ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station

ECOSTRESS Project Overview

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Jet Propulsion Laboratory, California Institute of Technology
Project Overview

**ECOSTRESS is an Earth Venture Instrument-2 on the ISS**

**Overview:**
- Cost-Capped, $29.9M Cat 3/Risk class D per NPR 7120.5E/NPR 8705.4
  - Type II project with tailoring of the JPL flight practices, single string with limited redundancy using COTS hardware
- August 2017 planned payload “delivery to storage” date with an April 2018 planned launch date
- Launch on SpX-15 and deployed on the ISS on JEM-EFU 10
- Baseline operations: 1 year after 30 days on-orbit checkout

**Timeline:**

<table>
<thead>
<tr>
<th>Cal Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<td>Phase</td>
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<td>B</td>
<td>C</td>
<td>ACC</td>
<td>D/E</td>
<td>F</td>
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<tr>
<td>Milestone</td>
<td>ATP</td>
<td>SRR/MDR</td>
<td>PDR</td>
<td>CDR</td>
<td>PL Completion</td>
<td>Delivery</td>
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<td>Launch</td>
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<td>TRR</td>
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<td>PSR SR</td>
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</table>

- ATP: Advance Technology Planning
- SRR: System Requirements Review
- MDR: Mission Design Review
- PDR: Preliminary Design Review
- CDR: Critical Design Review
- TRR: Test Readiness Review
- CoFR: Conceptual Flight Readiness
- HRCR: Hardware Readiness Critical Review
- PSR: Preliminary System Review
- SR: System Review
- CDR: Critical Design Review
- PL Completion: Payload Completion
- Delivery: Delivery
- Launch: Launch
Cost Capped vs Accommodation Scope

- Cost-capped project includes everything from Phase A through Phase E of the science investigation except the following identified items:

  - Other accommodation scope
    - ISS & LV System Engineering
    - Management & Mission Assurance for Accommodation scope
    - ATLO Phase
    - DAAC Interface & Archival
    - Phase C gap and storage

- High Efficiency Cryocoolers
- "Stand-offs" for payload testing
- Wi-Fi Hardware (Electronics/Firmware interfaces, memory and antennas)
- Oversight for Static Payload aperture cover (integrated in the Dragon Trunk)
Interfaces and Provided Hardware

- ECOSTRESS will launch in Dragon Trunk of a Falcon 9 launch vehicle
  - Receive survival power while stowed in trunk
  - Will use a standard JEM-EF payload vehicle interface attachment
- Robotically installed on JEM-EF
  - Will use both Canadian arm and transfer to Japanese arm
  - No planned EVA (same as performed on CATS)
- ECOSTRESS will be hosted on the ISS’s Japanese Experimental Module - Exposed Facility Unit 10 (JEM-EFU)
  - Will use the fluid loop for removing payload heat, 1553 for command and receive power
- ISS External Wireless Communications (EWC) expansion program to provide wireless science data transfer between ECOSTRESS and ISS by May 2017
  - The ISS will provide a delay tolerant network (DTN) and downlink the data through TDRSS
- The LP DAAC will be used for science and MSFC Payload Operations
- GFE and GSE per PIA
  - JEM-EF payload hardware; PIU, FRGF and H-fixture
  - Wi-Fi hardware; Moxa card
  - LV interface hardware; pFSE
  - GSE; RAPTR, WAP and PIU Adaptor
Mission Overview

Radiometer Instrument

ECOSTRESS Payload

Dragon-Trunk Falcon-9 LV

Installation on JEM-EF

Science Data Processing and Archive

MOS and Ground and Space Network

ISS

Data Collection

EOL Payload disposal via Dragon Trunk re-entry

Radiometer Instrument

ECOSTRESS Payload

Dragon-Trunk Falcon-9 LV

Installation on JEM-EF

Science Data Processing and Archive

MOS and Ground and Space Network

ISS

Data Collection

EOL Payload disposal via Dragon Trunk re-entry
Decommissioning, Disposal Plans and Re-Entry Debris Assessment

• ECOSTRESS Payload disposal will be via Dragon trunk jettison prior to Dragon capsule re-entry
  – The Flight Support Equipment (FSE) separation mechanism will be used for interface during disposal

• The reentry vehicle is targeted in remote ocean areas with high reliability (Controlled reentry) and the risks from debris that survive reentry has been pre-assessed as part of the overall risk for the returning vehicle

• JSC is responsible for ensuring safe disposal plan
  – JPL will supply materials information for orbital debris

• JPL has filed ECLASS (Environmental Compliance Launch Approval Status System) required documentation
## Major Milestones

<table>
<thead>
<tr>
<th>Item</th>
<th>Date</th>
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<tbody>
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<td>ETRR</td>
<td>April 2017*</td>
</tr>
<tr>
<td>Safety Phase III Review</td>
<td>June 2017</td>
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<tr>
<td>HRCR/CoFR*</td>
<td>Aug 2017</td>
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<tr>
<td>Payload Completion</td>
<td>Aug 2017</td>
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<tr>
<td>Storage Review</td>
<td>Aug 2017*</td>
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<td>Delivery to Storage</td>
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<tr>
<td>Pre-Ship Review</td>
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<td>ORR</td>
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<td>End of storage period</td>
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<td>Phase D Start</td>
<td>Jan 2018</td>
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<td>Ship to launch site</td>
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<td>Launch</td>
<td>Apr 2018</td>
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<tr>
<td>Complete IOC / begin Ops</td>
<td>May 2018</td>
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<tr>
<td>Phase E Start</td>
<td>May 2018</td>
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<td>Phase F Start</td>
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*center-led review*
## ECOSTRESS Investigation Schedule

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<th>Phases</th>
<th>FY14</th>
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<th>FY16</th>
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### Reviews & Milestones

- SRR/MDR 2/10
- PDR 7/28
- CDR 3/8
- ISS PDR 6/23
- ISS CDR 2/10

### ISS Safety Reviews

- Safety TIM 3/24
- PSDR I 7/14
- PSDR II 2/9

### Status Date: 4/30/2017

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**Acronyms:**

- **ACCU:** Accumulator
- **CC:** Cryocooler
- **CDR:** Critical Design Review
- **FMEA:** Failure Modes and Effects Analysis
- **FOV:** Field of View
- **HE CC:** High Efficiency Cryocooler
- **ICD:** Interface Control Document
- **I&T:** Integrate and Test
- **ISS:** International Space Station
- **KDP:** Key Decision Point
- **MDR:** Mission Definition Review
- **ORR:** Operations Readiness Review
- **PDR:** Preliminary Design Review
- **PR:** Peer Review
- **PSDR:** Payload Safety Design Review
- **PSR:** Project Status Report
- **SRR:** System Requirements Review
- **TRR:** Test Readiness Review

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**Subsystem**

- **Critical Path**
- **Secondary Path**
- **Milestones**
- **Funded Schd Reserve (days)**
- **Safety Reviews**
- **Archive**

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