NASA
George C. Marshall Space Flight Center
RECORD OF ENVIRONMENTAL CONSIDERATION

Project: Imaging X-ray Polarimetry Explorer (IXPE)

Description and Location of Proposed Action: The IXPE mission will fly three space telescopes with cameras capable of measuring the polarization of cosmic X-rays from astronomical objects, such as stellar and supermassive black holes, neutron stars and pulsars. The IXPE mission is slated to fly on a Pegasus vehicle which will be launched from Kwajalein Atoll.

A. Anticipated Date and/or Duration of the Proposed Action:
Project start date: January 17, 2017
Date of launch: November 20, 2020

B. It has been determined that the above action:

a. _____ Is adequately covered in and existing ____ EA, ____ EIS, entitled _____ and dated _____.

b. _____ Qualifies for Categorical Exclusion as described by NPG 8580.1, page _____, Section _____ and NASA NEPA regulations 14 CFR 1216.305, and has no special circumstances which would suggest a need for an Environmental Assessment.

c. _____ Is exempt from NEPA requirements under the provisions of (cite superseding law): _____.

d. ___X__ Has no environmental impact as indicated by the results of an Environmental Analysis Check Sheet and/or a detailed Environmental Analysis (attach check sheet and/or Environmental Analysis as applicable).

e. _____ Will require an Environmental Assessment or Environmental Impact Statement.

f. _____ Will include mitigation as described below:

Other Environmental Consideration (i.e. permits, hazardous material handling):

Signed: Ed Kansky **Date:** 6/22/17
Manager, Environmental Engineering and Occupational Health (EEOH) Office

NASA Routine Payload Checklist

PROJECT NAME: Imaging X-ray Polarimetry Explorer (IXPE) DATE OF LAUNCH: November 20, 2020
PROJECT CONTACT: Randy Baggett PHONE NUMBER: 256-961-7404 MAILSTOP: ST16
PROJECT START DATE: January 17, 2017 PROJECT LOCATION: MSFC
PROJECT DESCRIPTION: The IXPE mission will fly three space telescopes with cameras capable of measuring the polarization of cosmic X-rays from astronomical objects, such as stellar and supermassive black holes, neutron stars and pulsars. The IXPE mission is slated to fly on a Pegasus vehicle which will be launched from Kwajalein Atoll. The IXPE detector system contains a small amount of radioactive material which is in the lowest level of reporting and approval category. The IXPE Project will comply with all requirements for nuclear launch safety reporting and approval in accordance with NPR 8715.3. Beryllium or beryllium compounds can be found in different components and parts used in the IXPE Observatory. The use of beryllium articles in and of themselves does not present a hazard. The IXPE Project will not be modifying any elements that contain beryllium. The IXPE Observatory also contains lithium ion batteries and an S-band communications transceiver both of which are well within the Envelop Payload Characteristics in Table C-2 below.

A. SAMPLE RETURN:	**YES**	**NO**
1. Would the candidate mission return a sample from an extraterrestrial body?		X
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?		X
Provide a copy of the Radioactive Materials On Board Report as per NPR 8715.3 with the ERP submittal		
C. LAUNCH AND LAUNCH VEHICLES	**YES**	**NO**
1. Would the candidate spacecraft be launched on a vehicle and launch site combination other than those listed in Table C-1 below?		X
2. Would launch of the proposed mission exceed the approved or permitted annual launch rate for the particular launch vehicle or launch site?		X
Comments: None		
D. FACILITIES	**YES**	**NO**
1. Would the candidate mission require the construction of any new facilities or substantial modification of existing facilities?		X
Provide a brief description of the construction or modification required, including whether ground disturbance and/or excavation would occur: **Not Applicable.**		
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 EPCs in Table C-2 below?		X
2. Would the expected risk of human casualty from spacecraft planned orbital reentry exceed the criteria specified by NASA Standard 8719.14?		X
3. Would the candidate spacecraft utilize any potentially hazardous material as part of a flight system whose typo or amount precludes acquisition of the necessary permits prior to its use or is not included within the definition of the Envelope Payload Characteristics?		X
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?		X
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?		X
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)?		X
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 (BSL1)[1]?		X
Comments:		
F. OTHER ENVIRONMENTAL ISSUES:	**YES**	**NO**
1. Would the candidate spacecraft have the potential for substantial effects on the environment outside the United States?		X
2. Would launch and operation of the candidate spacecraft have the potential to create substantial public controversy related to environmental issues?		X
3. Would any aspect of the candidate spacecraft that is not addresses 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)?		X
Comments: None		

[1] The 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.

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)	N/A	Pad 0	LP-1[a]
Atlas V Family	LC-41	SLC-3	N/A	N/A	N/A
Delta II Family	LC-17	SLC-2	N/A	N/A	N/A
Delta IV Family	LC-37	SLC-6	N/A	N/A	N/A
Falcon 1/1e	LC-36	SLC-4W	Omelek Island	Pad 0	LP-3[b]
Falcon 9	LC-40	SLC-4E	Omelek	Pad 0	LP-3[b]
Minotaur I	LC-20 and/or LC-46	SLC-8	N/A	Pad 0	LP-1
Minotaur II-III	LC-20 and/or LC-46	SLC-8	N/A	Pad 0	LP-1
Minotaur IV	LC-20 and/or LC-46	SLC-8	N/A	Pad 0	LP-1
Minotaur V	LC-20 and/or LC-46	SLC-8	N/A	Pad 0	LP-1
Pegasus XL	CCAFS skidstrip KSC SLF	VAFB Airfield	Kwajalein Island	WFF Airfield	N/A
Taurus	LC-46 and/or LC-20	SLC-576E	N/A	Pad 0	LP-1
Taurus II	NA	NA	N/A	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 and LP-3 are currently under design.

[b]. 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=Vanderberg Air Force Base; WFF=Wallops Flight Facility.

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

Structure	• Unlimited: aluminum, beryllium, carbon resin composites, magnesium, titanium, and other materials unless specified as limited.
Propulsion[a]	• Liquid propellant(s); 3,200 kg (7,055 lb) combined hydrazine, monomethyhydrazine 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	• Various 10-100 Watt (RF) transmitters
Power	• Unlimited Solar cells; 5 kilowatt-Hour (kW-hr) Nickel-Hydrogen (NiH_2) 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 ($Ni-H_2$) battery.
Science Instruments	• 10 kilowatt radar • American National Standards Institute safe lasers (see Section 4.1.2.1)
Other	• 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