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

March 3, 2015

Reply to Attn of:
460

MEMORANDUM FOR THE RECORD

The National Environmental Policy Act Compliance for Global-scale Observations of the Limb and Disk

1.0 Introduction

The National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, *et seq.*), requires Federal agencies to consider the environmental impacts of a project in their 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 has prepared an environmental assessment (EA) for routine payloads launched on expendable launch vehicles (Ref: *Environmental Assessment for Launch of NASA Routine Payloads*, November 2011). The 2011 NASA Routine Payload Environmental Assessment (NRPEA) assesses the environmental impacts of missions launched with spacecraft that are considered routine payloads from existing launch facilities at Cape Canaveral Air Force Station (CCAFS), FL, Vandenberg Air Force Base (VAFB), CA, the United States Army Kwajalein Atoll/Reagan Test Site (USAKA/RTS), RMI, NASA's Wallops Flight Facility (WFF), VA, and the Kodiak Launch Complex (KLC), AK.

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 EA meet specific criteria ensuring that the spacecraft, its operation and decommissioning, do not present any new or substantial environmental or safety concerns.

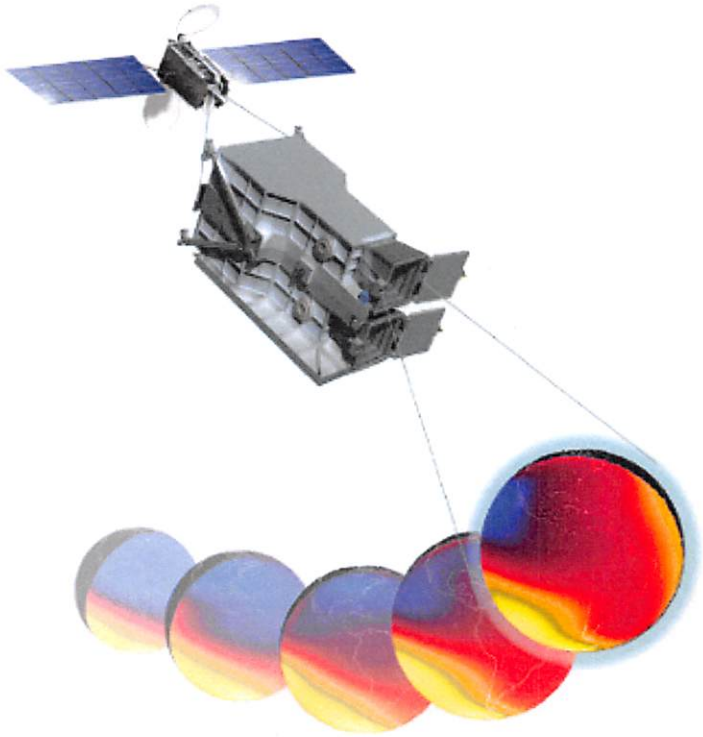
To determine the applicability of a routine payload classification for a mission, the mission is evaluated against the criteria defined in the EA using the routine payload checklist (RPC).

2.0 Mission Description

The Global-scale Observations of the Limb and Disk (GOLD) mission is a NASA mission of opportunity that will be the first mission to study the weather of the thermosphere-ionosphere rather than its climate. The GOLD mission will use an ultraviolet imaging spectrograph flying as a hosted

payload on a geostationary satellite to perform remote-sensing measurements of densities and temperatures in the thermosphere and ionosphere. GOLD will be able to make observations from an entire hemisphere (disk) and the horizon (limb) of the Earth.

GOLD will fill a critical gap in our knowledge of Sun-Earth connections by examining the response of the upper atmosphere to forcing from the Sun, the magnetosphere and the lower atmosphere. The measurements from GOLD will be used, in conjunction with advanced models of the thermosphere and ionosphere, to revolutionize our understanding of the space environment and are important for understanding satellite drag, and ionospheric disruptions of communications and navigation.



GOLD is a principal investigator (PI) led mission. As the PI institution, the University of Central Florida (UCF) is accountable to NASA for the success of the investigation, with full responsibility for its scientific integrity and for its execution within committed cost and schedule.

