HyspIRI

DRAFT PRELIMINARY Level 1 Requirements

NASA Earth Science and Applications Decadal Survey

Robert O. Green, Simon Hook, Betsy Middleton, Stephen Ungar, Bob Knox, Woody Turner, John LaBrecque and the HyspIRI Team

Overview

Beginning in January 2007 a Mission Concept effort for HyspIRI Mission has been under way with involvement of NASA HQ, JPL, GSFC, and a broad Science Study Group and the 2008 workshop, 2009 workshop, 2010 symposium.

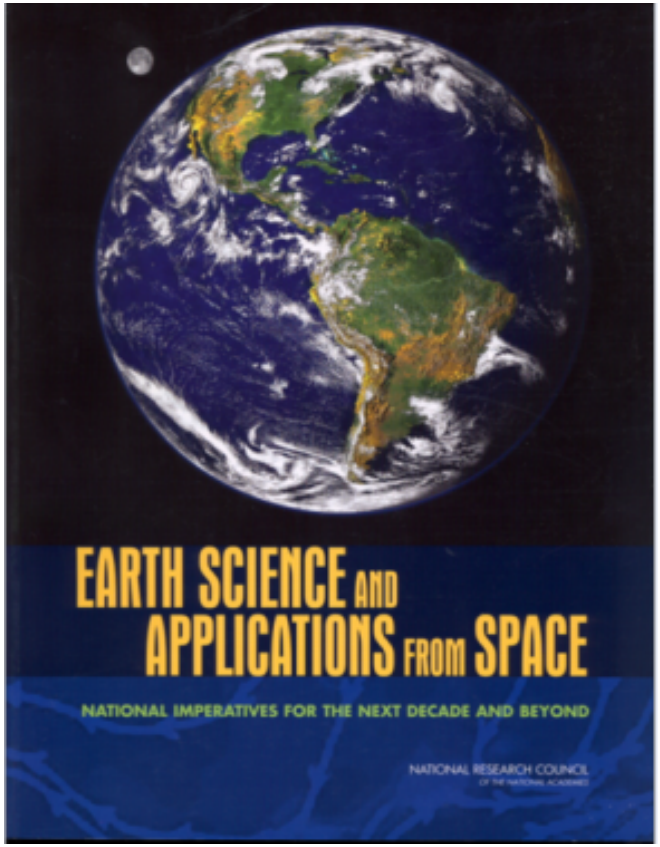
With the call of the NASA Earth Science and Applications Decadal Survey this team has worked to develop a end-to-end concept for implementation of the HyspIRI Mission.

Based on this effort and with input from SSG and the relevant communities a set of Level 1 Requirements and Success Criteria have been develop in accordance with the required NASA process.

The Level 1 Requirements are a NASA Headquarters Document and provide an important basis for tracking the progress and judging the success of HyspIRI

HyspIRI Science Study Group
(Selected by NASA Program Science Leadership)

- Request list from authors



Level 1 Requirements Outline

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- 3.1 Project Organization and Management
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11.0 Approvals and Concurrences

Level 1 Requirements

Draft Preliminary

HyspIRI

Visible to Short Wavelength Infrared Imaging Spectrometer and Thermal Infrared Imager (HyspIRI) Decadal Survey Earth Science and Applications Mission

Level 1 Requirements and Mission Success Criteria

Version X-8.0
Date: August 27, 2010

Owner: NASA Decadal Survey HyspIRI Program Executive and Program Scientist

Draft Preliminary

Level 1 Requirements

- ***2.2. Science Objectives***

- The HyspIRI Project will implement an earth observation space mission designed to collect and deliver global surface spectral reflectance, remote sensing reflectance over shallow water, thermal emissivity and surface temperature imaging measurements that will enable science and applications users to advance the current understanding of the Earth's ecology, biogeochemistry, biodiversity, coastal and inland water research, geology, natural hazards, hydrology, climate, climate change impact and adaptation, and studies of the carbon cycle[NRC DS].

Level 1 Requirements

4. Performance Requirements

4.1 Science Requirements

The science objectives in Section 2.2 can be achieved by either the baseline or minimum science mission requirements listed here, but the baseline mission provides substantially more value to NASA and the Earth Science Community.

