

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771



October 1, 2019

Reply to Attn of: 448

RECORD OF ENVIRONMENTAL CONSIDERATION

Wide Field Infrared Survey Telescope (WFIRST) National Environmental Policy Act (NEPA) Compliance

1.0 Introduction

The NEPA of 1969, as amended (42 U.S.C. 4321, et seq.), requires Federal agencies to consider the project's environmental impacts in its decision making process. To comply with NEPA and associated regulations (the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA [40 CFR Parts 1500-1508] and NASA policy and procedures [14 CFR, Part 1216, Subpart 1216.3]), NASA prepared the, "Final Environmental Assessment for Launch of NASA Routine Payloads on Expendable Launch Vehicles," dated November 2011. The 2011 NASA Routine Payload Environmental Assessment (NRPEA) assessed the environmental impacts of missions launched with spacecraft that are considered routine payloads from existing launch facilities at Cape Canaveral Air Force Station (CCAFS), Florida; Vandenberg Air Force Base (VAFB), California; the United States Army Kwajalein Atoll/Reagan Test Site (USAKA/RTS) in the Republic of the Marshall Islands; NASA's Wallops Flight Facility (WFF), Virginia; and the Kodiak Launch Complex (KLC), Alaska.

Spacecraft defined as routine payloads utilize materials, quantities of materials, launch vehicles, launch sites, and operational characteristics that are consistent with normal and routine spacecraft preparation and flight activities at VAFB, CCAFS, USAKA/RTS, WFF, KLC, and Kennedy Space Center. The environmental impacts of launching routine payloads from these sites fall within the range of routine, ongoing, and previously documented impacts that have been determined not to be significant. Spacecraft within the scope of this environmental assessment (EA) meet specific criteria ensuring that the spacecraft, its operation, and decommissioning do not present any new or substantial environmental or safety concerns.

Applicability of a routine payload classification for a mission is determined through an evaluation against the criteria defined in the EA using the routine payload checklist (RPC).

2.0 Mission Description

WFIRST, the Wide Field InfraRed Survey Telescope, is a NASA observatory designed to settle essential questions in the areas of dark energy, exoplanets, and infrared astrophysics.

The primary science objectives of the WFIRST mission are: to investigate the acceleration of the expansion of the Universe; to search for new populations of extra-solar planets; and to address a broad range of Decadal Survey science questions by offering opportunities for both key projects and archival studies to the astronomical community.

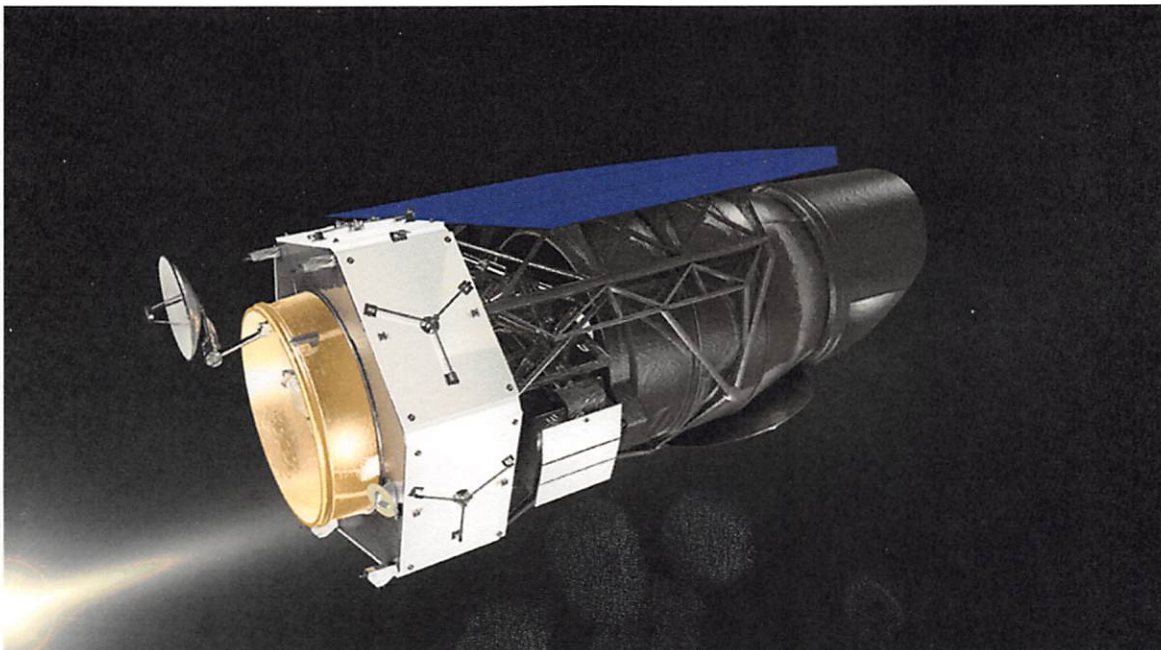
The first objective will be accomplished by measuring the expansion history of the Universe and characterizing the growth of large-scale structures within it. The second objective will be accomplished primarily through a large microlensing survey. The third objective will be enabled through competitive opportunities for community-proposed survey-scale new observations and through an open and timely science archive.

