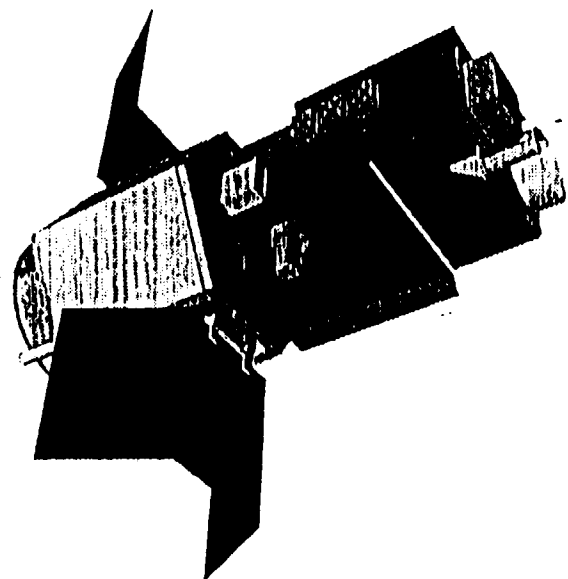




GALS

WEATHER AND CLIMATE NEEDS AND GOALS

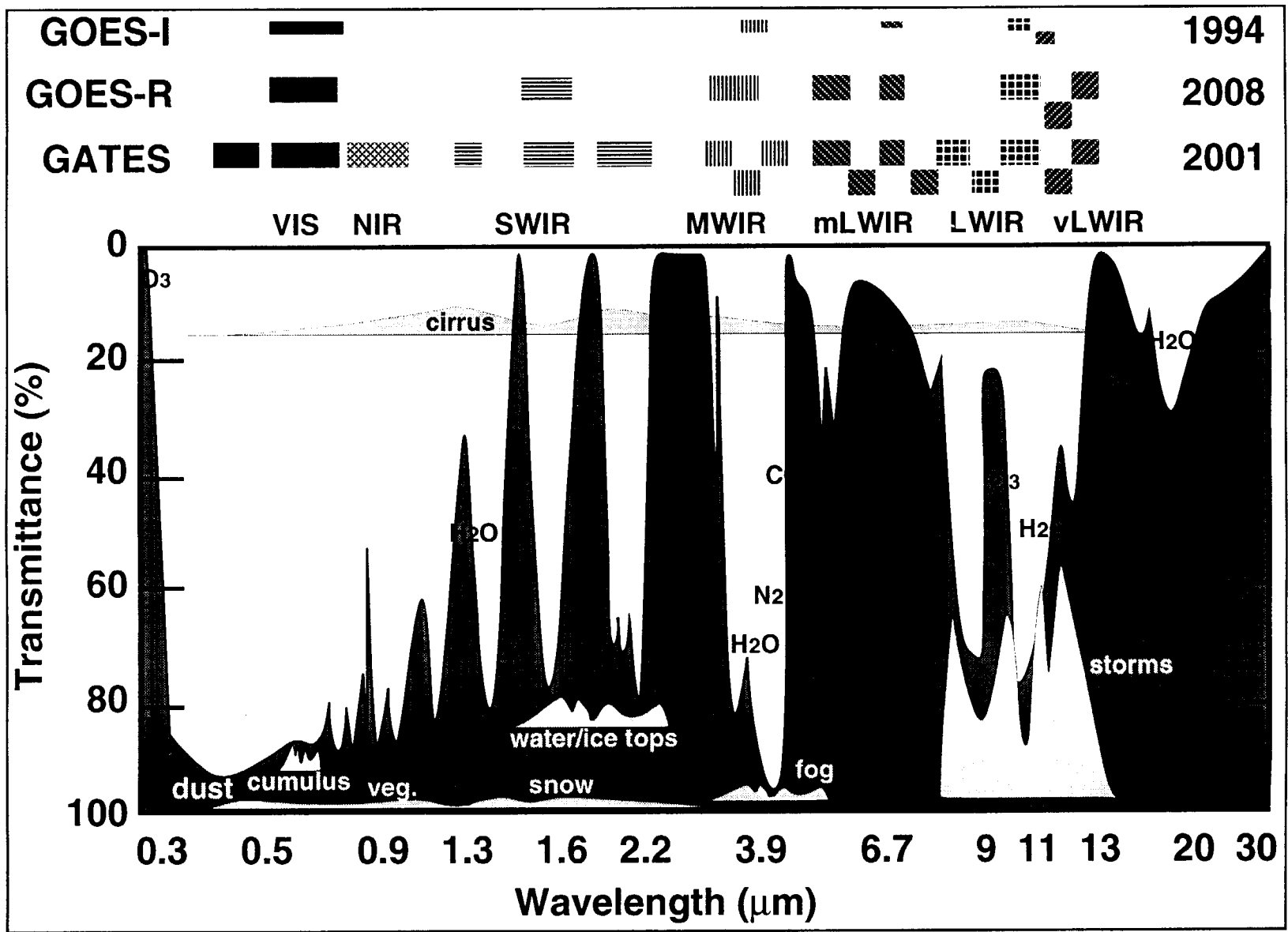
... Dr. Dennis Chesters
NASA/GSFC Code 913



Geostationary
Advanced
Technology
Environmental
System

A Concept for a new geosynchronous satellite
for imaging weather and climate in 1999 AD

NASA-GSFC
April 4, 1996



GATES SPECTRAL BANDS (9/96 draft)

Band	Wavel. μm	Bandpass μm	Noise	FOV km	Heritage	Purpose
VIS						
1a	0.475	0.45-0.50	250/1	0.5	M	aerosols
1	0.60	0.53-0.67	250/1	0.5	ARMIS	cloud albedo
NIR						
2	0.80	0.75-0.85	200/1	0.5	AM	vegetation
SWIR						
3	1.375	1.36-1.39	150/1	1	M	cirrus
4	1.65	1.57-1.73	250/1	1	MR	cloud water, snow
5	2.22	2.10-2.35	200/1	1	M	cloud ice
MWIR						
6	3.60	3.40-3.80	0.1 K	2	MS	low water vapor
7	3.95	3.85-4.05	0.1 K	2	ARMIS	sfc & cloud temp.
8	4.15	4.10-4.20	0.2 K	2	MS	low air temp.
mLWIR						
9	6.55	6.4-6.7	0.2 K	2	S	very high water vapor
10	6.85	6.7-7.0	0.2 K	2	RMIS	high water vapor
11	7.15	7.0-7.3	0.2 K	2	RS	mid water vapor
12	7.45	7.3-7.6	0.2 K	2	MS	low water vapor
LWIR						
13	8.5	8.0-9.0	0.2 K	2	M	total water vapor
14	9.7	9.6-9.8	1.0 K	2	MS	ozone
15	11.0	10.2-11.7	0.2 K	2	ARMIS	sfc & cloud temp.
vLWIR						
16	12.4	11.9-12.9	0.3 K	2	ARMIS	total water vapor
17	13.3	13.0-13.5	0.5 K	2	MRIS	high cloud cover

A = AVHRR, R = GOES-R Imager, M = MODIS, I = GOES Imager, S = GOES Sounder

Weather & Climate Channels

8 weather channels baseline on the GOES-R Imager

0.6 μm	hi-res. clouds	cloud-track winds
1.6 μm	cloud/snow diff.	winds in winter
3.9 μm	surface/fog diff.	aviation weather
5.5 μm	500 mb water vapor	mid-level winds
7.0 μm	300 mb water vapor	high-level winds
11. μm	cloudtop temp.	convective vigor & wind
12. μm	split window (H₂O)	total water vapor
13. μm	CO₂-sliced cloudtop	ASOS supplement

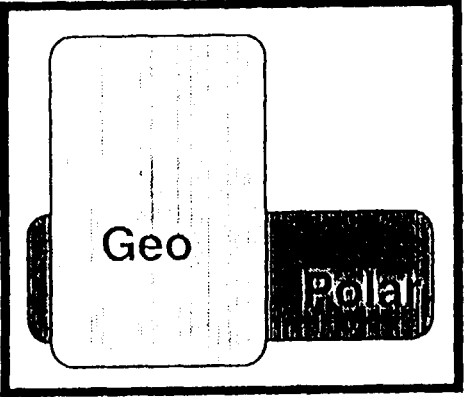
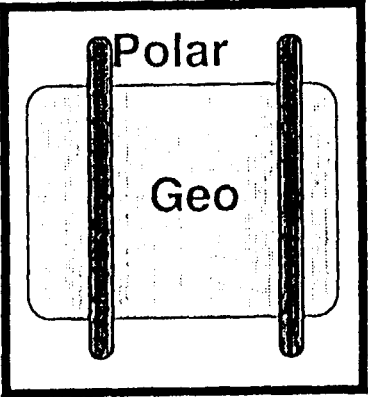
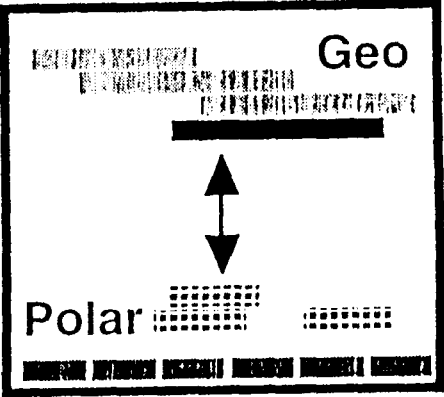
9(+1) climate channels on GATES

0.4 μm	smoke & haze	aerosol processes
0.8 μm	vegetation	bio-status Americas
1.3 μm	cirrus	greenhouse process
2.2 μm	water/ice cloudtop	cloud phase processes
3.6 μm	split window (H₂O)	fires/day, water/night
4.1 μm	split window (N₂)	boundary layer temp.
6.5 μm	200 mb water vapor	tropopause structure
7.5 μm	700 mb water vapor	low-level winds & water
8.5 μm	split window (H₂O)	total water vapor
9.7 μm	split window (O₃)	total ozone



GATES Compliments . . .

GATES

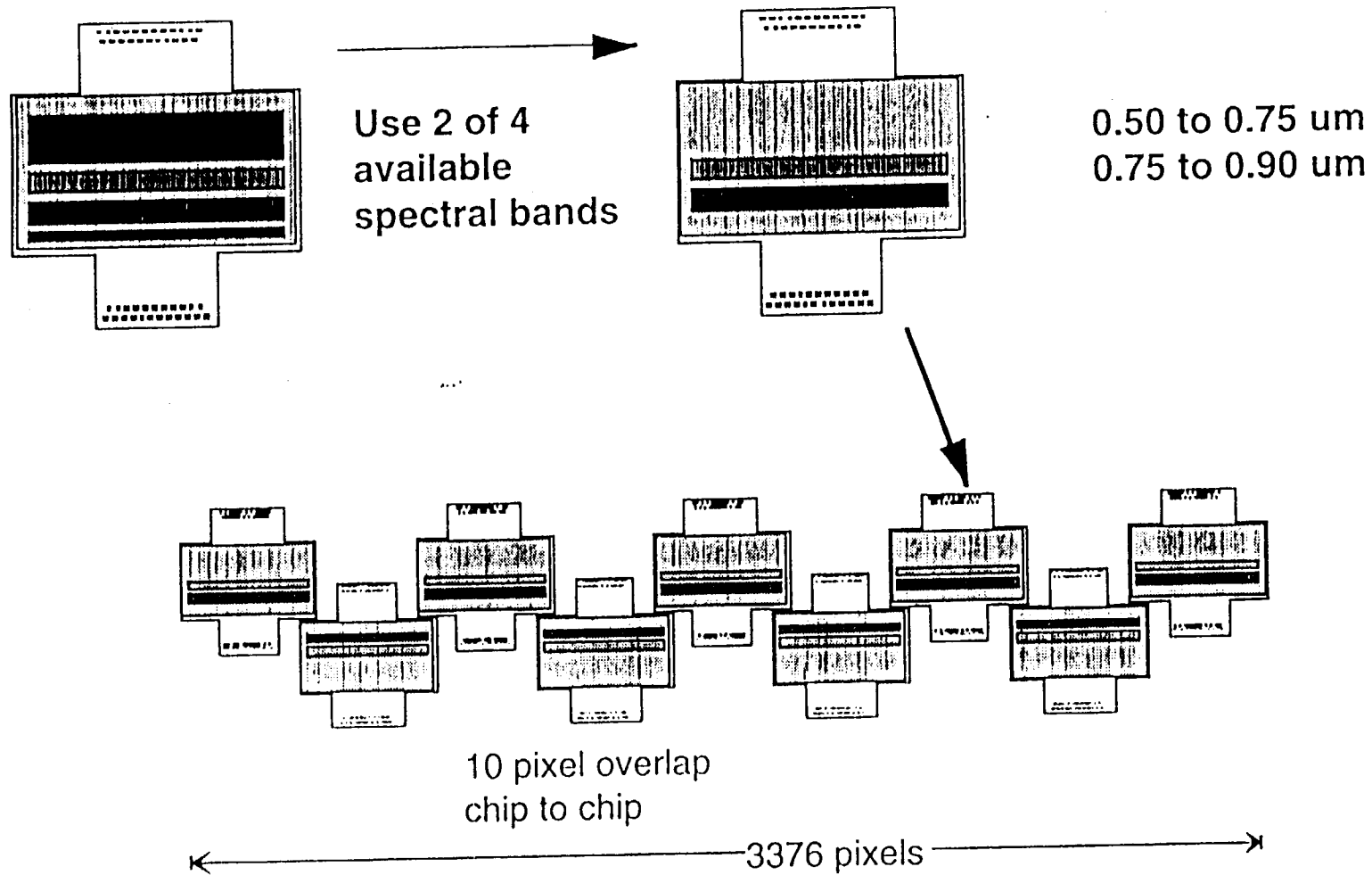
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">time resolution</p>  <p style="text-align: center;">space & spectral resolution</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">latitude</p>  <p style="text-align: center;">time-of-day</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">satellites</p>  <p style="text-align: center;">duration</p>
<p>LEO</p> <ul style="list-style-type: none"> Small footprint Global coverage Good signal/noise High spectral res. 	<p>LEO</p> <ul style="list-style-type: none"> Fixed time-of-day Polar latitudes 	<p>LEO</p> <ul style="list-style-type: none"> Ops weather series Climate tryouts
<p>GEO</p> <ul style="list-style-type: none"> Continuous view Hemispheric view Long life Stable radiometry 	<p>GEO</p> <ul style="list-style-type: none"> All day Very frequent Energetic latitudes Programmable 	<p>GEO</p> <ul style="list-style-type: none"> Ops weather series Climate-capable Cross-reference