- **4.1.1 Requirement: Baseline Science Mission**
- *The scientific requirements that must be achieved in order to fully satisfy the baseline science objectives.*

- a) VSWIR

- b) TIR

- c) Combined

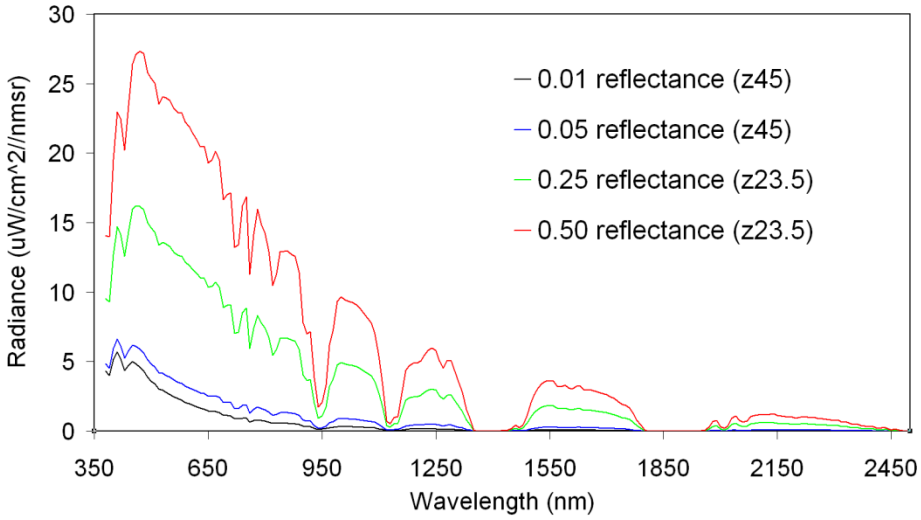
Level 1 Requirements

VSWIR

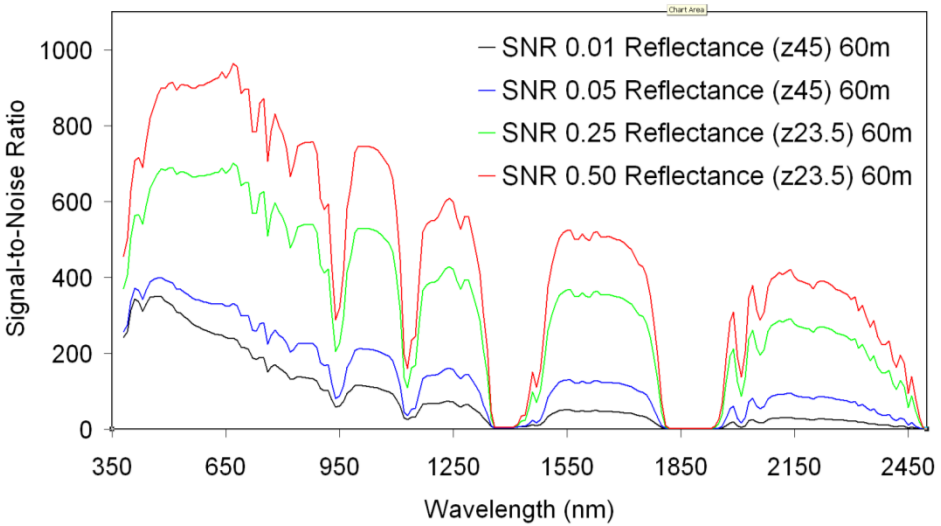
- a) To address the Decadal Survey and community identified science and application questions related to terrestrial and coastal ocean ecosystem composition, function, and change as well as surface composition (DS113-115), the baseline science mission shall provide global mapping measurements of the surface reflectance or remote sensing reflectance for shallow water regions across the solar reflected spectrum from 380 to 2500 nm at ≤10 nm sampling at the specified signal-to-noise ratio and accuracy with >95% spectral/spatial uniformity at ≤60 m nadir spatial sampling with <20 day revisit to provide >60% seasonal and >80% annual coverage of the terrestrial and shallow water regions of the Earth for at least three years with a subset of measurements available near-real-time for designated science and applications.