In addition to meeting the wide-field science objectives described above, WFIRST will satisfy a set of technology objectives associated with a technology demonstration in space of a coronagraph instrument.

The primary systems of WFIRST are a flight system, a launch vehicle, the terrestrial ground-data and operations system and a science operations center for data processing, archiving and dissemination.

The flight system consists of a spacecraft, an existing 2.4 meter (7.9 feet) telescope modified for unique WFIRST requirements, and two instruments, the Wide-Field Instrument (WFI) and a Coronagraph Instrument (CGI).

WFI will have a field of view that is 100 times greater than the Hubble infrared instrument, capturing more of the sky with less observing time. As the primary instrument, WFI will measure light from a billion galaxies over the course of the mission lifetime. It will perform a microlensing survey of the inner Milky Way to find ~2,600 exoplanets. CGI will perform high contrast imaging and spectroscopy of individual nearby exoplanets.



WFIRST is a joint effort led and managed by NASA's Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. GSFC will provide project management, integration & testing and a portion of the WFI. Ball Aerospace will provide the other portion of the WFI, designated the Wide-Field Opto-Mechanical Assembly (WOMA). JPL will oversee the work on the CGI and Harris Corp will provide the telescope. KSC is responsible for the launch vehicle.

The Space Telescope Science Institute (STScI) in Baltimore, and the Infrared Processing and Analysis Center (IPAC) at Caltech will partner with GSFC to provide the Science Operations Center functions for WFIRST.

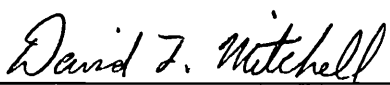
The WFIRST observatory will be launched into orbit aboard an expendable launch vehicle from the Eastern Test Range at Cape Canaveral, Florida. The launch vehicle has not yet been selected. The baseline orbit in the design reference mission is a libration point orbit around Sun-Earth L2. The prime mission duration will be 5 years.

3.0 NASA Routine Payload Determination

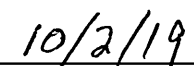
The components utilized in the WFIRST observatory are made of materials normally encountered in the space industry. The WFIRST mission will not utilize radioactive flight sources, will not carry any pathogenic organisms, and will not return samples to Earth. The WFIRST observatory will not re-enter the earth's atmosphere.

The WFIRST mission has been evaluated against the 2011 NRPEA, using the RPC (see enclosed evaluation recommendation package). As indicated on the RPC the candidate launch vehicles are not specifically listed in the NRPEA. However, the impacts of these launch vehicles are addressed in separate NEPA documentation (Final Environmental Assessment for Multi-Use of Launch Complexes 39A and 39B John F. Kennedy Space Center, FL., November 2013 and Environmental Assessment Blue Origin Orbital Launch Site at Cape Canaveral Air Force Station Florida, November 2016).

The WFIRST mission does not present any unique or unusual circumstances that could result in new or substantial environmental impacts. Based on the foregoing and the analyses set forth in the 2011 NRPEA, GSFC has determined that the environmental impacts associated with the WFIRST mission will not individually or cumulatively have a significant impact on the quality of the human environment and that a routine payload classification for the observatory is applicable. Once launch vehicle selection has occurred, the mission will be reviewed to assess whether additional NEPA action or documentation will be required.