. . . EOS & Weather Satellite Systems

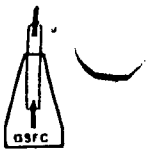
Ver 2 3/28/96



Available Focal Plane Technologies . . .



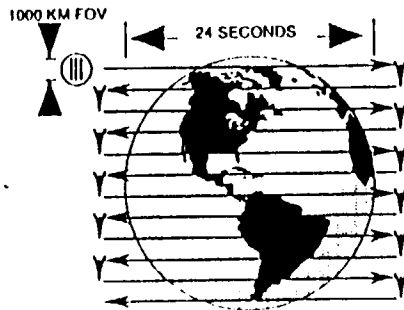
. . . Provide a No Moving Parts Imager



Full Disk and Storm Monitoring . . .

FULL DISK: 5.5 Minutes

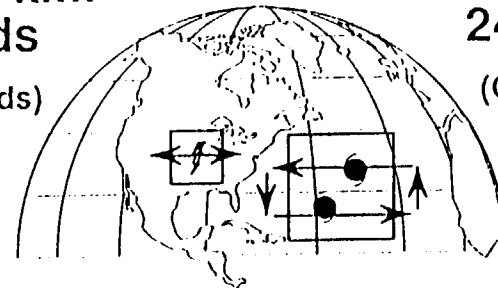
(GOES I-M: 26 minutes)



LOCAL STORMS

**1000 x 1000 km:
5 Seconds**

(GOES I-M: 42 seconds)

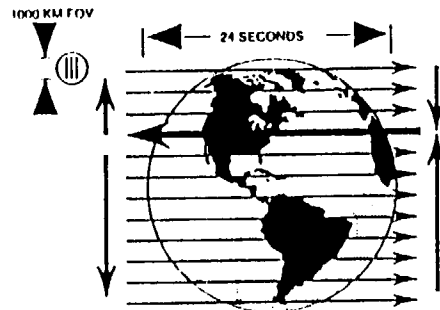


**2000 x 2000 km:
24 Seconds**

(GOES I-M: 120 seconds)

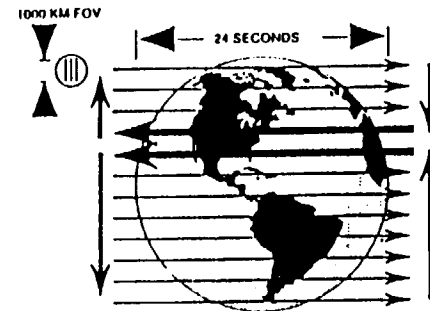
**13 Minute Full Disk with
1 Minute Local Storm**

(GOES I-M: Not Possible)

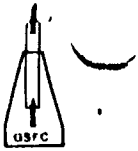


**13 Minute Full Disk with
2 Minute CONUS**

(GOES I-M: Not Possible)