The University of Colorado at Boulder's Laboratory for Atmospheric and Space Physics (LASP) is responsible for building the GOLD instrument, instrument-level integration and testing (I&T), working with the spacecraft vendor to integrate GOLD on to the spacecraft and test during spacecraft I&T, working with the host mission to command and monitor GOLD during launch, orbit raising, and on-orbit operations. UCF is also responsible for the GOLD Science Data Center (SDC). The Explorers program at Goddard Space Flight Center is responsible for providing project oversight.

The GOLD instrument is made up of two ultraviolet imaging spectrographs, which independently image the Earth's limb and disk, and a common electronics assembly which is packaged in a single housing. The GOLD flight ground system will consist of four main elements: the host mission Satellite Control Center (SCC), the GOLD Ground Station (GGS), the Science Operations Center (SOC) LASP, Boulder, CO, and the SDC UCF, Orlando, FL. Existing facilities will be utilized for ground system operations. Both the SCC and the GGS are entities provided by SES Government Solutions. Final locations of these entities will be known once the host mission provider and GEO slot are determined.

GOLD will fly as a hosted payload on a commercial communications satellite provided by SES Government Solutions. SES Government Solutions, as the host mission provider, will own and operate the satellite and will be responsible for the satellite procurement, launch operations, orbit insertion, satellite operations and antenna/ground station operations. The satellite vendor, launch vehicle, and launch location are still to be determined with the possibility of a foreign launch.

The launch is currently planned for fall of 2017. The launch vehicle and launch location will be identified prior to the GOLD Critical Design Review in the summer of 2015.

3.0 NASA Routine Payload Determination

The GOLD instrument will be hosted on a commercial communications satellite. NASA has no control over the satellite, the launch vehicle, or launch site activities. The launch of the commercial communications satellite will occur with or without NASA's GOLD instrument. NASA is not responsible for any NEPA compliance documentation associated with the satellite, launch vehicle, or launch site operations (*see* 40 C.F.R. § 1508.18). NASA is responsible for executing this NEPA review for the GOLD instrument because it has primary control and responsibility for the GOLD instrument.

The components utilized in the GOLD instrument are made of materials normally encountered in the space industry. GOLD will not utilize radioactive sources, will not carry pathogenic organisms and will not return samples to Earth. No reentry is planned for the GOLD instrument.

The GOLD instrument has been evaluated against the 2011 NRPEA, using the RPC (see enclosed evaluation recommendation package). The evaluation indicates that the GOLD instrument meets the criteria for a routine payload and falls within the scope of the reference EA. The instrument does not present any unique or unusual circumstances that could result in new or substantial environmental impacts. Based on the analyses set forth in the 2011 NRPEA, NASA has determined that the environmental impacts associated with the GOLD instrument will not individually or

cumulatively have a significant impact on the quality of the human environment and that a routine payload classification for the GOLD instrument is applicable. No additional NEPA action or documentation is required.

George W. Morrow
Director of Flight Projects

2/2/15
Date

Christopher J. Scolese
Director

3/3/15
Date

Enclosure

Reference
http://www.gold-mission.org/
http://www.gold-mission.org/GOLD_EX_Factsheet.pdf
http://www.gold-mission.org/DL/GOLD_AGU_JA_Poster_May2007_Rusch.pdf
GOLD Mission Concept of Operations, 135982rev B

EVALUATION RECOMMENDATION PACKAGE

Record of Environmental Consideration
Routine Payload Checklist
Flight Project Environmental Checklist

Enclosure

RECORD OF ENVIRONMENTAL CONSIDERATION

1. Project Name: Global-scale Observations of the Limb and Disk (GOLD)

2. Description/location of proposed action: The Global-scale Observations of the Limb and Disk (GOLD) mission is a NASA mission of opportunity that will be the first mission to study the weather of the thermosphere-ionosphere rather than its climate. The GOLD mission will use an ultraviolet imaging spectrograph flying as a hosted payload on a geostationary satellite to perform remote-sensing measurements of densities and temperatures in the thermosphere and ionosphere. GOLD will be able to make observations from an entire hemisphere (disk) and the horizon (limb) of the Earth.

Date and/or Duration of project: Launch – Fall 2017

3. 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 which would suggest a need for an Environmental Assessment.
Categorical Exclusion: _____

☐ c. Is exempt from NEPA requirements under the provisions of: _____

☐ d. Is covered under EO 12114, not NEPA.