David F. Mitchell
Director, Flight Projects



Date

Enclosure

EVALUATION RECOMMENDATION PACKAGE

**Record of Environmental Consideration
Routine Payload Checklist
Flight Project Environmental Checklist**

NASA Goddard Space Flight Center
RECORD OF ENVIRONMENTAL CONSIDERATION (REC)

PROJECT NAME: WFIRST

- 1. Description of proposed action:** WFIRST, the Wide Field InfraRed Survey Telescope, is a NASA observatory designed to settle essential questions in the areas of dark energy, exoplanets, and infrared astrophysics

Date and/or Duration of project: Launch - September 2025

- 2. It has been determined that the above action:**

- a. Is adequately covered in an existing EA or EIS.

Title: Environmental Assessment for Launch of NASA Routine Payloads

Date: November 2011

- b. Qualifies for Categorical Exclusion and has no extraordinary circumstances per 14 CFR 1216.304 (c) which would suggest a need for an Environmental Assessment.

Categorical Exclusion: _____

- c. Has no significant environmental impacts as indicated by the results of an environmental checklist and/or detailed environmental analysis.

- d. Is exempt from NEPA requirements under the provisions of: _____

- e. Will require the preparation of an Environmental Assessment.

- f. Will require the preparation of an Environmental Impact Statement.

- g. Is addressed under EO12114.

Is exempt from EO12114 requirements under the provisions of: _____

Action not included under EO12114: _____

Qualifies for an EO12114 categorical exclusion: _____

Is adequately covered in existing documentation: _____

Requires an environmental summary document: _____

Requires EO documentation IAW 2-4. (a) i, ii, iii: _____

- h. Is not federalized sufficiently to qualify as a major federal action.

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MONTGOMERY

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Beth Montgomery NEPA Manager, Code 250

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Jamie Dunn

Project Manager, Code 448

Date

Date

NASA Routine Payload Evaluation and Determination Process and Checklist



After a proposed spacecraft mission is sufficiently well formulated (usually the Phase B design study), the Sponsoring Entity, in coordination with the local Environmental Management Office (EMO), will prepare an environmental evaluation. An environmental evaluation is a preliminary review that determines what aspects of the proposal are of potential environmental concern. The environmental evaluation also assists in determining the appropriate level of National Environmental Policy Act (NEPA) documentation (i.e., environmental assessment [EA], or environmental impact statement [EIS]) for the proposal. The local EMO uses a comprehensive checklist to provide a level of rigor to this early evaluation of the proposal, helping to ensure that pertinent considerations are not overlooked. Local EMO review of the Routine Payload Checklist (RPC, below) forms the basis for evaluating the applicability of a NASA Routine Payload (NRP) spacecraft classification for a proposed mission.

The local EMO uses the completed RPC (and required attachments) to evaluate the proposed mission against the NRP EA criteria. If the EMO evaluation of the RPC indicates that a NRP categorization may be appropriate, the Sponsoring Entity documents this in an Evaluation Recommendation Package (ERP). The ERP is then processed for review and approval in accordance with established National Aeronautics and Space Administration (NASA) procedures and guidelines. If approved, the ERP would be attached to a Record of Environmental Consideration (REC).

The Sponsoring Entity can then proceed with the proposal while monitoring the project activities, for changes or circumstances during implementation that could affect classification of the proposed mission as a NRP spacecraft. If a NRP spacecraft categorization is determined to be inappropriate, the local EMO will initiate plans for preparation of additional NEPA documentation.

