun, Earth, Solar System, and Universe" in the "2018 NASA Strategic Plan."

The LWS program objectives are as follows:

1. Understand how the Sun varies and what drives solar variability.
2. Understand how earth and planetary systems respond to dynamic external and internal drivers.
3. Understand how and in what ways dynamic space environments affect human and robotic exploration activities.

These objectives are consistent with the most recent National Research Council (NRC) decadal survey, "Solar and Space Physics: A Science for a Technological Society (2013)", the "2014 Science Plan for NASA's Science Mission Directorate," and the "Heliophysics Roadmap (Our Dynamic Space Environment: Heliophysics Science and Technology Roadmap for 2014-2033).

The LWS Program Commitment Agreement (PCA) provides the linkages between LWS program components and the heliophysics research objectives, and they are given in Table 1.

**Table 1. Major and Supporting Contributions to the LWS Program Components**

<b>NASA Strategic Goal 1: Expand human knowledge through new scientific discoveries.</b>			
<b>NASA Strategic Objective 1.1: Understand the Sun, Earth, Solar System, and Universe.</b>			
<b>Applicability of Research Objectives for Heliophysics Science Goal to LWS program Components</b>			
<b>Heliophysics Goals</b>	Explore the physical processes in the space environment from the sun to the earth and throughout the solar system.	Advance our understanding of the connections that link the sun, the earth, planetary space environments, and the outer reaches of our solar system.	Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.
<b>LWS Science Missions</b>			
Solar Dynamics Observatory (SDO)	S	M	S
Solar Orbiter Collaboration (SOC)	S	S	M
Parker Solar Probe (PSP) Science	S	S	M
Space Environment Testbeds (SET) -1		M	

M=Major contribution; S=Supporting contribution

NASA's strategic goal, strategic objective, research objectives, and research focus areas align with the missions identified in Table 1 and provide the basis for NASA's Science Mission Directorate (SMD) determination of the sequence and content of additional missions in the LWS program. These mission priorities and rationales are described in the SMD summary of the 2014 Science Plan for NASA's SMD.

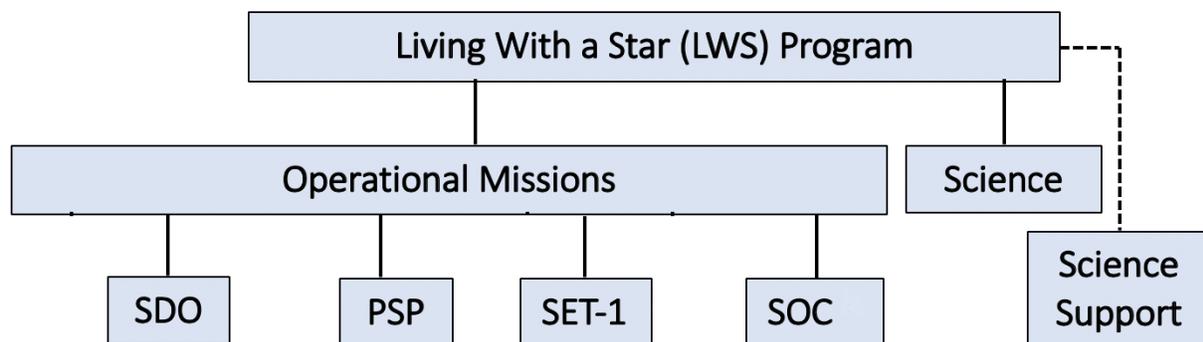
### 1.3 Program Architecture

The LWS program is a loosely coupled program of synergistic missions aimed at meeting the program objectives wherein each mission has unique science capability, which supports supplemental investigations in other LWS missions. The LWS missions are Category 1, 2, or 3 as defined in NASA NPR 7120.5, NASA Program and Project Management. The LWS program uses a systems approach to implement its objectives:

1. By establishing LWS Science, which is a space weather-focused and applications-driven research program, whose goal is to develop the scientific understanding and predictive capability necessary to address effectively those aspects of the connected Sun-Earth-Planet system that affect life and society.
2. LWS Missions will obtain unique observation to develop new scientific understanding of physics, dynamics, and behavior of connected Sun-Earth-Planet systems through a range of conditions occurring during solar cycles.

The LWS program presently contains four missions in operations: Solar Dynamics Observatory (SDO) (2010), Solar Orbiter Collaboration (SOC) (2020), Parker Solar Probe (PSP), previously known as Solar Probe Plus (SPP) (2018), and SET-1 (2019). Operationally SDO and SET-1 are operated by GSFC and the SOC and PSP are operated by Johns Hopkins University/Applied Physics Laboratory. SDO is in extended mission operations.

LWS missions are managed in accordance with NASA Policy Directive (NPD) 7120.4, NASA Engineering and Program/Project Management Policy and the current revision of NPR 7120.5.



**Figure 1. Elements of the LWS Program**

LWS Science addresses two major challenges of the Heliophysics Research community: understanding space weather including improvement of the capability to address problems such as predicting geomagnetic storms, and the sun-climate connection including improved understanding of the impact of solar irradiance variability on the terrestrial atmosphere. To address these challenges, research must couple traditionally separate disciplines in heliophysics, such as solar-heliospheric, geospace physics and climate science, and then it must demonstrate how results would enable an operational capability, such as the generation of forecasts for geomagnetic storms. LWS Science addresses these challenges using three main approaches:

1. It builds infrastructure by funding programs to create a cross-disciplinary and unified Heliophysics science community, including training the next generation of heliophysics experts, conducting a heliophysics graduate-level summer school, developing graduate course content, and supporting a limited number of postdoctoral positions at universities and government laboratories.

2. It addresses scientific needs by funding teams of researchers to tackle those major cross-disciplinary science problems that are most important for improving understanding and prediction, and identifies how this new understanding will have a direct impact on life and society. Teams are assembled from peer-reviewed proposals that individually address pieces of the problem but collectively, as a team, tackle the entire scientific need. Teams may also be formed prior to selection under a single Principal Investigator (PI).
3. It develops strategic capabilities by funding development of large-scale models and tools that can test understanding and serve as prototypes for prediction schemes that are broadly useful to the larger communities in universities, government laboratories, industry, and the military.

LWS Science uses peer-reviewed competitions from NASA Headquarters; its requirements are derived using inputs and reviews from the Heliophysics science community through the LWS Steering Committee.

The LWS program relates to other organizations both inside and outside of NASA through its projects. These may include other NASA offices, government agencies, academic institutions, and industry providers.

The project-specific requirements appendices, i.e., program-level requirements appendices (PLRA) attached to this LWS program plan, defined relationships with external organizations. Each approved PLRA is attached to Appendix B of this document and maintained under Program Office Configuration Management control. Note: See Appendix C for optional PLRA Cover Sheet.

#### **1.4 Stakeholder Definition**

The science community and NASA SMD are the immediate customers of the LWS program. NASA Headquarters HPD provides the program with its operating budget, programmatic guidelines, and identification of the scientific goals and objectives. The Heliophysics science community is the principal user of the data resulting from the selected mission and provides the intellectual advice and rationale for the measurements.

Customers benefitting from the LWS include the following: the Heliophysics science community, NASA mission operations, the national operational space weather community (led by the National Oceanic and Atmospheric Administration and the Department of Defense), other agencies of the US and international governments.

