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

PROJECT NAME: Tracking and Data Relay Satellite (TDRS) M

1. **Description of proposed action:** TDRS-M is the third and final space communications satellite of the current generation of TDRS-K, L & M satellites that will replenish NASA's Space Network. The objective of the replenishment program is to provide follow-on spacecraft required to maintain and expand the Space Network by replacing the current constellation of geosynchronous TDRS satellites as they begin to exceed their designed lifetimes. The satellites and launch vehicles/launch sites in the TDRS KLM generation are identical.

   Date and/or Duration of project: Launch – August 2017
   Location: Launch – Cape Canaveral Air Force Station

2. It has been determined that the above action:

☒ a. Is adequately addressed in an existing EA or EIS.
   Title: *Environmental Assessment for Launch of NASA Routine Payloads*
   Date: November 2011
   (Ref: Memorandum for the Record – NEPA Compliance for TDRS-K, L August 1, 2009)

☐ 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.

Beth Montgomery 3/10/17

Beth Montgomery Date
GSFC NEPA Manager, Code 250

3/13/17

Dave Littmann Date
Project Manager, Code 454

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 [IEIS]) 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: TDRS M Mission		Date of Launch: August 2017
Project Contact: Dave Littmann	Phone Number: 301-286-8520	Mailstop: 454
Project Start Date: 12/28/2007	Project Location: GSFC Managed, Boeing El Segundo Prime Contractor	

Project Description:
Design, Develop, Build, Ship, Launch, Achieve Orbit, Deploy, Activate, Calibrate and Complete On-Orbit Verification and Acceptance of the TDRS-M S/C

	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.	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?	☐	☒
2. Would the proposed mission exceed the approved or permitted annual launch rate for the particular launch vehicle or launch site?	☐	☒
Comments:		
D. Facilities:	Yes	No
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:		

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 (continuation)

Project Name: TDRS M Mission		Date of Launch August 2017
Project Contact: Dave Littmann	Phone Number: 301-286-8520	Mailstop: 454
Project Start Date: 12/28/2007	Project Location: GSFC Managed, Boeing El Segundo Prime Contractor	

Project Description:
Design, Develop, Build, Ship, Launch, Achieve Orbit, Deploy, Activate, Calibrate and Complete On-Orbit Verification and Acceptance of the TDRS-M S/C

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:

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 (NiH_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.

GSFC Flight Project Environmental Checklist

1. Project/Program	Date:
Tracking and Data Relay Satellite (TDRS) M	02/16/2017

2. Schedule

PDR/CDR:	Launch Date:
PDR (N/A) / CDR: March 2013	August 2017

3. Current Status

TDRS K/L Contract Award in December 2007; TDRS-M Option ATP exercised 12/2011. TDRS-M Pre-Ship Review scheduled for June 2017

4. Project Description

a. Purpose:
Design, Develop, Build, Ship, Launch, Achieve Orbit, Deploy, Activate, Calibrate and Complete On-Orbit Verification and Acceptance of the TDRS-M S/C

b. Spacecraft:
Tracking and Data Relay Satellite (M)

c. Instruments:
Telecommunications Payload including receivers, processors, transmitters, antennas and associated equipment required to relay RF signals

d. Launch Vehicle:
Atlas V

e. Launch Site:
Eastern Test Range

f. NASAs Involvement/Responsibility: (include other NASA Centers)
Progam and Technical Management of contract to the Boeing Company

g. Participants/Locations:
NASA/GSFC, Greenbelt, Md; The Boeing Company, Satellite Development Center, El Segundo, CA; NASA/Kennedy Space Center, FL

h. End-of-Mission Plan: Planned Re-entry (controlled/uncontrolled?)
At the end of the mission, the TDRS-M satellite will be retired to a super synchronous orbit

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

None, similar in function and operation to TDRS K/L and the current on-going TDRSS missions.

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 ☐

Compliant with NPR 8715.6 and NASA Standard 8719.14

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	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 Cultural Resources	☐	☒	☐
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:
A: Liquid Bi propellants (Nitrogen tetroxide oxidizer and Monomethyl hydrazine fuel); C: Pyrotechic Actuators; D: Ammonia in Heat pipes; K: See Section 9, Communications

8. What Safety Hazards are associated with the mission?

Liquid Bi propellants (Nitrogen tetroxide oxidizer and Monomethyl hydrazine fuel), Pryotechnic Actuators, 4200 psia COPV

9. Summary of Subsystem Components

Propulsion (Include fuel type, amount, tank size, materials, dimensions	Four spherical tanks, two composite overwrap pressure vehicles (COPV); propellant tanks are titanium 6Al-4V with 1035 kg NTO in two tanks, 638 kg of MMH in two propellant tanks.
Communications	S, Ku and Ka band antennas with Solid State Power Amplifiers and TWTA (70W)
Structural Materials	Aluminum honeycomb, graphite composite, titanium, beryllium, steel
Power	Solar Cells; 110 AHr NiH2 battery
Science Instruments	None, payload is communications equipment
Hazardous components (radioactive materials, lasers, chemicals, etc.)	Liquid Bi propellants (Nitrogen tetroxide oxidizer and Monomethyl hydrazine fuel), Pryotechnic Actuators, 4200 psia COPV
Other (include dimensions and weight of s/c)	3313 kg total mass, 1673 kg fuel 824 inch x 537 inch x 300 inch deployed

GSFC Flight Project Environmental Checklist

Project Manager Printed Name:	Signature Field		
David Littmann	DAVID LITTMANN Digitally signed by DAVID LITTMANN DN: c=US, o=U.S. Government, ou=NASA, ou=People, cn=DAVID LITTMANN, 0.9.2342.19200300.100.1.1=dlittman Date: 2017.03.06 15:56:19 -05'00'		
Project Name:	Date:	Phone Number:	Org Code:
Tracking and Data Relay Satellite (TDRS) M	March 6, 2017	(301) 286-8520	454

Comments:
Third and Final satellite of the current generation of TDRS-K,L & M Satellites. TDRS-K and TDRS-L were launched in January 2013 and 2014 respectively, on a Atlas V from the Eastern Test Range. TDRS-K and L had a nominal launch and orbit raising phase of their respective missions and are currently supporting Space Network operations. Identically, TDRS-M, will launch on an Atlas V, in August 2017 from the Eastern test range, pad 41.