NASA Routine Payload Checklist

Project Name: WFIRST		Date of Launch: September 2025
Project Contact: Kenneth Anderson		Phone Number: 301-614-7054
Project Start Date:		Mailstop: 448.0
Project Location: Project Office - GSFC		
Project Description: Optical observatory orbiting at L2 with two primary science objectives: investigation of the nature of dark energy, and studying and characterizing exoplanets.		
A. Sample Return:		Yes No
1. Would the candidate mission return a sample from an extraterrestrial body?		<input type="checkbox"/> <input checked="" type="checkbox"/>
B. Radioactive Materials:		Yes No
1. Would the candidate spacecraft carry radioactive materials in quantities that produce an A2 mission multiple value of 10 or more?		<input type="checkbox"/> <input checked="" type="checkbox"/>
Provide a copy of the Radioactive Materials On Board Report as per NPR 8715.3 with the ERP submittal.		Attachment
C. Launch and Launch Vehicles:		Yes No
1. Would the candidate spacecraft be launched on a vehicle and launch site combination other than those indicated in Table C-1 on Page 2?		<input checked="" type="checkbox"/> <input type="checkbox"/>
2. Would the proposed mission exceed the approved or permitted annual launch rate for the particular launch vehicle or launch site?		<input type="checkbox"/> <input checked="" type="checkbox"/>
Comments: No present plans for significant modifications; only some internal laboratory modifications required.C-1: SLS, Falcon-Heavy, New Glenn and Vulcan are current options; not listed in Table C-1		
D. Facilities:		Yes No
1. Would the candidate mission require the construction of any new facilities or substantial modification of existing facilities?		<input type="checkbox"/> <input checked="" type="checkbox"/>
Provide a brief description of the construction or modification required, including whether ground disturbance and/or excavation would occur. No present plans for significant modifications; only some internal laboratory modifications required.C-1: SLS, Falcon-Heavy, New Glenn and Vulcan are current options; not listed in Table C-1		
E. Health and Safety:		Yes No
1. Would the candidate spacecraft utilize batteries, ordnance, hazardous propellant, radiofrequency transmitter power, or other subsystem components in quantities or levels exceeding the EPC's in Table C-2 below?		<input type="checkbox"/> <input checked="" type="checkbox"/>
2. Would the expected risk of human casualty from spacecraft planned orbital reentry exceed the criteria specified by NASA Standard 8719.14?		<input type="checkbox"/> <input checked="" type="checkbox"/>
3. Would the candidate spacecraft utilize any potentially hazardous material as part of a flight system whose type or amount precludes acquisition of the necessary permits prior to its use or is not included within the definition of the Envelope Payload Characteristics?		<input type="checkbox"/> <input checked="" type="checkbox"/>
4. Would the candidate mission, under nominal conditions, release material other than propulsion system exhaust or inert gases into the Earth's atmosphere or space?		<input type="checkbox"/> <input checked="" type="checkbox"/>
5. Are there changes in the preparation, launch or operation of the candidate spacecraft from the standard practices described in Chapter 3 of this EA?		<input type="checkbox"/> <input checked="" type="checkbox"/>
6. Would the candidate spacecraft utilize an Earth-pointing laser system that does not meet the requirements for safe operation (ANSI Z136.1-2007 and ANSI Z136.6-2005)?		<input type="checkbox"/> <input checked="" type="checkbox"/>
7. Would the candidate spacecraft contain, by design (e.g., a scientific payload) pathogenic microorganisms (including bacteria, protozoa, and viruses) which can produce disease or toxins hazardous to human health or the environment beyond Biosafety Level 1 (BSL 1) ¹ ?		<input type="checkbox"/> <input checked="" type="checkbox"/>
Comments: No present plans for significant modifications; only some internal laboratory modifications required.C-1: SLS, Falcon-Heavy, New Glenn and Vulcan are current options; not listed in Table C-1		

Continued on next page

¹The use of biological agents on payloads is limited to materials with a safety rating of "Biosafety Level 1." This classification includes defined and characterized strains of viable microorganisms not known to consistently cause disease in healthy human adults. Personnel working with Biosafety Level 1 agents follow standard microbiological practices including the use of mechanical pipetting devices, no eating, drinking, or smoking in the laboratory, and required hand-washing after working with agents or leaving a lab where agents are stored. Personal protective equipment such as gloves and eye protection is also recommended when working with biological agents.

NASA Routine Payload Checklist (continuation)

Project Name: WFIRST		Date of Launch September 2025
Project Contact: Kenneth Anderson		Phone Number: 301-614-7054
Project Start Date:		Mailstop: 448.0
Project Location: Project Office - GSFC		

Project Description:
Optical observatory orbiting at L2 with two primary science objectives: investigation of the nature of dark energy, and studying and characterizing exoplanets.

F. Other Environmental Issues:	Yes	No
1. Would the candidate spacecraft have the potential for substantial effects on the environment outside the United States?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. Would launch and operation of the candidate spacecraft have the potential to create substantial public controversy related to environmental issues?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Would any aspect of the candidate spacecraft that is not addressed by the EPCs have the potential for substantial effects on the environment (i.e., previously unused materials, configurations or material not included in the checklist)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Comments:
No present plans for significant modifications; only some internal laboratory modifications required. C-1: SLS, Falcon-Heavy, New Glenn and Vulcan are current options; not listed in Table C-1