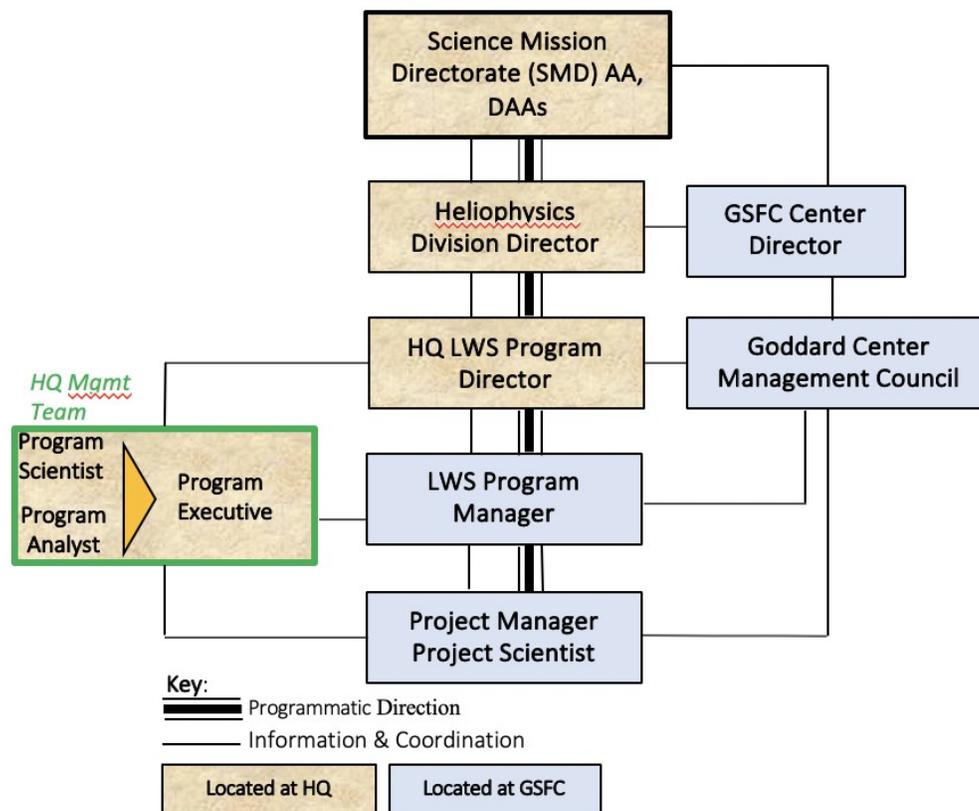
The SMD HPD engages stakeholder communities to ensure advocacy through a variety of venues, such as, the NASA Heliophysics Advisory Committee, the American Geophysical Union, the American Astronomical Society, the American Meteorological Society, the National Academy of Science, and its Space Studies Board, including the Committee for Solar and Space Physics.

#### **1.5 Program Authority, Management Approach, and Governance Structure**

The LWS program is a loosely coupled multi-project program. The LWS program manager resides at GSFC, reporting to the Center Director and, programmatically, through the Heliophysics Division Director (DD) to the Associate Administrator (AA) for the SMD at

Headquarters. The governing Program Management Council (PMC) for the LWS program is the Agency PMC. The Agency PMC is also the approving PMC for Category 1 projects. The SMD AA is the decision authority for Category 2 and 3 projects. The SMD AA is the selecting official for individual projects within the program.

GSFC's Center Management Council (CMC) evaluates cost, schedule, and technical content to ensure that the project is receiving the necessary Center resources to accomplish its tasks, and from a technical authority (TA) viewpoint, to ensure compliance with the PCA, program plan, formulation agreements, project plan, Center procedures and processes, as well as applicable NASA technical standards. The CMC does not make programmatic decisions without the approval of SMD.



**Figure 2. SMD Program Management Accountability**

Figure 2 shows the lines of authority for SMD management accountability of programs and projects as well as lines of programmatic coordination for a mission implemented by Goddard Space Flight Center. In cases where the mission is not being implemented by Goddard, the Project Scientist and Project Manager would be located at the implementing institution.

The SMD AA delegates responsibilities for managing the program and projects under NPR 7120.5 NASA Space Flight Program and Project Management Requirements, and NPR 7123.1, NASA Systems Engineering Processes and Requirements, to the Deputy Heliophysics Division Director, who serves as the program director. The program director acts as the primary interface for the DD with the program and project managers at GSFC or other implementing organizations.

The LWS program has a NASA Headquarters program executive (PE). Each project has a lead NASA Headquarters PE. The PE reports to the program director and serve as the program director's technical arm. The PE maintains insight into all programmatic activities and ensures the program or project is initiated and executed according to approved processes. The PE does not issue formal direction unless specifically delegated this authority from the program director or deputy AA for programs in SMD.

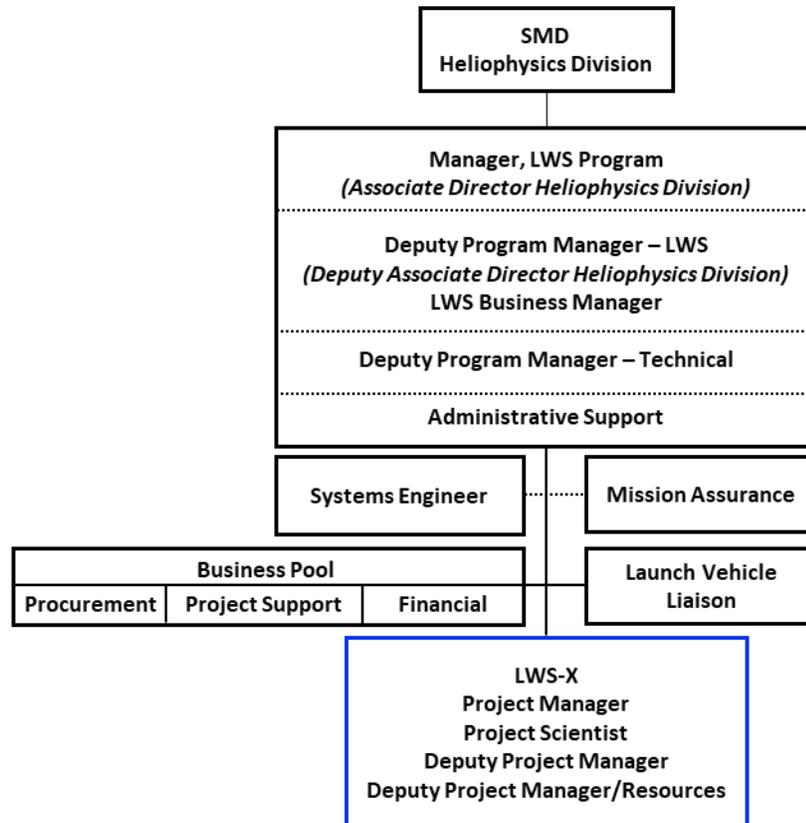
The LWS program has a NASA Headquarters lead program scientist (PS), and a NASA Headquarters PS assigned to each project. The lead PS administers the science segment of the LWS program and, in support of the Heliophysics DD, provides a science interface and integrating function between the Heliophysics science community, the Heliophysics advisory subcommittees, the international science community, and the space weather community.

LWS Science is competed and selected annually through the Research Opportunities in Space and Earth Sciences solicitation process.

For each project, its PS is the senior NASA scientist responsible for all flight project's science content as defined for that SMD science investigation. The PS is SMD's interface with the project scientist or the principal investigator for an announcement of opportunity (AO)-selected mission. The PS monitors science management and NASA Headquarters program execution and ensures the science of the mission remains viable and true to strategic objectives during development of the mission. The PS is the steward of the Level 1 science requirements and maintains regular communications with the PE. Both participate fully in decisions and meetings relevant to mission planning and implementation.