Level 1 Requirements

Benchmark Radiances

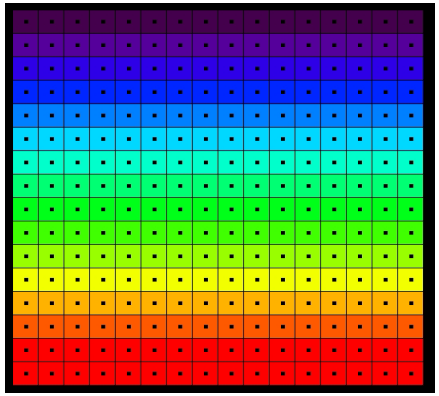


Required SNR



Uniformity Requirement

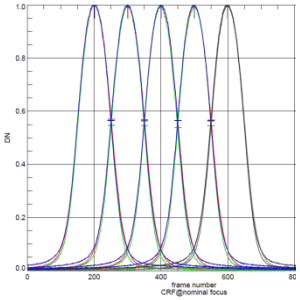
Cross Track Sample

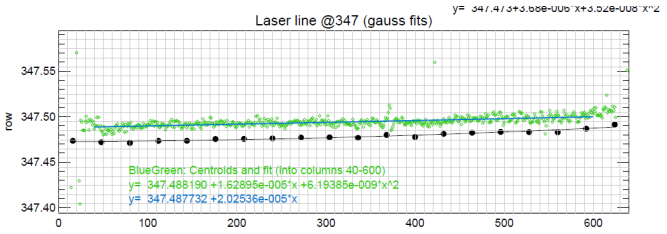


Wavelength

Depiction

-Grids are the detectors
-Dots are the IFOV centers
-Colors are the wavelengths





Requirement

Spectral Cross-Track	>95% cross-track uniformity {<0.5 nm min-max over swath}
Spectral-IFOV-Variation	>95% spectral IFOV uniformity {<5% variation over spectral range}

TIR

Level 1 Requirements

TIR

b) To address the Decadal Survey and community-identified science and application questions related to volcanoes, wild fires, water usage, urbanization and surface composition (DS113-115), the baseline science mission shall provide global mapping measurements of the surface radiance, temperature and emissivity with 8 spectral bands from the 3-5 micron and 8-12 micron regions of the spectrum at the specified noise-equivalent-delta-temperature and accuracy at ≤60 m nadir spatial sampling with ≤5 day revisit to provide >60% Monthly, >70% seasonal and >85% annual coverage of the terrestrial and shallow water regions of the Earth for at least three years with a subset of measurements available near-real-time for designated science and applications.

Specified NEdT

	Wavelength	Spectral Bandwidth	Min Nominal Radiance and Temperature	Max Nominal Radiance and Temperature	NEdT at Min nominal Temperature	NEdT at Max Nominal Temperature	NEdT at 300 K
	(microns)	(microns)	(W/m^2/micron/sr)	(W/m^2/micron/sr)	Kelvin	Kelvin	Kelvin
Band 1	3.98	0.08	14 (400 K)	9600 (1400 K)	1	0.12	11.2
Band 2	7.35	0.32	0.34 (200 K)	110 (500 K)	2.8	0.22	0.28
Band 3	8.28	0.34	0.45 (200 K)	100 (500 K)	2	0.22	0.24
Band 4	8.63	0.35	0.57 (200 K)	94 (560 K)	1.6	0.24	0.24
Band 5	9.07	0.36	0.68 (200 K)	86 (500 K)	1.2	0.24	0.22
Band 6	10.53	0.54	0.89 (200 K)	71 (500 K)	0.64	0.22	0.16
Band 7	11.33	0.54	1.1 (200 K)	58 (500 K)	0.56	0.26	0.16
Band 8	12.05	0.52	1.2 (200 K)	48 (500 K)	0.52	0.3	0.18

Digitization @ min radiance	Digitization @ max radiance	Digitization @ 300 K
(W/m^2/micron/sr)	(W/m^2/micron/sr)	(W/m^2/micron/sr)
4.0e-2 (0.12 K)	4.0e-2 (0.01 K)	5.0e-2 (1.4 K)
5.6e-3 (0.30 K)	5.6e-3 (0.009 K)	5.6e-3 (0.03 K)
4.8e-3 (0.23 K)	4.8e-3 (0.009 K)	4.8e-3 (0.03 K)
4.5e-3 (0.19 K)	4.5e-3 (0.009 K)	4.5e-3 (0.03 K)
4.1e-3 (0.15 K)	4.1e-3 (0.010 K)	4.1e-3 (0.03 K)
2.5e-3 (0.08 K)	2.5e-3 (0.008 K)	2.5e-3 (0.02 K)
2.2e-3 (0.07 K)	2.2e-3 (0.010 K)	2.2e-3 (0.02 K)
2.1e-3 (0.06 K)	2.1e-3 (0.012 K)	2.1e-3 (0.02 K)

Notes

Center wavelength is the average of the max and min wavelengths at the FWHM
Spectral bandwidth is the FWHM
Minimum nominal radiance is 200K except for 4 um band where it is 400K
Maximum nominal radiance is 500K except for 4 um band where it is 1400K

Level 1 Requirements

COMBINED

c) To address Decadal Survey and community-identified science and application questions (DS113-115), requiring combined reflectance, emissivity and temperature measurements, the baseline mission shall provide combined global mapping data sets.