Table C-1. Launch Vehicles and Launch Sites

Launch Vehicle and Launch Vehicle Family	Space Launch Complexes and Pads				
	Eastern Range (CCAFS)	Western Range (VAFB)	USAKA/RTS	WFF	KLC
Athena I, IIc, III ^a	LC-46	CA Spaceport (SLC-8)	NA	Pad 0	LP-1 ^a
Atlas V Family	LC-41	SLC-3	NA	NA	NA
Delta II Family	LC-17	SLC-2	NA	NA	NA
Delta IV Family	LC-37	SLC-6	NA	NA	NA
Falcon I/le	LC-36	SLC-4W	Omelek Island	Pad 0	LP-3 ^b
Falcon 9	LC-40	SLC-4E	Omelek	Pad 0	LP-1
Minotaur I	LC-20 and/or LC-46	SLC-8	NA	Pad 0	LP-1
Minotaur II-III	LC-20 and/or LC-46	SLC-8	NA	Pad 0	LP-1
Minotaur IV ^c	LC-20 and/or LC-46	SLC-8	NA	Pad 0	LP-1
Minotaur V	LC-20 and/or LC-46	SLC-8	NA	Pad 0	NA
Pegasus XL	CCAFS skidstrip KSC SLF	VAFB Airfield	Kwajalein Island	WFF Airfield	NA
Taurus	LC-20 and/or LC-46	SLC-576E	NA	Pad 0	LP-1
Taurus II	NA	NA	NA	Pad 0	LP-3 ^b
Any other launch vehicle/launch site combination for which NASA has completed or cooperated on the NEPA compliance.					

^a
Athena III is currently under design.

^b
LP-3 is currently under design.

^c
While not explicitly listed in this table, the Minotaur IV includes all configurations of this launch vehicle, including the Minotaur IV+, which is a Minotaur IV with a Star 48V 4th stage.

Key: CA = California; CCAFS = Cape Canaveral Air Force Station; KSC = Kennedy Space Center; LC = Launch Complex; LP = Launch Pad; MARS = Mid-Atlantic Regional Spaceport; SLC = Space Launch Complex; SLF = Shuttle Landing Facility; USAKA/RTS = United States Army Kwajalein Atoll/Reagan Test Site; VAFB = Vandenberg Air Force Base; WFF = Wallops Flight Facility.

NASA Routine Payload Checklist

Table C-2. Summary of Envelope Payload Characteristics by Spacecraft Subsystems

Structure	<ul style="list-style-type: none"> • Unlimited: aluminum, beryllium, carbon resin composites, magnesium, titanium, and other materials unless specified as limited.
Propulsion ^a	<ul style="list-style-type: none"> • Liquid propellant(s); 3,200 kg (7,055 lb) combined hydrazine, monomethylhydrazine and/or nitrogen tetroxide. • Solid Rocket Motor (SRM) propellant; 3,000 kg (6,614 lb) Ammonium Perchlorate (AP)-based solid propellant (examples of SRM propellant that might be on a spacecraft are a Star-48 kick stage, descent engines, an extra-terrestrial ascent vehicle, etc.)
Communications	<ul style="list-style-type: none"> • Various 10-100 Watt (RF) transmitters
Power	<ul style="list-style-type: none"> • Unlimited Solar cells; 5 kilowatt-Hour (kW-hr) Nickel-Hydrogen (NiH₂) or Lithium ion (Li-ion) battery, 300 Ampere-hour (A-hr) Lithium-Thionyl Chloride (LiSOCl), or 150 A-hr Hydrogen, Nickel-Cadmium (NiCd), or Nickel-hydrogen (NiH₂) battery.
Science Instruments	<ul style="list-style-type: none"> • 10 kilowatt radar • American National Standards Institute safe lasers (see Section 4.1.2.1)
Other	<ul style="list-style-type: none"> • U. S. Department of Transportation (DoT) Class 1.4 Electro-Explosive Devices (EEDs) for mechanical systems deployment • Radioactive materials in quantities that produce an A2 mission multiple value of less than 10 • Propulsion system exhaust and inert gas venting • Sample returns are considered outside of the scope of this environmental assessment

^a

Propellant limits are subject to range safety requirements.

Key: kg=kilograms; lb=pounds.