The HPD resource program analyst (PA) maintains each project's new obligation authority (NOA) and budget plan. The PA oversees the annual planning, programming, budgeting, and execution (PPBE) process. The PA serves as the budget expert for the PE and the PS on project budget matters. The PA distributes project funding to appropriate field centers; reviews center obligation and cost plans for the current fiscal year (FY); generates an internal SMD cost phasing plan; and monitors actual costs and obligations.

The SMD PE, PS, and PA management team maintains close contact with program and project personnel to keep abreast of project status. PEs, PSs, and PAs are not in the direct line of authority. The Heliophysics DD, deputy DD, or the SMD AA sign letters of direction to the program. The program office may send letters of direction to the projects.



**Figure 3. LWS Program Organization Chart**

For LWS projects, the project requirements are attached to the LWS program plan as project-specific requirements appendices (Appendix B), referred to as either PLRAs or Level 1 Requirements. For each project, the PE leads the development of a baseline version of the PLRA to the program plan, ensuring all required contents are addressed in clearly stated, unambiguous, and verifiable language. The PE generates PLRA through coordination with the PS, the program manager, the mission manager, mission scientist, project manager, the principal investigator and/or project scientist. The DD places the PLRA under configuration control after the system requirements review but before key decision point (KDP)-B, satisfying the KDP-B requirement from NPR 7120.5 for strategic missions to establish a “baseline.”

The PLRA or Level 1 requirements are approved by the same signatories who approve the LWS program plan, since the PLRA is an extension of that plan. These signatories are the SMD AA, the Center Director, and the program manager. In addition, the Heliophysics DD, PE, PS, project manager, and SMD chief engineer must concur.

The LWS program office at GSFC (Fig. 3) is the prime interface to SMD and has all of the authorities, responsibilities, and accountabilities defined in NPR 7120.5 (Fig. 2-2). It is also the prime interface with the project office. The program office reports to Goddard CMC, the Deputy Heliophysics DD (program director), the SMD PMC, and the Agency PMC, as required.

The LWS program manager is the senior official for the program and, according to NPD 1000.0, NASA Governance and Strategic Management Handbook, reports to the SMD AA for all program-related activity. The SMD AA delegates day-to-day oversight to the Heliophysics DD. Therefore, the program manager reports to the Heliophysics DD. The program manager manages the program office. The program manager implements SMD policy and guidelines via interfacing with the PE, the program director, or deputy AA for programs, on program cost, schedule, and technical scope. The program manager monitors and provides direction and guidance for projects in the LWS program. More than one project manager may report to a program manager depending on the structure of a program. The program office controls its own budget (a separate line item from that of the projects), which, excluding project overruns, is used to fund studies or other activities in support of the program and its projects. The program office does not have direct control of project funds or project reserves, but can make recommendations to SMD for their use.

The LWS program manager is responsible for oversight of all LWS missions. The program office develops the integrated budget requirements and recommendations for the LWS program based on SMD budget guidelines that are prepared coincident with the release of the President's budget request for the upcoming FY. The program office establishes operational policies for the LWS program, assures appropriate independent review of the projects under NPR 7120.5 and NPR 7123.1, monitors the progress of each project, reports project and program status to GSFC and SMD management, recommends necessary corrective and preventative actions, and facilitates access to GSFC and other NASA expertise in support of projects requests. The technical staff will generally be matrixed to the program. Risk driven identification of technical areas may require deeper insight and closer tracking by the program office. Additional resources may be applied if necessary.

The LWS program manager is responsible for tracking program metrics and reporting status to NASA Headquarters. Program management oversight and TA responsibilities will include regular communications with the appropriate project manager. Program staff will attend periodic and lower-level reviews at the implementing organizations as appropriate. Program and project office monthly status reviews (MSRs) will be presented to the CMC and SMD.

SMD has established a Standing Review Board (SRB) for the LWS program in accordance with the requirements of NPR 7120.5. For NASA-led missions, the implementing center makes the initial recommendation of the SRB chair and suggested key members to NASA Headquarters.

For non-NASA-led missions, the implementing organization and the program host center makes a combined initial recommendation of the SRB chair and the suggested key members to NASA Headquarters. The implementing organization, with the TA, leads the reviews below the SRB level. The review chair will report out results, significant actions, and coordinate with the SRB per the comprehensive review plan. All LWS SRBs will be conducted under NASA's Standing Review Board Handbook (NASA/SP-2016-3706 rev B). For each mission, a Terms of Reference (TOR) is established that describes the agreed upon terms for SRB life-cycle reviews. The TOR is prepared by the Center Review Manager with inputs from the PE, the project and program office. It is approved by the SMD AA and GSFC's Center Director.

The LWS program and projects follow the TA process established in section 3.3. of NPR 7120.5. NASA established this process as part of its system of checks and balances to provide independent oversight of programs and projects in support of safety and mission success through the selection of specific individuals with delegated levels of authority. For all GSFC-led and non-NASA center-led NASA missions, the TA resides at GSFC. For center-led missions other than GSFC the TA typically resides with the host center. Further, the LWS program office is responsible to SMD for recommending the launch readiness of the mission.

The project office is responsible for developing and delivering the mission within cost and schedule commitments while meeting all Level-1 Requirements. Typical responsibilities include project and business management, science implementation, engineering, and safety and mission assurance. The project office has all of the authorities, responsibilities, and accountabilities defined in NPR 7120.5 to execute the mission, subject to limitations resulting from NASA's fiduciary obligations under the Federal Acquisition Regulation (FAR) and any applicable mission unique requirements or restrictions defined in the FAR. Requirements flow from this LWS program Plan to the project offices. The baseline implementation approach for executing a project, including any mission specific tailoring, will be explicitly defined in the individual mission's project plan which is subject to SMD approval. The project office contingencies (reserves) for cost and schedule, technical descope options, and technical resource margins will be the responsibility of and managed by the project office. The project office will report to their organization CMC, the program office, the SMD PMC, and the Agency PMC as required. For JHU/APL managed missions, both JHU/APL and GSFC are responsible for signoff/commitment for launch readiness at the launch site.

## **1.6 Implementation Approach**

The LWS program office implements the program consistent with the latest PCA, NPR 7120.5, and Agency requirements. Individual projects will be implemented per NPR 7120.5 or NPR 7120.8, NASA Research and Technology Program and Project Management Requirements, as applicable. SMD AA approves the program plan, which describes how the program office proposes to manage and implement the program, and holds the program manager accountable. NASA projects use the PLRA to generate lower-level requirements for implementation. SMD uses the PLRA to evaluate the project's performance during implementation and for decisions on mission accomplishment.

Individual mission implementation is defined by each project in the project plan and approved by the program office and SMD AA. Major project element make-or-buy and trade studies are conducted at the project level to support an SMD decision. Each project develops its acquisition strategy in accordance with NASA and Center procurement processes to ensure cost, schedule, technical, and risk performance are assessed and the optimal contractual vehicles are used including cost plus incentive fee, cost plus award fee, et cetera. Provisions for partners contributing elements to a project are controlled by project or NASA Office of Interagency and International Relations (OIIR) agreements.

## 2 GENERAL

### 2.1 Requirements Baseline

#### 2.1.1 Program Requirements

1. The LWS program implements missions selected by SMD.
2. A Formulation Authorization Document issued by SMD for each selected project constitutes the authorization to begin formulation.
3. SMD uses the AO process to select science investigations that include science instruments, sensors, instrument suites and/or an entire (PI-led) mission.
4. The selected science investigations and the mission requirements for a project defines the project science and technical performance requirements.
5. Launch vehicles used for LWS missions are certified vehicles consistent with the payload class defined in NPR 8705.4, Risk Classification for NASA Payloads.
6. International partnerships for space flight hardware and software are defined using international agreements arranged by OIIR.
7. Each science investigation team maintains a data archive of its instrument science and science data products for the life of the prime mission.
8. Each science investigation team provides the data obtained as part of the mission, including the engineering data and ancillary information and analysis software necessary to validate and calibrate the science data, to the public as defined in the PLRA.
9. Each science investigation team delivers the data archive from the prime mission to NASA for a deep data archive within 1 year of the completion of the prime mission.
10. Each science investigation team performs scientific analyses required for the science requirements for the mission as defined in the PLRA.

#### 2.1.2 Requirements Documentation

LWS program requirements for specific LWS projects are documented in the PLRA to this program plan.

#### 2.1.3 Program Requirements on Projects

1. The technical performance requirements for the missions and projects are detailed in the appendices to the LWS Program Plan (Appendix B) and are baselined when each mission or project begins implementation.
2. Program requirements that flow down to the projects are identified in Center processes and directives in safety mission assurance (SMA), risk management, schedule

management, resources management and information, and configuration management (CM) as well as SMD and NASA strategic objectives and requirements.

3. Compliance verification and traceability of the requirements that flow down from the program to the projects are conducted as part of the review and signature of the project plan and during the life cycle through regular MSRs, project reviews, and assessments.
4. Changes to program requirements require approval of the program manager, Center Director, and the SMD AA.
5. Changes to key project personnel (PI, project manager) require approval of the program manager and concurrence from Heliophysics DD and, in some cases, the SMD AA.
6. Missions have no exclusive use data analysis periods and release mission data as soon as possible after a brief validation period.
7. A requirements traceability and verification matrix, as defined in the safety mission assurance plan, is used to confirm that the mission system has met all requirements and is ready for launch.

#### 2.1.4 Mission Classification and Life-Cycle Costs

Table 2 below defines the LWS mission categorization, the governing PMC, and the risk classification. The program level requirements including cost limits and launch dates for the missions are set forth by SMD in the PLRA.

**Table 2. Program/Project Categorization, Governing Program Management Council, Risk Classification for Projects in Operations and Development**

Program or Project/TA	Category	Governing Program Management Council	Risk Classification
LWS program/GSFC	N/A	Agency	N/A
SDO/GSFC	2	Mission Directorate	B
SET-1/GSFC	3	Mission Directorate	D
SOC/GSFC	2	Mission Directorate	C
PSP/GSFC	1	Agency	B
GDC	2	Mission Directorate	C

Table 3 defines the key dates and time frames for the phase transitions for each project. Dates and costs for projects in formulation are guidelines for planning purposes and are subject to change as the LWS program matures.

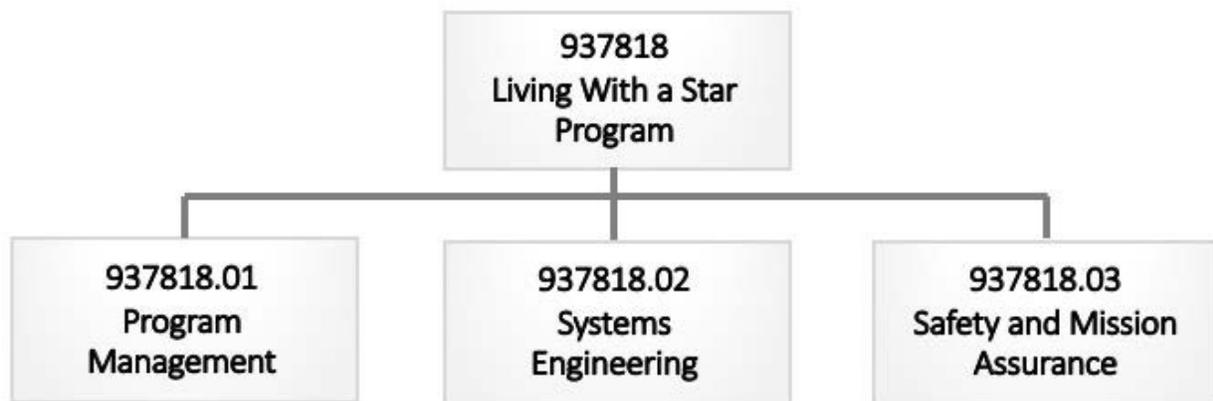
**Table 3. Key Milestones and Life-Cycle Cost for Projects in Development**

Project	Start Formulation	Mission Definition Review	Start Implementation	Ready for Launch	Start Prime Operations	End Prime Operations	Life Cycle Cost for Prime Mission (\$M)
GDC	09/2020	05/2022	11/2023	05/2028	08/2028	08/2031	985
LWS-8	2032	2034	2035	2040	2040	2043	1,400

The Agency budget database (N2) identifies budget constraints by FY for the LWS program and each project. Life cycle-cost constraints for LWS projects are identified in appendices PLRA. See Section 2.4, Table 4, for yearly LWS program budget constraints. Constraints are validated during the yearly budget cycle and as required throughout the FY.

## 2.2 Work Breakdown Structure (WBS) Baseline

The LWS program work WBS is depicted in Figure 4. As a loosely coupled program, each major program element or project is funded by a unique WBS number. The LWS program management element is executed by the LWS program office. Detailed project WBS and WBS dictionaries are developed and controlled at the project level.



**Figure 4. LWS Program Work Breakdown Structure**

The WBS dictionary for the LWS program is shown below.

**Program Management:** The business and administrative planning, organizing, directing, coordinating, analyzing, controlling, and approving processes used to accomplish overall program objectives, program level reviews, and reports to the Center and agency management. The effort includes LWS program management, program office general support, configuration management, scheduling, information technology (IT) services, housing cost, Center assessments, independent review funding for the LWS program and its projects. Includes labor, travel, procurements, and other direct cost.

This WBS also encompasses two efforts that are not managed by the LWS program office. The LWS Communication effort which is directed by NASA Headquarters SMD Heliophysics Division and includes support for the Science Visualization Studio, Headquarters website and graphics support, conference and workshop logistics, and the planning, coordination, and execution of media, visualization, and PAO activities. This WBS also includes the Heliophysics Science Support Office (HSSO) which is managed and directed by GSFC's Heliophysics Science Division.

Systems Engineering: Program provided systems engineering support to maximize the successful definition, implementation, integration and operation of space flight missions.

Safety and Mission Assurance: Program provided safety and mission assurance support to improve the ability of safe operations, enable proactive issue avoidance and resolution, and identify, communicate, and mitigate risk more effectively to assure mission success.

### **2.3 Schedule Baseline**

As a loosely coupled program, the LWS program does not utilize a program level integrated master schedule. Individual project schedules are generated and maintained by the respective projects under the project schedule management plan, as flowed down through the LWS program schedule management plan. The project schedules are generated and maintained by the projects and are reviewed and updated monthly. The program office monitors and analyzes project schedules and offers scheduling advice and expertise, as required.

### **2.4 Resource Baseline**

Table 4 identifies the current LWS program NOA requirement. Table 5 identifies the current LWS program workforce requirements. These requirements reflect the FY 2022 PPBE budget submission in April 2020. LWS program office requirements are based on the shared infrastructure approach identified below.

The LWS program utilizes a shared infrastructure to accomplish program level requirements. The Explorers and Heliophysics Projects Division (EHPD) at GSFC encompasses the LWS, Solar Terrestrial Probes, and Explorers programs. Staff, IT infrastructure, and other routine resources are shared across the programs to any extent possible, to maintain efficiency and consistency across EHPD. Other than routine office space, there are no facilities requirements at the program level. Infrastructure requirements for LWS projects, including acquisition, renovations, property/facilities, personal property, and IT resources are identified in the individual project plans.