☐ e. Has no significant environmental impacts as indicated by the results of an environmental checklist and/or detailed environmental analysis.
(Attach checklist or analysis as applicable)

☐ f. Will require the preparation of an Environmental Assessment.

☐ g. Will require the preparation of an Environmental Impact Statement.

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

Beth Montgomery — NEPA Program Manager, Code 250 — Date: 1/15/15

Steven Horowitz — Project Manager, Code 460 — Date: 1/21/15

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: The Global-scale Observations of the Limb and Disk (GOLD) Mission		Date of Launch: September 2017 (TBC)
Project Contact: Steven Horowitz / Mission Manager	Phone Number: 301-286-4620	Mailstop: Code 460
Project Start Date: May 2013	Project Location: PI is at UCF/Orlando FL; The project is at LASP/Boulder, CO; & s/c provide is SES-GS / Reston, VA	

Project Description:
Global-scale Observations of the Limb and Disk (GOLD) is a NASA Mission of Opportunity to perform remote-sensing measurements of the Earth's thermosphere and ionosphere, using an ultraviolet imaging spectrograph located in a geostationary orbit.

	Yes	No
A. Sample Return:		
1. Would the candidate mission return a sample from an extraterrestrial body?	☐	☑
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?	☐	☑
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?	☑	☐
2. Would the proposed mission exceed the approved or permitted annual launch rate for the particular launch vehicle or launch site?	☐	☑

Comments:
The commercial communication satellite manufacture & the commercial launch vehicle are not selected yet (will be selected by CDR). After the spacecraft & launch vehicle are selected, these initial responses will be confirmed. NASA has no control over the satellite/launch vehicle/site.

	Yes	No
D. Facilities:		
1. Would the candidate mission require the construction of any new facilities or substantial modification of existing facilities?	☐	☑
Provide a brief description of the construction or modification required, including whether ground disturbance and/or excavation would occur.		
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?	☐	☑
2. Would the expected risk of human casualty from spacecraft planned orbital reentry exceed the criteria specified by NASA Standard 8719.14?	☐	☑
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?	☐	☑
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?	☐	☑
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?	☐	☑
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)?	☐	☑
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]?	☐	☑

Comments:
The commercial communication satellite manufacture and the commercial launch vehicle are not selected yet (will be selected by CDR). After the spacecraft and the launch vehicle are selected, these initial responses will be confirmed.

Continued on next page

[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.

NASA ROUTINE PAYLOAD CHECKLIST

Project Name:		Date of Launch:
The Global-scale Observations of the Limb and Disk (GOLD) Mission		September 2017 (TBC)
Project Contact:	**Phone Number:**	**Mailstop:**
Steven Horowitz / Mission Manager	301-286-4620	Code 460
Project Start Date:	**Project Location:**	
May 2013	PI is at UCF/Orlando FL; The project is at LASP/Boulder, CO; & s/c provide is SES-GS / Reston, VA	

Project Description:
Global-scale Observations of the Limb and Disk (GOLD) is a NASA Mission of Opportunity to perform remote-sensing measurements of the Earth's thermosphere and ionosphere, using an ultraviolet imaging spectrograph located in a geostationary orbit.

F. Other Environmental Issues:	Yes	No
1. Would the candidate spacecraft have the potential for substantial effects on the environment outside the United States?	☐	☑
2. Would launch and operation of the candidate spacecraft have the potential to create substantial public controversy related to environmental issues?	☐	☑
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)?	☐	☑

Comments:
The commercial communication satellite manufacture and the commercial launch vehicle are not selected yet (will be selected by CDR). After the spacecraft and the launch vehicle are selected, these initial responses will be confirmed.

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/Ie	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.

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.

Goddard Space Flight Center
FLIGHT PROJECT ENVIRONMENTAL CHECKLIST

1. PROJECT/PROGRAM	Date:
The Global-scale Observations of the Limb and Disk (GOLD) Mission	12/9/14

2. SCHEDULE

PDR/CDR:	Launch Date:
PDR	September 2017

3. CURRENT STATUS

Held the PDR on 12/9-11/2014, the CMC is late January 2015, and the KDP-C is late February 2015.