GSFC Flight Project Environmental Checklist



1. Project/Program WFIRST	Date:
2. Schedule	
PDR/CDR: PDR: October 28, 2019; CDR - June 14, 2021	Launch Date: September, 2025
3. Current Status	
In Phase A	
4. Project Description	
<p>a. Purpose: Two primary science objectives: Measure acceleration of the expansion of the Universe Search for extra-solar planets</p>	
<p>b. Spacecraft: In-house GSFC developed spacecraft</p>	
<p>c. Instruments: Wide-Field Instrument (joint GSFC/industry development) Coronagraph Instrument (JPL)</p>	
<p>d. Launch Vehicle: TBD - Heavy lift vehicle</p>	
<p>e. Launch Site: Eastern Range</p>	
<p>f. NASAs Involvement/Responsibility: (include other NASA Centers) GSFC - Project Management, spacecraft, portion of Wide Field Instrument, I&T JPL - Coronagraph Instrument KSC - Launch Vehicle</p>	
<p>g. Participants/Locations: Harris Corp, Rochester, NY - Telescope Ball Aerospace, Boulder, CO - Wide Field Instrument (portion)</p>	
<p>h. End-of-Mission Plan: Planned Re-entry (controlled/uncontrolled?) No reentry; at L2</p>	
5. Is there anything controversial or unique about the mission, spacecraft or instruments? If yes, Explain. Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
6. Is the mission compliant with NASA requirements for limiting orbital debris (NPR 8715.6, and NASA Standard 8719.14? Explain non-compliances. Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	

7. During any phase, does the mission/project include or involve: Check yes for all that apply. If uncertain, check the corresponding box. For all that apply, provide an explanation	Check the corresponding box. For all that apply, provide an explanation		
	Yes	No	Uncertain
A. Fuels	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Ionizing Radiation Devices/Sources	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
C. Explosives	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
D. Hazardous Materials/Substances/Chemicals	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Lasers (Class, Earth Pointing)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
F. Disease Producing Pathogenic Microorganisms/Biological Agents	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
G. Discharges/Venting of any Substances into Air, Water, or Soil	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
H. Hazardous Waste Generation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
I. High Noise Levels	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J. Sample Return to Earth	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
K. Radio Frequency Communications	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L. Construction/Modification/Demolition of a Facility/Lab (onsite - offsite)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M. Land Disturbance, Tree Clearing, Removal of Vegetation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
N. Impact on Threatened or Endangered Species	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
O. Impact/Destruction of Sensitive Wildlife Habitat	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
P. Impact on Cultural Resources	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Q. Impact on Local Social or Economic Conditions (Increase in Traffic, Employment, etc.)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
R. Impact on Minority or Low Income Populations	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
S. New or Foreign Launch Vehicle	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
T. Other Issues of Potential Environmental Impact	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
U. Environmental Permits	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Additional Information:

B. Ionizing Radiation Sources - only small cal/test sources, if any; D. Hazardous Materials - None expected, except fuel;
 I. High Noise Levels - None expected, except associated with LV; L. Construction/Modification - only rework/new labs, no new buildings or facilities; M. Land disturbance/tree clearing - None expected at this time; S. Launch Vehicle - Possible use of Falcon 9 Heavy, SLS, New Glenn, Vulcan

8. What Safety Hazards are associated with the mission?

9. Summary of Subsystem Components

Propulsion (Include fuel type, amount, tank size, materials, dimensions)	Fuel type: Hydrazine (N ₂ H ₄), high purity grade per MIL-PRF-26536, Amount: 960 kg (CBE) Tank size: Volume (1 tank)= 22,672 in ³ , 31.5" diameter x 41.65" long. Tank qty - 4. Materials: Tank – titanium, Propellant lines - 304L stainless steel, Other components – primarily stainless steel
Communications	Ka- and S-Band
Structural Materials	Aluminum structure, composite instrument carrier
Power	Standard solar array and batteries; no RTG or other radioactive source
Science Instruments	Wide Field Instrument (WFI) Coronagraph Instrument (CGI)
Hazardous components (radioactive materials, lasers, chemicals, etc.)	None at this time
Other (include dimensions and weight of s/c)	7226 kg (MEV, Observator dry mass) Observatory Dimensions: STOWED: Xdir = 8.9m, Ydir = 4.4m, Zdir = 4.4m DEPLOYED: Xdir = 12.4m, Ydir = 6.6m, Zdir = 6.0m

GSFC Flight Project Environmental Checklist

Project Manager Printed Name: Jamie Dunn	Signature Field JAMIE DUNN	Digitally signed by JAMIE DUNN Date: 2019.09.05 06:57:14 -04'00'	Date:	Phone Number:	Org Code: 448.0
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Comments: