

Mission Technology Forum

Section 14

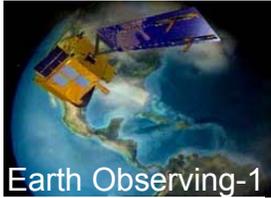
From Hyperion to the Future



08/15-16/01

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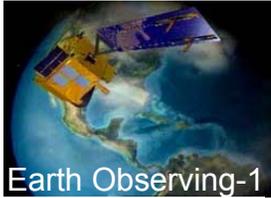
Hyperion Is a Highly Successful Instrument Development



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- ◆ ***Delivered a complex hyperspectral imager to NASA GSFC in just 51 weeks -- one week earlier than target date***
- ◆ ***Delivered to original cost and schedule in spite of the normal run of challenges (parts availability, design evolution, test surprises)***
- ◆ ***Performance in orbit has been outstanding***
- ◆ ***Secret of success was three-fold***
 - ***Early and close working relationship with customer***
 - ***Constant communication at all levels of the team***
 - ***Focused and flexible program management approach***





Keys to Program Management Success

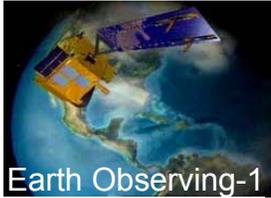


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- ◆ *Excellent planning and schedule control*
- ◆ *Rigorous risk management process*
- ◆ *Utilization of hardware designs (and residual parts) from several different programs*
- ◆ *Innovative approach to acceptance testing*



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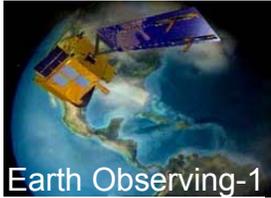
Excellent Planning & Schedule Control



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- ◆ **Implemented Lewis/HSI lessons learned**
 - *Met with Lewis & HSI project managers to avoid major pitfalls*
- ◆ **Developed very detailed schedules -- over 1500 tasks**
 - *Schedules created and owned by performing organizations*
- ◆ **Utilized “critical chain” techniques to establish schedule slack**
 - *Managed slack to reduce risk*
 - *Minimized multitasking*
- ◆ **Daily status meetings, weekly schedule updates**
 - *Revised network logic as necessary to maintain delivery*





Successful Risk Management Process

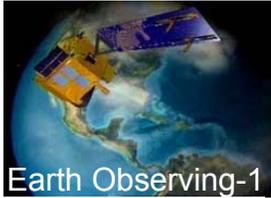


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- ◆ **Developed a state-of-the-art risk management plan**
- ◆ **Implemented plan with team and a Risk Management Board**
 - *Trained team in the process for identifying, assessing and controlling risk*
 - *The team, not just the management, owned the process*
 - *Performed monthly reassessment of risk throughout the program*
- ◆ **Deployed resources for risk reduction**
 - *For example, parallel development of dichroic beam splitter averted delays in grating spectrometer delivery by subcontractor SSG*



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Utilized Heritage Hardware & Suppliers

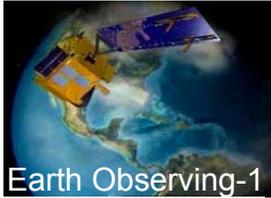


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- ◆ **Utilized key elements from several heritage sensors without modification**
 - *Enabled by flexibility of customer team in establishing performance requirements that would be satisfied without redesign of existing hardware*
- ◆ **Close working relationships with suppliers allowed access to critical components on tight schedules**
- ◆ **High use of heritage hardware significantly reduced program cost and schedule risk**



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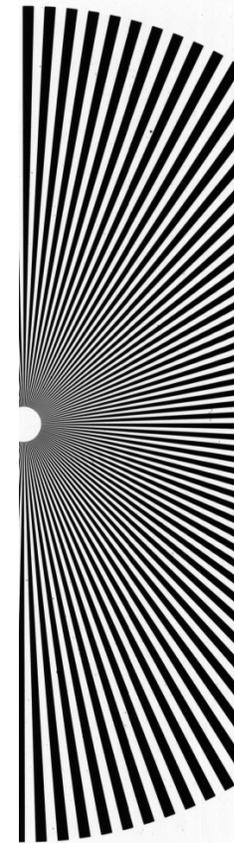


Innovative Acceptance Test Program



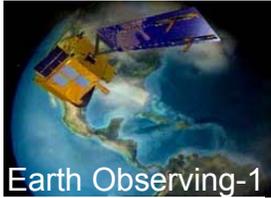
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- ◆ **Integrated calibration and performance testing within thermal vacuum cycles**
- ◆ **Designed test tools & techniques to enable single images to provide multiple measurements**
 - *Developed radiometric calibration panel for both radiometric and spectral tests*
 - *Developed integrated performance diagnostic through 2-D imaging*
- ◆ **Automated Multispectral Test Bed (MSTB) with Hyperion Instrument Test Set**
 - *Enabled rapid sequences of MSTB mirror positions to quickly acquire data*



2-D imaging





Summary

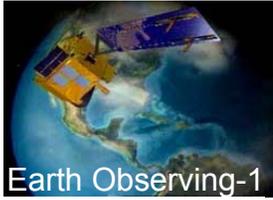


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- ◆ ***Stay close to the customer and agree early on requirements***
- ◆ ***Communicate, communicate, communicate***
- ◆ ***Actively address risk***
- ◆ ***Work the details - continually***



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Earth Observing-1

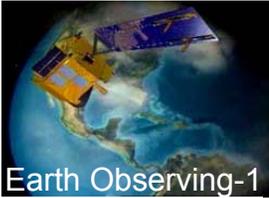


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Beyond Hyperion



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Earth Observing-1



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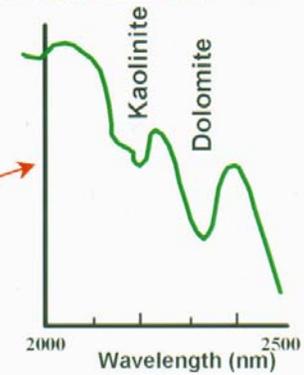
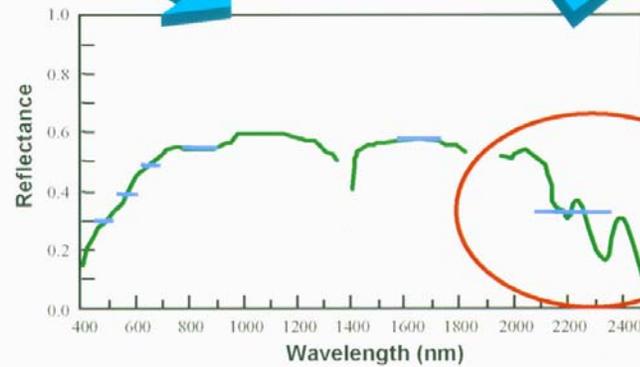
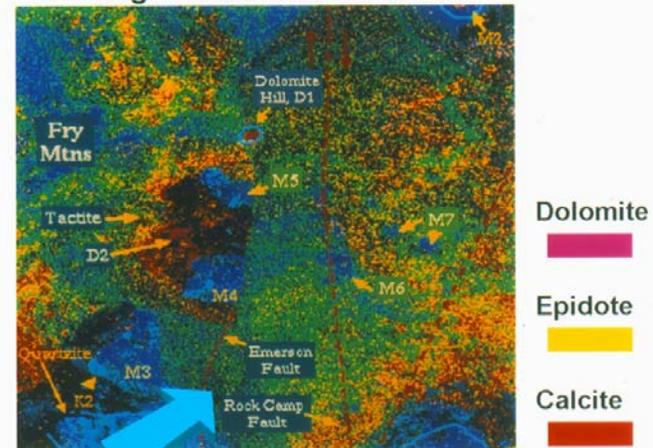
HSI: Turning Images into Information Products



Desert Scene



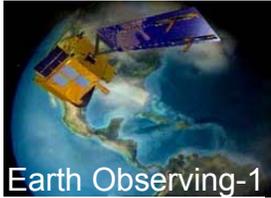
Geologic Information Product



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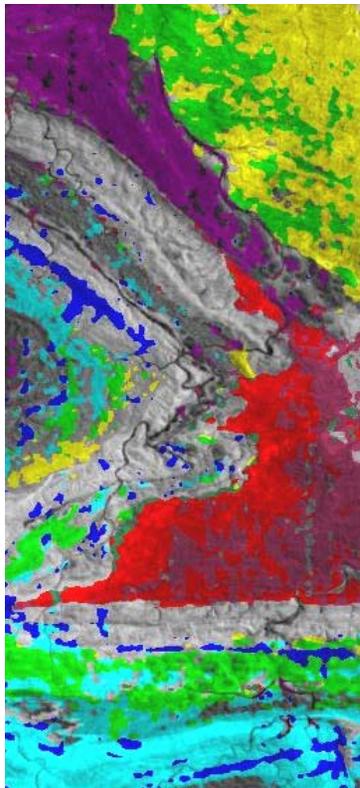
A Sample Hyperion Product



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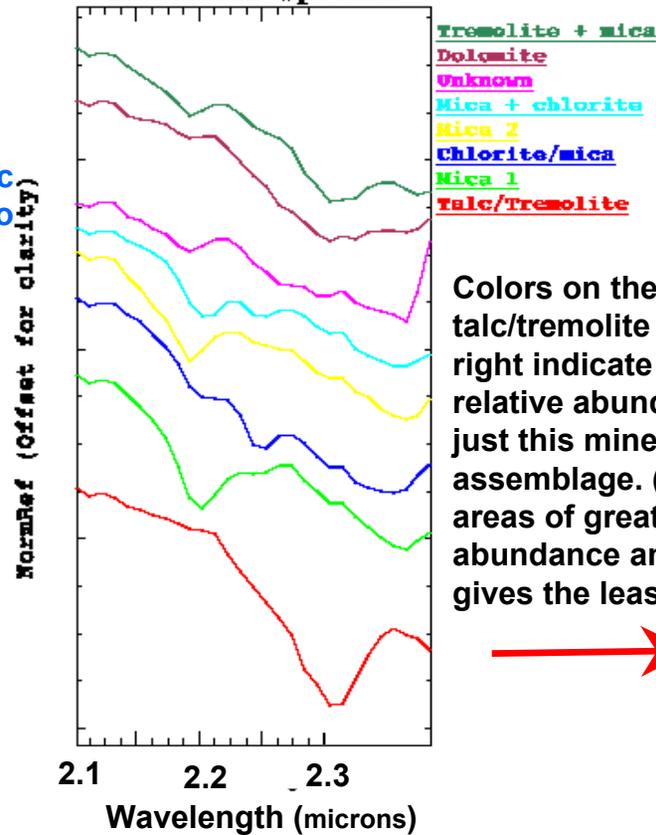
Post-processing and application of an automatic mineral mapping algorithm creates, in 30 seconds, a quick-look mineral map (left & centre). Subsequent processing can reveal more precise detail (right).

Quick-look Thematic Mineral Map

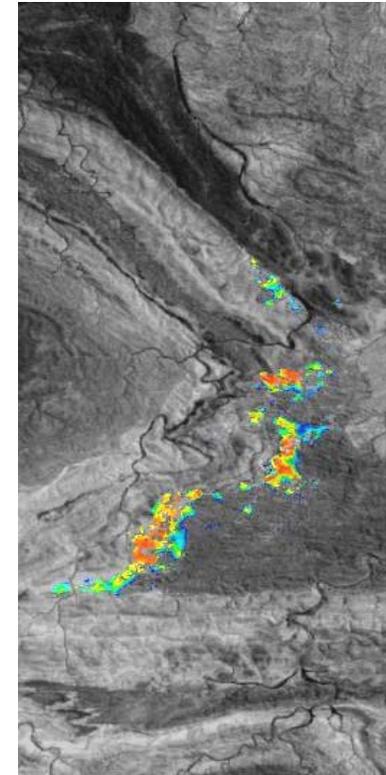


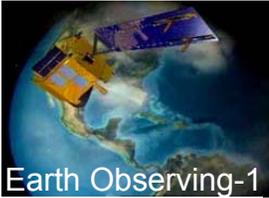
Colors of spectra match the thematic image to left.

Endmember Spectra



Detailed Talc / Tremolite Distribution Map



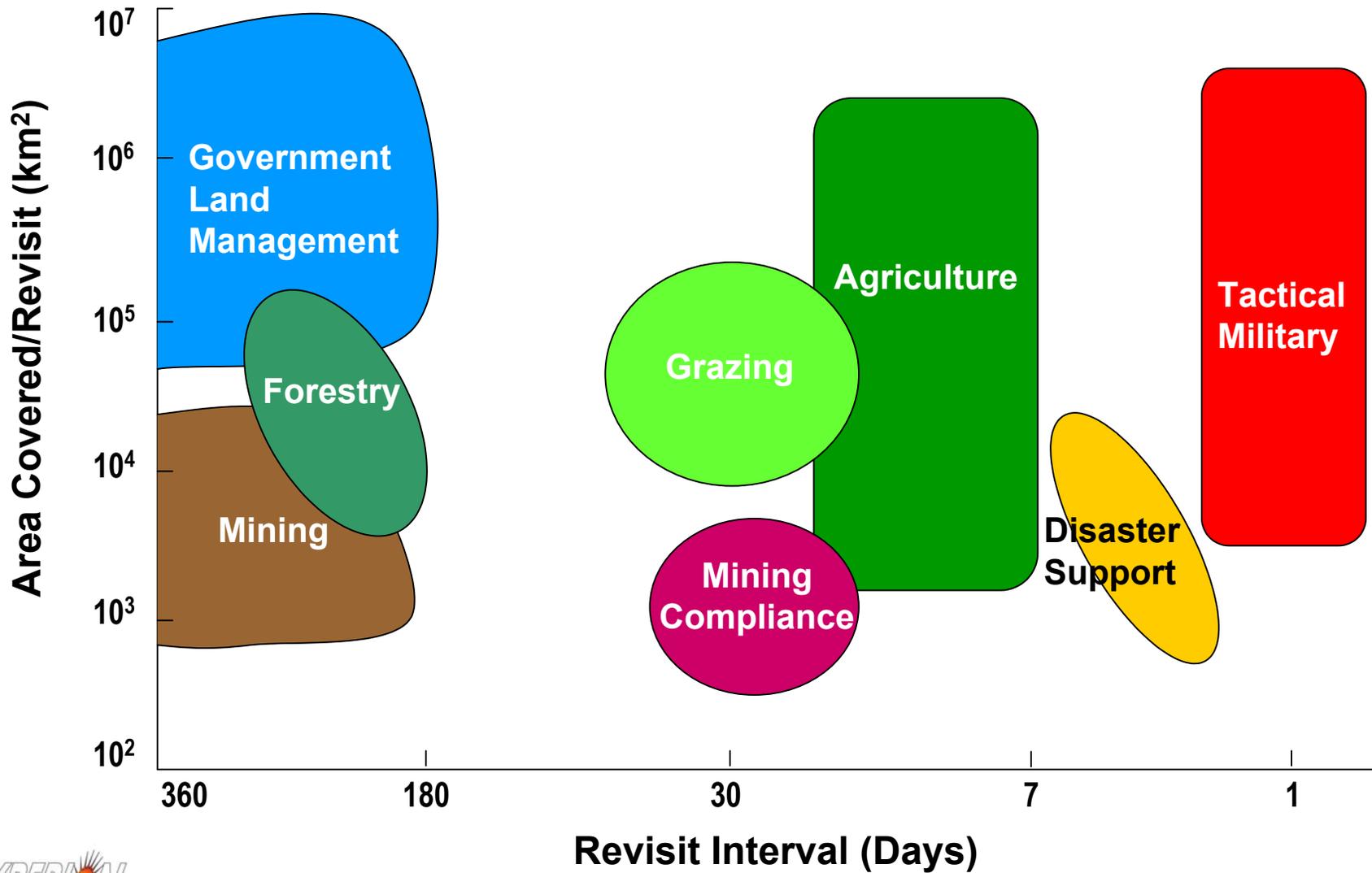


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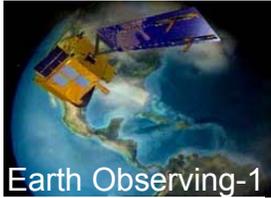
User Requirements



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Program Directions (Typical System)

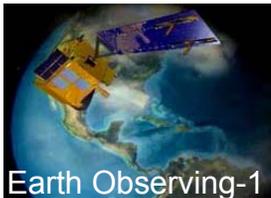


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- ◆ ***Polar Orbit***
- ◆ ***Global access, but not global coverage***
- ◆ ***Technical Specifications: VNIR/SWIR (+thermal?); less than 30m GSD, swath greater than 20km, 5-10nm bandwidth, well calibrated***
- ◆ ***Data Flowthrough: 1 - 2 Terrabits/day***
- ◆ ***Five to ten year life***
- ◆ ***Typical build time: 24 to 36 months***
- ◆ ***Customer Base: government and commercial***



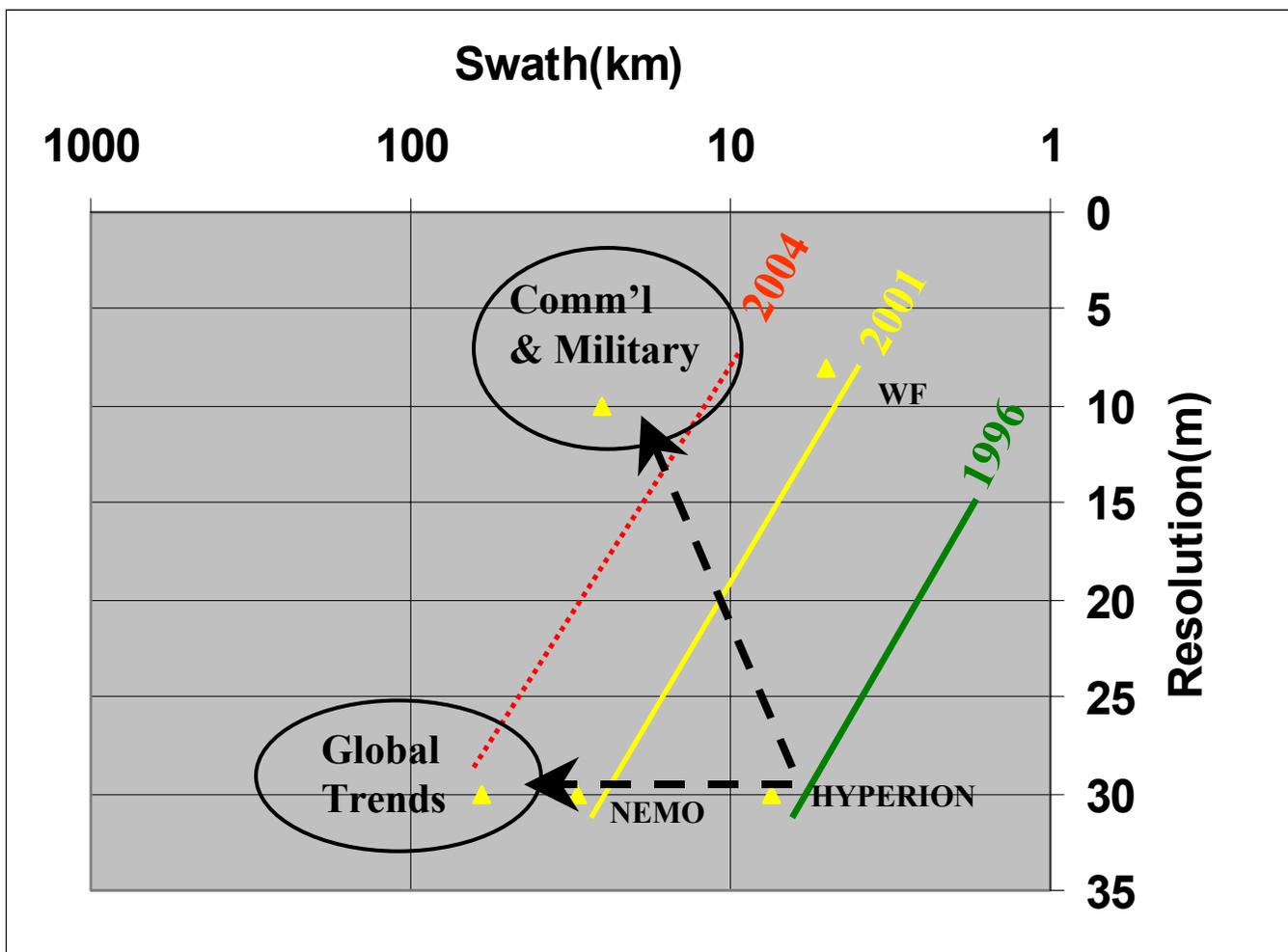
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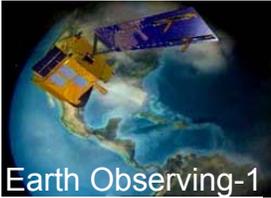
Hyperspectral System Trends



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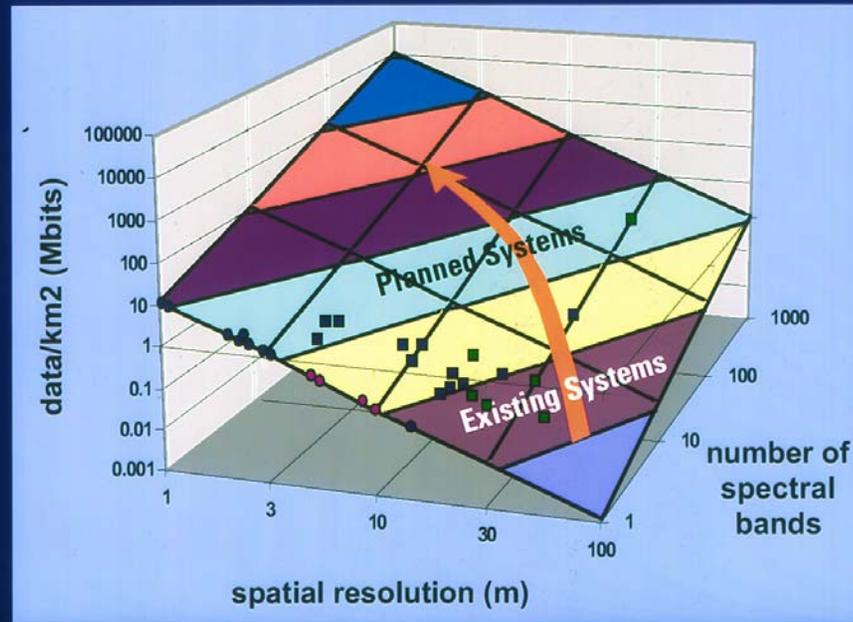


Industry Trends



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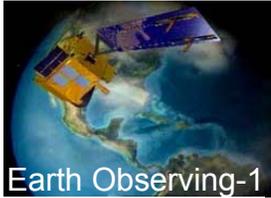
Industry Trends Are for More Information Content



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Key Enabling Technologies

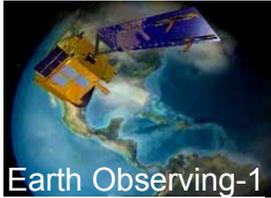


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Technology (launch date)	Next Generation (2004)	Advanced Systems (2010)	Comments
Sensor-Focal Planes	?	?	niche development for near term
Optical Packaging	?	—	Common issue among users
Communication- downlinks	?	?	High bandwidth commercial systems
On-Board processing	?	?	Long range government research
Local user processing	?	?	Desk top computer evolution
SW-Algorithms	?	—	Mineral applications mature; others developing



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Earth Observing-1

Hyperspectral Space Systems

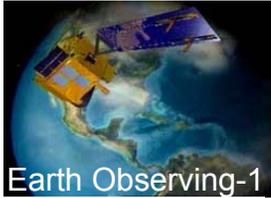


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System	Lead	Swath (km)	GSD (m)	Status
Hyperion	TRW	7.5	30	Operational
Warfighter	OSC	5	8	Launch 2001
CHRIS	ESA/ CIRA	19	25	Launch 7/01 – selectable bands – limited downlink
NEMO	ESSI	30	30	In process
Canada HSI	CSA	TBD	TBD	Award study phase 6/01
Commercial Hyperspectral	Private Company	25	10	Pre-funding study



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Conclusions



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- ◆ ***EO-1/Hyperion is demonstrating the utility of space-based hyperspectral imaging for a variety of applications***
 - ***Mining/Mineralogy***
 - ***Agriculture***
 - ***Forestry***
 - ***Land Use***
- ◆ ***Future commercial and military systems will grow the utility of hyperspectral imaging***
- ◆ ***Data volume remains a key issue for future hyperspectral systems***
 - ***On-board processing***
 - ***Selective image acquisition***
 - ***Wide band downlinks***