Level 1 Requirements

Threshold Science Requirements

- Threshold (or minimum) scientific requirements (the “science floor”) that are required to scientifically justify performing the mission.

Level 1 Requirements

Threshold Science Requirements

4.1.2 Threshold Science Requirements

a) [VSWIR] To address the Decadal Survey and community identified science and application questions related to terrestrial and coastal ocean ecosystem composition, function, and change as well as surface composition (DS113-115), the baseline science mission shall provide global global mapping measurements of the surface reflectance or remote sensing reflectance for shallow water regions across the solar reflected spectrum from 380 to 2500 nm at ≤10 nm sampling at >80% of the specified signal-to-noise ratio and accuracy with > 90% spectral/ spatial uniformity at ≤60 m nadir spatial sampling with <20 day revisit to provide > 50% seasonal and >70% annual coverage of the terrestrial and shallow water regions of the Earth for at least two years.

Level 1 Requirements

Threshold Science Requirements

b) [TIR]To address the Decadal Survey and community identified science and application questions related to volcanoes, wild fires, water usage, urbanization and surface composition (DS113-115), the baseline science mission shall provide global mapping measurements of the surface temperature as well as emissivity and surface radiance in 8 spectral bands from the 3-5 micron and 8-12 micron regions of the spectrum at >80% the specified noise-equivalent-delta-temperature and accuracy at ≤60 m nadir spatial sampling with ≤5 day revisit to provide > 40% Monthly, > 60% seasonal and >70% annual coverage of the terrestrial and shallow water regions of the Earth for at least two years.

c) [COMBINED] To address Decadal Survey and community identified science and application questions requiring combined reflectance, emissivity and temperature measurements, the threshold mission shall provide combined global mapping data sets.

Summary

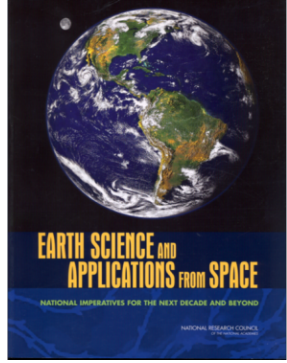
Program Level Requirements (or Level 1 Requirements) are a required gate product
KDP-A: Draft
KDP-B: Updated Draft Baseline
KDP-C: Baseline Update

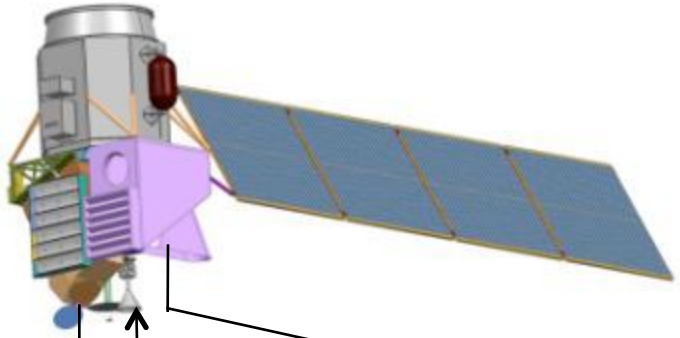
In the pre Phase A period of the HyspIRI Mission concept input to the Level 1 Requirements will be requested from the SSG and Community.

The Level 1 Requirements are a NASA Headquarters Document and provide an important basis for tracking the progress and judging the success of HyspIRI

Questions?

NRC Decadal Survey
HysplRI Mission Concept



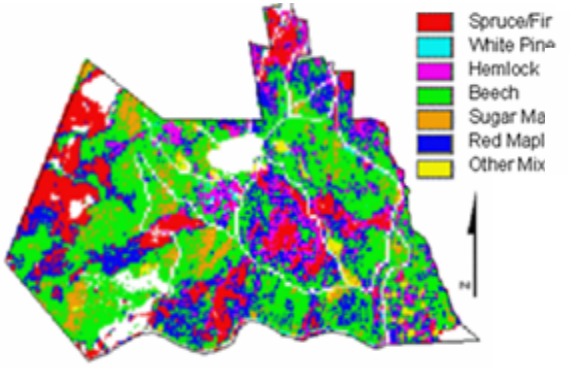


Visible ShortWave InfraRed (VSWIR) Imaging Spectrometer

Multispectral Thermal InfraRed (TIR) Scanner

IPM Low Latency Data

Map of dominant tree species, Bartlett Forest, NH



Soil C:N Ratio

White Mountain National Forest, NH