4. PROJECT DESCRIPTION

a. Purpose:

Global-scale Observations of the Limb and Disk (GOLD) is a NASA Mission of Opportunity to perform remote-sensing measurements of the Earth's thermosphere and ionosphere, using an ultraviolet imaging spectrograph located in a geostationary orbit. The goal of the mission is to provide answers to key elements of a fundamental challenge of Heliophysics science: What is responsible for the dramatic variability in many of the state variables describing the ionosphere-thermosphere-mesosphere region?

b. Spacecraft:

The commercial communication satellite owner/operator is not yet under contract. The owner/operator has not yet selected the spacecraft manufacturer or the launch vehicle. If the GOLD instrument is significantly delayed, the communications satellite will launch without the GOLD instrument.

c. Instruments:

The GOLD instrument (spectrograph) consists of two independent, mirror-image channels. Each measures airglow emissions in the far-ultraviolet from 132 to 162 nm, with 0.15 nm spectral resolution, scanning the disk and limbs in the east-west direction with a 30-minute cadence.

d. Launch Vehicle:

TBD (the commercial communication satellite owner will procure the launch vehicle).

e. Launch Site:

TBD

f. NASAs Involvement/Responsibility:

NASA/GSFC is the program office and provides the mission manager.

g. Participants/Locations:

UCF / Orlando FL
LASP / Boulder, CO
SES-GS / Reston, VA

h. End-of-Mission Plan: Planned Re-entry (controlled/uncontrolled?)

At the end of mission, the geosynchronous communication satellite is boosted to a graveyard orbit, a few hundred kilometers above the operational orbit.

5. Is there anything controversial or unique about the mission, spacecraft or instruments? If yes, Explain. Yes ☐ No ☑

GOLD is a mission of opportunity flying on a commercial communication satellite as a hosted payload.

6. Is the mission compliant with NASA requirements for limiting orbital debris (NPR 8715.6, and NASA Standard 8719.14? Explain non-compliances. Yes ☑ No ☐

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. Use the additional space below if needed.	Yes	No	Uncertain
A. Fuels	☐	☑	☐
B. Ionizing Radiation Devices/Sources	☐	☑	☐
C. Explosives	☐	☑	☐
D. Hazardous Materials/Substances/Chemicals	☐	☑	☐
E. Lasers (Class, Earth Pointing)	☐	☑	☐
F. Disease Producing Pathogenic Microorganisms/Biological Agents	☐	☑	☐
G. Discharges/Venting of any Substances into Air, Water, or Soil	☐	☑	☐
H. Hazardous Waste Generation	☐	☑	☐
I. High Noise Levels	☐	☑	☐
J. Sample Return to Earth	☐	☑	☐
K. Radio Frequency Communications	☐	☑	☐
L. Construction/Modification/Demolition of a Facility/Lab (onsite - offsite)	☐	☑	☐
M. Land Disturbance, Tree Clearing, Removal of Vegetation	☐	☑	☐
N. Impact on Threatened or Endangered Species	☐	☑	☐
O. Impact/Destruction of Sensitive Wildlife Habitat	☐	☑	☐
P. Impact on/near Areas of Cultural Significance	☐	☑	☐
Q. Impact on Local Social or Economic Conditions (Increase in Traffic, Employment, etc.)	☐	☑	☐
R. Impact on Minority or Low Income Populations	☐	☑	☐
S. New or Foreign Launch Vehicle	☐	☑	☐
T. Other Issues of Potential Environmental Impact	☐	☑	☐
U. Environmental Permits	☐	☑	☐
Additional Information			

8. What Safety hazards are associated with the mission?
None

9. Summary of Subsystem Components	
Propulsion (Include fuel type, amount, tank size, materials, dimensions	None
Communications	None
Structural Materials	AL and composites.
Power	Not generating or storing power.
Science Instruments	GOLD is flying one instrument on the communication satellite.
Hazardous Components (radioactive materials, lasers, chemicals, etc.)	None
Other (include dimensions and weight of s/c)	S/C mass and dimensions: TBD (will be defined after the contract is awarded) P/L mass and dimensions: 33 kg (CBE) and 51 × 55 × 69 cm3

Goddard Space Flight Center
FLIGHT PROJECT ENVIRONMENTAL CHECKLIST

Project Manager Printed Name:	Project Manager Signature:		
Steven Horowitz / Mission Manager			
Project Name:	**Date:**	**Phone Number:**	**Org. Code:**
Global-scale Observations of the Limb and Disk (GOLD)	12/9/2014	301-286-4620	460

Comments: