



HyspIRI Intelligent Payload Module(IPM) and Benchmarking Algorithms for Upload

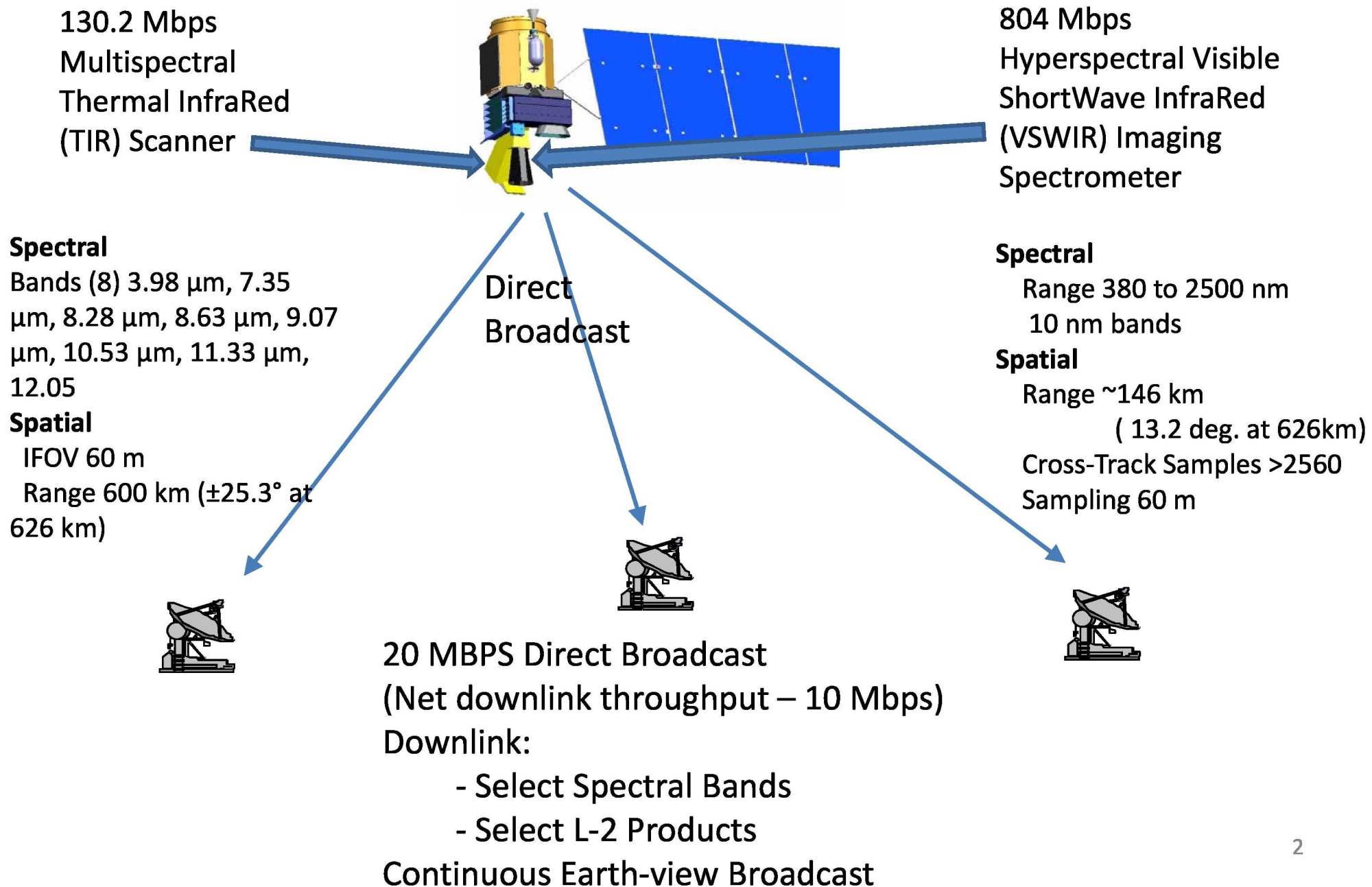
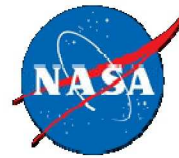
Dan Mandl/GSFC

5-4-10



HyspIRI Science Symposium on
Ecosystem Data Products

HyspIRI Low Latency Data Production Concept

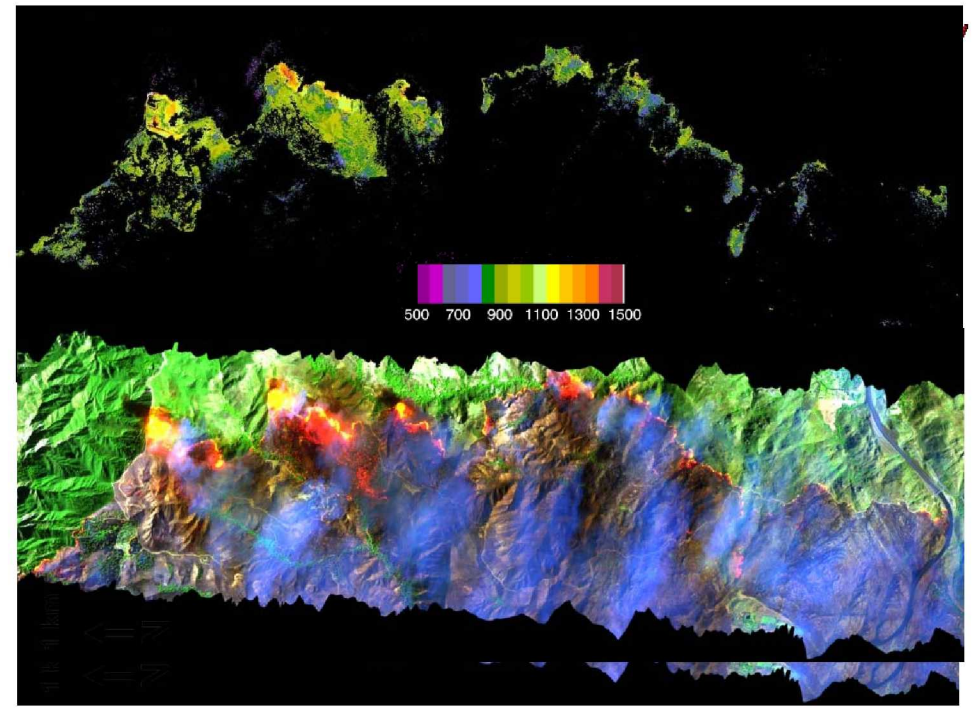


4 run onboard automatically

3 upload mobile agent

2 transform algorithm into mobile agent

HyspIRI Intelligent Payload Module (IPM)



Web Processing Coverage Service

Select scene: menu

Type Your Classifier In The Edit Box Below

Classifier

```
for c in ( scene )
return
encode(
(char) ( ((c.0 / ((float)c.0 + c.1))-c.1 /
((float)c.0 + c.1))) > 0.6 ) * 255, "png")
```

<< Copy

Or Select One From This Toolbox

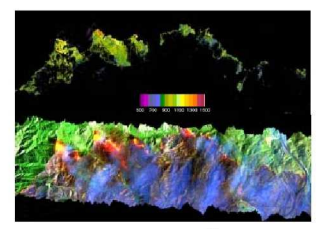
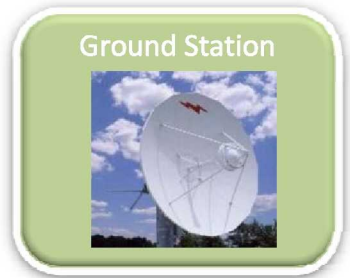
Burnscar
NDVI
RDSI

Test It Upload It >>

Print ADD DELETE... check to confirm delete

5 download customized low-latency onboard generated data products

1 create, edit, test algorithms/classifiers for use onboard space-based sensors



One Possible HyspIRI IPM Ops Concept

Image data products- Phil Dennison 2008

Low Fidelity HypIRI IPM Testbed



Features

- Hardware
 - Xilinx Virtex-5 (GSFC Space Cube 2)
 - 2 x 400MHz PPC
 - 100MHz Bus
 - 2 x 512MB SDRAM
 - Dual Gigabit Ethernet
- Support Linux kernel 2.6.31 (gcc version 4.2.2)
- Support software running in standalone mode for better performance
- Can stream raw data up to 800 Mbps
- Ready for operations

Software Application Examples

- Band-stripping
- Algorithms: cloud, sulfur, flood, thermal, SWIL, NDVI, NDWI, SIWI, oil spills, algae blooms, etc.
- Corrections: geometric, radiometric, atmospheric
- Core Flight System / dynamic software bus
- CCSDS File Delivery Protocol
- Delay Tolerant Network
- CASPER / onboard planning
- Fault monitoring / recovery software
- S/C command and telemetry software
- Data compression
- Sensor Web for Autonomous Mission Operations

Low Fidelity HyspIRI IPM Testbed



Data Generator Workstation

- Generates test data and streams it to the board at rate up to 800Mbps.

NETGEAR Gigabit Switch

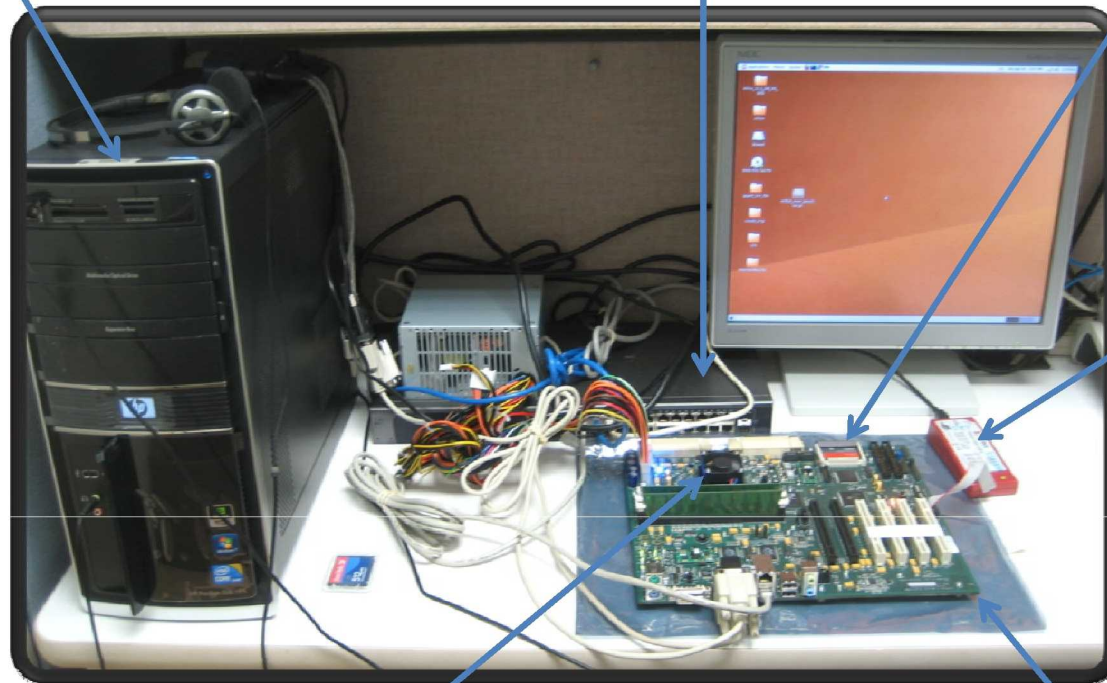
- Allows the board and the data generator workstation to connect at Gigabit speed.

Compact Flash

- Ext3 formatted file system with Linux libraries and tools

Platform Cable USB

- Provides an easy method for debugging software running on the board



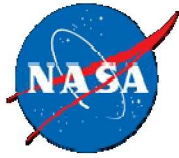
Virtex-5 FPGA

- GSFC Space Cube 2 core FPGA
- Configured as dual 400MHz PPC design
- Capable of running with Linux or in a standalone mode

Xilinx ML510 Development Board

- Enables the development team to verify the Virtex-5 while the GSFC Space Cube 2 is finalizing the design

Initial Benchmark Results



32-bit Memory Test	Write (ms)	Read + Verify (ms)
128MB	711	1179
256MB	1564	2365
512MB	2942	4731
1024MB	6673	10670

Not Optimized!
FPGA not leveraged

Algorithms	Linux (ms)	Standalone (ms)	Linux (ms)	Standalone (ms)
	EO1 scene (256 x 1000 pixels)		HyspIRI ¼ swath (640 x 565 pixels)	
Cloud	1791	431	2170	589
Flood	3024	937	3782	1311
SWIL	7350	2872	10226	4058
Sulfur	116362	29515	164978	42026
Thermal	1103	304	1475	431
SIWI	580	44	823	62
NDVI	630	44	904	62
NDWI	589	44	836	62

Disclaimer: Code not optimized. Performance based on a 400MHz PPC design.



IPM Process Chain

Processes	Ground	Flight
Level 0	Yes	-
Level 1R	Yes	-
Atmospheric Correction	Automation in progress	-
Dynamic Algorithms	JPL WCPS/SWAMO	In Testbed
Geometric Correction	L1G	-
Compression	CCSDS	Card Available
Downlink	N/A	-