**Table 4. LWS Program Office Budget\***

<b>LWS Program FY 2022 PPBE Budget Submission</b>					
<b>(\$ in millions)</b>					
	<b>FY 2020</b>	<b>FY2021</b>	<b>FY2022</b>	<b>FY2023</b>	<b>FY2024</b>
	<u>NOA</u>	<u>NOA</u>	<u>NOA</u>	<u>NOA</u>	<u>NOA</u>
<b>Program Management</b>	<b>4.98</b>	<b>5.08</b>	<b>5.45</b>	<b>5.45</b>	<b>5.86</b>
Program Office	1.58	1.96	2.26	2.18	2.51
HSSO	1.34	1.00	1.02	1.05	1.07
HQ Communications	2.06	2.12	2.17	2.22	2.28
<b>Systems Engineering</b>	<b>0.29</b>	<b>0.42</b>	<b>0.44</b>	<b>0.45</b>	<b>0.46</b>
<b>Safety &amp; Mission Assurance</b>	<b>0.00</b>	<b>0.04</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>
<b>GDC Oversight</b>	<b>0.00</b>	<b>0.01</b>	<b>0.12</b>	<b>0.40</b>	<b>0.55</b>
<b>Total</b>	<b>5.27</b>	<b>5.55</b>	<b>6.06</b>	<b>6.35</b>	<b>6.92</b>

\*This chart will not be maintained. The budget is updated annually via the PPBE process.

**Table 5. LWS Program Work Force\***

<b>LWS Program FY 2022 PPBE Workforce Submission</b>					
	<b>FY 2020</b>	<b>FY2021</b>	<b>FY2022</b>	<b>FY2023</b>	<b>FY2024</b>
<b>Program Management</b>	<b>18.6</b>	<b>20.4</b>	<b>20.2</b>	<b>20.4</b>	<b>20.6</b>
Program Office	6.6	8.2	8.1	8.3	8.5
HSSO	2.0	2.2	2.1	2.1	2.1
HQ Communications	10.0	10.0	10.0	10.0	10.0
<b>Systems Engineering</b>	<b>0.4</b>	<b>0.8</b>	<b>0.8</b>	<b>0.8</b>	<b>0.8</b>
<b>Safety &amp; Mission Assurance</b>	<b>0.0</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>
<b>GDC Oversight</b>	<b>2.6</b>	<b>4.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Total</b>	<b>21.6</b>	<b>26.2</b>	<b>21.2</b>	<b>21.4</b>	<b>21.6</b>

\*This chart will not be maintained. The workforce plan is updated annually via the PPBE process. Includes civil servant and support service contractor workforce.

## **2.5 Joint Cost and Schedule Confidence Level**

A range of cost and a range for schedule are provided at each project or mission's KDP-B. Each range (with confidence levels identified for the low and high values of the range) is to be established by a probabilistic analysis and based on identified resources and associated uncertainties by FY.

A resource-loaded schedule is developed and a risk-informed probabilistic analysis that produces a joint confidence level is performed for the budget baseline at KDP-C. This is documented in the KDP-C decision memorandum.

### 3 PROGRAM CONTROL PLANS

#### 3.1 Technical, Schedule, and Cost Control Plan

Monthly technical, schedule, and cost information is collected, analyzed, acted upon, and reported to GSFC's CMC, SMD, and agency budget and performance report to assure that all project and program requirements are being met with adequate reserves. The LWS program and/or project manager and their team conduct project reviews, failure review boards, configuration control boards CCBs, and schedule and cost reviews.

Risk management is applied following the guidelines of Goddard Procedural Requirement (GPR) 7120.4, Risk Management Procedural Requirements. The minimum set of risk management tools that must be used are schedule, technical, and financial reserves, risk mitigation starting early in the program, probabilistic risk assessment, failure modes and effects analysis, fault tree analysis, engineering models, and use of descope options.

Technical status for each mission is tracked via requirements shown in the Level 1 through Level 4 requirements traceability and test verification matrices. Tracking follows processes and requirements specified in the project's systems engineering management plan and risk management plan. Design margins are established and the reserves tracked and reported.

Schedule management for the LWS program and projects is implemented under GSFC's schedule management policy (400-PG-7120.0.2B). Integrated master schedules are generated for all projects of the LWS program using automated scheduling tools and appropriate schedule management methodology that shows both baseline and current schedule data. The Integrated Master Schedules identify the project critical path for management and control and ensure that schedules contain all critical milestones for internal and external activities, time durations for activities, schedule reserves or slack, and interdependencies.

Cost control incorporates monthly tracking metrics such as reserve status, liens and encumbrances, reserve percentage of cost to go, obligations and cost – plan vs. actual forecast, and labor – (plan vs. actual) forecast. The project is responsible for implementing a system that meets NASA requirements as stated in NPR 7120.5 for a cost, schedule, and milestone tracking system that provides sufficiently detailed data to adequately and quantitatively assess the current progress of the mission on a monthly basis, and provide a forecast for accomplishing work to be completed within the remaining established cost and schedule parameters. Schedule and cost status must be provided as part of the monthly project review process.

Earned value management (EVM) is not implemented at the program level. Each project implements an EVM process under current NASA policies, NPR 7120.5 requirements, and consistent with Center/organization EVM practices. For contracts, EVM policy is defined in NASA's FAR Supplement (NFS) 1834.201 and requirements outlined in the NFS 1852.234-2.

Costs and schedules are tracked against baseline projections and reviewed monthly to ensure that performance is closely monitored and appropriate actions taken, if necessary. The program office will use the project EVM data to perform independent cost and schedule analysis.

Formal Dissent is based on the personal responsibility, which each individual has to adhere to the Agency's shared core values of safety, teamwork, integrity, and mission success. In exercising this personal responsibility, individuals are required and encouraged to bring dissenting opinions to the appropriate authority (e.g. the program or project manager, anyone in the Technical Authority [engineering or SMA TA] chain) in an open and timely manner, and without fear of retribution. The LWS program office follows GSFC 500-PG-7120.0.1A, section 2.5 (Dissenting Opinion), Engineering Technical Authority Implementation Plan.

### **3.2 Safety and Mission Assurance Plan**

The LWS program office is responsible for ensuring that LWS projects develop approved SMA plans and implement those plans as listed in NPR 7120.5, section 3.2. The SMA processes of the project host organization will be used when the project office resides in that organization. The project office will address the SMA requirements included in NASA's procurement vehicle (e.g., AO, etc.) and obtain concurrence with the LWS program office for any waivers to these requirements.

Project requirements flow from NASA and GSFC SMA requirements and may be tailored and/or expanded for the specific mission. Each project develops SMA plans that meet current requirements and reflect a project life-cycle process perspective, addressing areas including: procurement, management, design and engineering, design verification and test, software design, software verification and test, manufacturing, manufacturing verification and test, operations, and pre-flight verification and test.

For GSFC-managed projects, the program will utilize the existing nonconformance report/corrective action system database and the problem report/problem failure report database for the closed loop problem reporting and resolution system. Projects that are not hosted at GSFC will utilize their existing problem reporting system.

### **3.3 Risk Management Plan**

The LWS program addresses risk per the Explorers and Heliophysics Projects Division (EHPD) Program Continuous Risk Management Plan (CRMP) (462-Plan-0002). Each LWS project must establish a project risk management plan that identifies the cost, schedule and technical risks within the project and methods to accommodate or mitigate them. Details of each project's risk management approach will be described in its risk management plan under the requirements of NPR 7120.5, NPR 8000.4 and GPR 7120.4 risk management procedures.

The project risk management plans govern how technical, cost, schedule, and other forms of risk will be identified, analyzed, tracked, controlled, communicated, and documented to increase the likelihood of achieving program/project goals. The goal of risk management in the LWS projects is to identify risks and mitigations necessary to avoid occurrence or negative effects from these risks.

On a monthly basis, the program office holds an internal review with each project to focus on the risks, issues and status. The program office reviews each risk for proper classification per 462-Plan-0002, the EHPD Program CRMP. The mitigations for risks are discussed and potential new risks are suggested. Crosscutting risks are identified and shared with the appropriate projects within EHPD. The program office presents the project risks to the Center and Headquarters

at the Center MSR. The program evaluates each LWS project's top risks and develops a program level top risk list, which is presented at the HPD Flight Program Review.

### **3.4 Acquisition Plan**

There are no major acquisitions at the program level. The program office supports SMD in the identification of new missions and the conduct of the acquisitions strategy meeting (ASM). All major acquisitions are performed at the project level. Each project's acquisition strategy and processes are fully described in its Acquisition Plan per NPR 7120.5. Science investigations will be provided by SMD-selected PI's through AO's or an international or interagency partner under an approved agreement. In the acquisition of scientific instruments, spacecraft, and science investigations (including research and analysis), NASA will use full and open competitions to the greatest extent possible. Certain instruments, missions, or mission systems may be acquired without competition (e.g., through international partnerships or in-house builds) provided that there is a clear scientific, technological, or programmatic benefit to NASA to do so. Such arrangements must be approved by the SMD AA. The project manages the implementation of these investigations. Spacecraft may be provided through industry, in-house by a NASA field center, or an international partner under an approved agreement. SMD retains make-or-buy decision authority for all spacecraft.

Launch vehicles will be acquired through existing contracts managed by the Launch Services Program in the Human Exploration and Operations Mission Directorate. The exception is when it is provided by an international partner or another organization under an approved agreement, or when the LWS mission is not a primary payload on the launch vehicle. In the latter case, arrangements for access to space will be made on a case-by-case basis and documented using agreements. Acquisitions for operations services must be consistent with NASA policy. The project will utilize established host organization processes and procedures in accordance with NPR 7120.5.

For GSFC managed projects, the project acquisition plan is developed by the project manager, supported by GSFC Office of Procurement and is consistent with the results of the acquisition strategy planning meeting and the ASM. The project acquisition plan documents an integrated acquisition strategy that enables the project to meet its mission objectives, provides the best value to NASA, and complies with the FAR and NFS.

Projects describe completed or planned studies supporting project level make-or-buy decisions, considering NASA's in-house capabilities and the maintenance of NASA's core competencies, as well as cost and best overall value to NASA. For each science mission, the Heliophysics DD may charter a science and technology definition team before the start of formulation to provide advice including prioritized science requirements and to identify a pre-concept that satisfies the science requirements constraints and technology development requirements for the project. These requirements may form the basis for an AO for the acquisition of scientific investigations that include science instruments.

If there are no program level agreements in place, projects will describe all agreements, memorandum of understanding (MOU), barter, contributions, and other arrangements for collaborative and/or cooperative relationships in the project plans. Partnerships created through

mechanisms other than those prescribed in the FAR will be identified in the Level I requirements for each project. All such agreements (the configuration control numbers and the date signed, or projected dates of approval) necessary for project success will be listed. All agreements concluded with the concurrence of the program manager will be included and referenced.

Agreements between NASA and other governments or foreign entities are established through agreements, memorandums, and arrangements such as letters of agreement (LOA), MOUs, and implementing agreements. NASA Headquarters OIIR leads the establishment of LOAs, MOUs and implementing agreements with the support of the program and project offices. The LOAs can either be exclusively for formulation if the dollar value of the contribution is high and then followed by an MOU (or equivalent) during implementation or a LOA can cover both formulation and implementation, if the dollar value is low as determined by the OIIR. MOUs and LOAs are only established for hardware and software contributions and not for science contributions. The MOUs and LOAs go through the State Department via OIIR so they can be used to get technology assistance agreements.

When external (non-LWS) agreements are needed and made, their documentation is part of the project-specific requirements appendix to the LWS program Plan.

### **3.5 Technology Development Plan**

Each project provides a technology development plan that includes the content tailored for the project as specified in, paragraph 3.5, in NPR 7120.5.

### **3.6 Systems Engineering Management Plan**

LWS is a loosely coupled program and, therefore, each project within LWS develops and maintains a project system engineering management plan (SEMP). The LWS program systems engineer ensures that the project's SEMPs meet the requirements defined in NPR 7123.1.

The test, validation, and verification requirements for hardware and software are mission unique and are addressed separately in the SEMPs and/or project plan for each project. The individual plans must also address software independent verification and validation.

The LWS program systems engineer monitors the technical progress of all LWS projects and conducts periodic meetings with all of the project systems engineers to facilitate and encourage dialogue and knowledge sharing across the projects. He or she identifies or conducts trade studies for areas that span multiple projects to encourage risk or cost reduction for the program.

### **3.7 Verification and Validation Plan**

LWS projects and program will follow processes defined in NPR 7123.1, NASA Systems Engineering Processes and Requirements.

### **3.8 Information Technology Plan**

1. Each LWS project develops an approach to knowledge capture and dissemination including compliance with NPD 2200.1, Management of NASA Scientific and Technological Information and NPR 2200.2, Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technological Information.

2. Each LWS project manages information throughout its life cycle through the use of the EHPD Management Information System (MIS). The EHPD MIS is an electronic library/CM system used to identify, control, and disposition program and project records under NPD 1440.6 NASA Records Management, NPD 1441.1 NASA Records Management Program Requirements, and NASA Records Retention Schedules 1441.1 NASA Records Retention Schedules. The MIS allows control of records, including documents and drawings from inception through disposition.

The MIS assigns document numbers to all LWS program and project documents. The document number consists of the organization acronym (LWS), project name, configured item category, and a four-digit number assigned sequentially. The MIS serves as a central hub to track and update all revisions and relay information to all approved users.

An LWS organizational file plan is updated annually to serve as an inventory of all records maintained by LWS. All records are identified by their Agency filing scheme, record title, record custodian, file location, and retention period. The retention period is established by the type of record it is. Temporary records are records that the National Archives and Records Administration (NARA) has approved for either immediate disposal or for disposal after a specified time or event. Permanent records are those that NARA appraises as having sufficient value to warrant continued preservation by the Federal Government as part of the National Archives of the United States.

3. The LWS program implements IT security requirements under NPR 2810.1, Security of Information Technology, through compliance with the Agency Consolidated End User Services (ACES) Security Plan, OA-999-M-NSS-1015-ACES Services.

### **3.9 Review Plan**

#### **3.9.1 Program Reviews**

The LWS program office supports reviews consistent with NPR 7120.5. A program level status review and program implementation review will be conducted by an SRB or as determined by SMD, on a schedule requested by the Agency AA, the SMD AA or the DD. The review entrance and success criteria will be established by the SRB chair with concurrence from the LWS program office and HPD. This review will consider all aspects of the LWS program and the flow down to individual projects.

#### **3.9.2 Program Review of Projects**

The LWS program conducts reviews on a periodic and as-required basis to assess project progress, evaluate risk, ensure compliance, and address issues. These reviews may include, but are not limited to, monthly project reviews, independent reviews, and weekly informal tag-ups. Monthly project reviews will assess technical, schedule, and cost status, and include accomplishments, issues, risks, resources status (e.g., mass, power, schedule reserve, cost reserve), schedule changes, and cost variance analysis.

### 3.9.3 Review Processes for the Project Office(s)

The project office will ensure that the review process, as specified in the project review plan and applicable project host organization directives, is followed and supported. GPR 8700.4, Goddard Systems Reviews, defines the purpose of each review. The following sets of reviews are included in the project's review plan:

1. Project Gate Reviews leading to each KDP, as defined by NPR 7120.5, will be conducted by the SRB and defined in the project plan. These formal reviews will be convened by the applicable technical and programmatic authorities. The review entrance and success criteria will be established by the project with concurrence from the LWS program office and HPD early in the phase. The SRB will report out to the project office, LWS program office, GSFC's CMC, and the SMD and Agency PMC's consistent with the mission project classification per NPR 7120.5.
2. Engineering Peer Reviews - A comprehensive set of engineering peer reviews will be established by the organization that is the provider of the engineering product. Participants will be selected by the project office host organization and are independent of the development activity under review. Every effort will be made to include technical experts from, or recommended by, GSFC. The results of the review will be reported to the LWS program office.
3. Anomaly Reviews – Review Boards for anomalies that have an unknown cause and represent significant programmatic or technical risk, will be held and will be independent of the project and established by the project office host organization's SMA office and chief engineer with applicable membership from the LWS program office's supporting TA.
4. Management Reviews - The project office host organization will conduct regular status reviews and provide reports to the SMD weekly reporting system (as required by SMD), and monthly and/or quarterly status reviews. The project office will provide/present an overall project assessment to include the following: technical, schedule, cost, and management including significant progress; concerns/issues (including resolution plans/expected outcomes); contingency/reserves and liens status; and all significant risk threats to the implementation or mission success. The LWS program office will have a standing seat in the project office host organization's monthly senior status review process. A summary of the project's status must be provided to the LWS program office in support of the program's monthly review process. The project office will present to GSFC's CMC on a monthly basis.
5. Assessment Reviews – The project office host organization will convene, when necessary, assessment reviews to evaluate the readiness of the project to execute a mission critical event, e.g., launch, encounter, etc., or to assess the design risk of a pending implementation. Representatives of the LWS program office and NASA Headquarters can also participate in these reviews.

### 3.9.4 Cancellation Review Criteria

During implementation, each project will develop the mission within the established performance, schedule, and cost requirements identified in the PLRA (Level 1 document). If at any time during development, it is determined that the project is unable to achieve the PLRA (Level 1) requirements or that the project is anticipated to exceed the Agency baseline commitment in terms of cost or schedule, the project is subject to a cancellation review.

A cancellation review is not required if the SMD AA agrees to change the requirements or if the project is able to demonstrate that cost growth is above and beyond their control or if they can descope the mission concept or design in order to stay within the technical, cost, and schedule constraints. If none of these occurs, then it is appropriate to recommend a cancellation review. The recommendation for a cancellation review may come from the program office or the HPD.

### 3.9.5 Mission Termination Review

Within SMD, mission termination refers to the decommissioning of a mission. It is the process for ending a project that has conducted part of or its entire prime mission and which may have completed one or more extended missions. This is different than mission cancellation which refers to ending project activity before the mission is launched.

There are two paths within SMD that can lead to mission termination:

1. The first is through a programmatic path, such as the outcome of a Senior Review or a significant budget reduction.
2. The second is as a result of a condition on the spacecraft, which may be an unexpected on-orbit anomaly, or the exhausting of consumable resources.

## 3.10 Mission Operations Plan

There is no LWS mission operations plan since the program is a set of fairly loosely coupled missions, each of which have dedicated mission operations plans.

## 3.11 Environmental Management Plan

The LWS program and projects comply with NPR 8580.1, NASA National Environmental Policy Act Management Requirements. There is no program specific environmental management plan as the requirement is flowed to the LWS project offices. Each LWS project office prepares an environmental management plan utilizing Goddard Policy Directive 8500.1, Environmental Policy and Program Management or equivalent institutional requirements.

The LWS program office supports the project offices in the development of this plan. Products and processes having environmental issues will be identified at the earliest possible time during formulation to ensure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts. Project environmental data management plans must be submitted to the LWS program office for approval.

### **3.12 Integrated Logistics Support Plan**

The logistics requirements are identified by each project in their individual project plans. There is no program level logistics plan. The LWS project offices prepare logistics plans utilizing established Center/Institutional processes and procedures in accordance with the project plan requirements in NPR 7120.5 and NPD 7500.1, Program and Project Logistics Policy.

### **3.13 Science Data Management Plan**

There is no LWS Program-level science data management plan as the requirement is flowed down to the LWS projects. LWS project offices develop a draft project data management plan by Preliminary Design Review under NASA Heliophysics Science Data Management Policy (Version 1.2, dated 10/2016) to address the total activity associated with the flow of science data, from acquisition, through processing, data product generation and validation, to archiving, and preservation. The data management plan will be formally approved no later than the project office's Critical Design Review (CDR). Science analysis software development, utilization, and ownership must be covered in the data management plan.

It is NASA policy that all data taken by NASA's space flight mission programs is made publicly available as soon as they can be properly validated and calibrated. NASA's science AOs require that this activity be budgeted in proposals. All data collected through the LWS program are to be placed in the public domain in the standard formats specified in the Heliophysics Science Data Management Policy at the earliest possible time following their validation and calibration in either of the two designated active archives for Heliophysics data: the Solar Data Analysis Center, or the Space Physics Data Facility. Exceptions are on a mission-by-mission basis. Data preparation will be accomplished within a few months from the time that NASA delivers the data to the investigation team. One exception is data that may be released almost immediately for outreach purposes, after the appropriate review process.

The LWS program adherence to all NASA sample handling, curation and planetary protection directives and rules, including NASA Interim Directive 8020.109, Planetary Protection Provisions for Robotic Extraterrestrial Missions, is not required as there are no LWS missions currently envisioned requiring planetary protection.

### 3.14 Configuration Management Plan

The LWS program has a stand-alone CM process, 460-PG-1410.2.2, LWS Configuration Management Procedure. This procedure defines the CM requirements for the LWS program and projects to meet the requirements of NPR 7123.1 and GPR 1410.2, Configuration Management.

The LWS CM procedure describes the structure of the CM organization and tools used. It describes the methods and procedures to be used for configuration identification, configuration control, interface management, configuration traceability, and configuration status accounting and communications. It also describes how CM will be audited.

The CM procedure addresses CM requirements for document configuration control only. Configuration control for products is not required at the program office level but is addressed as necessary in project office CM procedures.

The LWS CM system uses CCBs at both the program and project levels. This allows for CM to be handled at the most appropriate level within the organization. For each organization level, types of CIs have been assigned for CM. The LWS program CCB is chaired by the LWS program manager or designee who has overall responsibility for all LWS program and project office activities.

The LWS CM procedure does not apply to LWS directives posted in the Goddard Directives Management System (GDMS). These directives are controlled using the procedures described in GPR 1410.1, Directives Management.

The LWS program follows the information management and knowledge capture requirements in NPD 2200.1, Management of NASA Scientific and Technical Information, NPR 2200.2 Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information, NPD 1440.6, NASA Records Management, and NPR 1441.1, NASA Records Retention Schedules.

### 3.15 Security Plan

#### 3.15.1 Security Requirements

The LWS program methodology for ensuring security and technology protection will use established procedures in the GPR documents with the assistance of the GSFC's Facilities Division and GSFC Security Division. GSFC maintains building emergency plans (GPR 8710.2). Required security training such as "Cybersecurity and sensitive unclassified information awareness training course" is recorded and maintained in the SATERN Learning System. The program's approach to implementing IT security requirements are in accordance with NPR 2810.1. The content of these plans addresses the Emergency Notification System, Types of Emergency Situations, Occupant Response Procedures, and Incident Management Responsibilities. The program office identifies an individual who works with the facilities operations managers (FOMs) to maintain and communicate building emergency plans.

#### 3.15.2 IT Security Requirements

Projects hosted at other centers or organizations will use their own institutional requirements and applicable NPRs.

The LWS Program IT system is covered under the OA-999-M-CIO-2965 ACES Security Plan. This IT security plan covers all of the areas specified in National Institute of Standards and Technology 800-53, "Recommended Security Controls for Federal Information Systems," and Federal Information Processing Standards 199 "Standards for Security Categorization of Federal Information and Information Systems."

The IT plan covers the following: access, control and authentication; training; auditing; certification, accreditation and assessment; CM; contingency planning; incident response; maintenance; media protection; physical and environmental protection; personnel security; risk assessment; system and services acquisition; system and communication protection; and system and information integrity.

#### 3.15.3 Emergency Response Requirements for Facilities

The LWS program complies with NPR 1040.1, NASA Continuity of Operations Planning and Procedural Requirements and GPR 8710.2, Emergency Preparedness Plan for Greenbelt. The program office identifies an individual (nominally the program support manager) who works with the facilities operations managers to maintain and communicate building emergency plans.

### 3.16 Threat Summary

Threat summaries attempt to document the threat environment that a NASA space system/constellation or aircraft is most likely to encounter as it reaches operational capability. These documents contain Top Secret/Sensitive Compartmented Information on the valid threats to US space systems and are the basis for establishing threat levels that the program office will use to develop survivability strategies. Threat summaries are completed by an Agency team with proper clearances at the request of the program manager through the Office of the Chief Engineer. This team discusses with the program manager risk mitigation strategies which are incorporated into the program threat summary. Secret information is handled appropriately and not included in the program plan.

LWS program managers will provide program and project documentation to aid in the preparation of threat summaries, such as, mission overviews/requirements and operations concepts to either crewed or robotic space protection program personnel to draft these documents. High-risk threat information will be extracted from the threat summary at the Secret level and transferred to the hostile threat section of the project protection plan to develop mission survivability strategies and protection measures. The LWS program manager will provide program and project/mission documentation to adhere to this process at the appropriate level. Each NASA mission works with Space Asset Protection Program to develop a project protection plan. Each plan will define the specific space asset protection measures based on threat assessment for individual mission.

### **3.17 Technology Transfer Control Plan**

Each project prepares and implements an export control plan as required. There will be no LWS program level export control plan as the deliverables subject to export control are provided at the project office level. Individual LWS project office export control plans will be prepared and implemented at the project office level working with GSFC's Export Control Office. LWS project offices will comply with the export control requirements specified in NPR 2190.1, NASA Export Control Program.

When there is no contribution to NASA (for example, when a project contractor wants to purchase components from Europe), the contractor is responsible for getting approval through the State Department for the import. Applications for licenses and technology assistance agreements to the State Department for LWS missions are routinely routed through the LWS PEs for concurrence. US International Traffic in Arms Regulations and Export administration regulation laws still apply.

LWS program and project office personnel will receive U.S. International Traffic in Arms Regulations training per NPR 2190.1. All international technical exchanges will be approved by GSFC's Export Control Office.

### **3.18 Education Plan**

There are no LWS program-level educational activities. The project-level education plans will follow the current guidance provided by the SMD in a separate memorandum. All education activities will follow the established SMD policy.

### **3.19 Communications Plan**

There is no LWS program-level communication plan. The requirement is flowed down to the LWS projects. The LWS projects will follow the current guidance provided by the SMD in a separate memorandum.

### **3.20 Knowledge Management Plan**

To ensure that the Agency's knowledge is captured and accessible across all NASA Centers, with appropriate measures to safeguard Sensitive but Unclassified knowledge and comply with Federal laws and regulations, the mission manager is responsible for determining lessons learned and entering them into NASA's database under NPD 7120.6, Knowledge Policy on Programs and Projects throughout the program/project lifecycle NPD 7120.4, NASA Engineering and Program/Project Management Policy.

The LWS project or mission manager is responsible for determining lessons learned and entering them into NASA's database throughout the program/project lifecycle under NPR 7120.6, Knowledge Policy on Programs and Projects.

### **3.21 Human Rating Certification Package**

There is no LWS program-level human rating certification package. The requirement is flowed down to LWS projects, when applicable. The projects will follow NPR 8705.2, Human Rating Requirements for Space Systems.

## Appendix A Acronyms and Abbreviations

AA	Associate Administrator
ACES	Agency Consolidated End User Services
AO	Announcement of Opportunity
ASM	Acquisitions Strategy Meeting
CCB	Configuration Control Boards
CCR	Configuration Change Request
CDR	Critical Design Review
CM	Configuration Management
CMC	Center Management Council
CMO	Configuration Management Office
CRMP	Continuous Risk Management Plan
DD	Division Director
DPM	Deputy Program Manager
EHPD	Explorers and Heliophysics Projects Division
EVM	Earned Value Management
FAD	Formulation Authorization Document
FAR	Federal Acquisition Regulation
FOM	Facilities Operations Managers
FY	Fiscal Year
GDMS	Goddard Directives Management System
GPR	Goddard Procedural Requirement
GSFC	Goddard Space Flight Center
HEOMD	Human Exploration and Operations Mission Directorate
HSSO	Heliophysics Science Support Office
HQ	Headquarters
IT	Information Technology
HPD	Heliophysics Division
ITAR	International Traffic in Arms Regulations

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JHU/APL	Johns Hopkins University/Applied Physics Laboratory
KDP	Key Decision Point
LOA	Letters Of Agreement
LCC	Life-Cycle Cost
LWS	Living With a Star
MDR	Mission Definition Review
MIS	Management Information System
MOU	Memorandum of Understanding
MSR	Monthly Status Review
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration
NOA	New Obligation Authority
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
NRC	National Research Council
OIIR	Office of Interagency and International Relations
PA	Program Analyst
PAO	Public Affairs Office
PCA	Program Commitment Agreement
PDLM	Product Data and Life-Cycle Management
PE	Program Executive
PI	Principal Investigation
PLRA	Program Level Requirements Appendices
PMC	Program Management Council
PPBE	Planning, Programming, Budgeting, and Execution
PS	Program Scientist
PSP	Parker Solar Probe
SDO	Solar Dynamics Observatory
SEMP	System Engineering Management Plan
SMA	Safety Mission Assurance
SMD	Science Mission Directorate
SMD AA	Science Mission Directorate Associate Administrator
SOC	Solar Orbiter Collaboration
SPP	Solar Probe Plus
SRB	Standing Review Board
TA	Technical Authority
TOR	Terms of Reference
WBS	Work Breakdown Structure

## **Appendix B      Program Level Requirements Appendix**

## **Appendix C PLRA Cover Sheet (optional)**

**LWS-PLAN-0005, Rev C**

**LIVING WITH A STAR**

**PROGRAM PLAN**

**PROJECT SPECIFIC: PROGRAM LEVEL REQUIREMENT  
APPENDICES (PLRA)**

**Project Name: \_\_\_\_\_**

### **IMPORTANT NOTE:**

**All Project Specific PLRA(s) attached are approved and under  
Code 460 Configuration Management Control**