. . . Provided Simultaneously



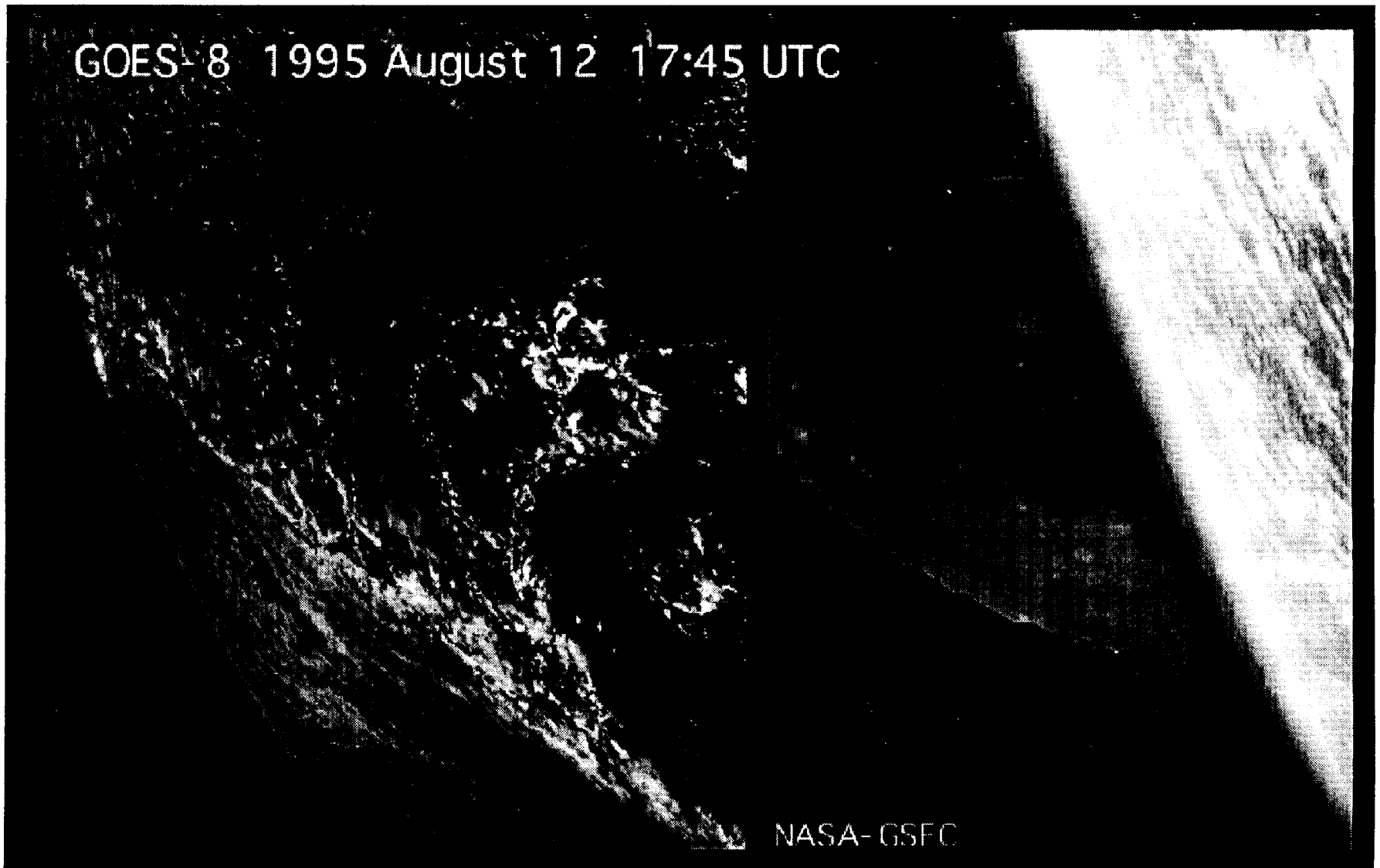
GATES

GATES Demonstrates Technologies . . .

- HIGH GROUND COVERAGE RATE WITH HIGH RESOLUTION
 - Large Focal Plane Arrays
 - Large Field-of-View Off-Axis Telescope
 - Scan Satellite Imaging
 - Superresolution
- PRECISE GROUND REGISTRATION
 - Integrated Inertial And Optical System
 - Advanced Thermally Stable Materials
 - Real-Time Image Regridding
- LOW NOISE PERFORMANCE
 - Active Cooling
 - PV HgCdTe Detectors
- HIGH RATE DATA DISTRIBUTION
 - High Performance Focal Plane Electronics
 - Lossless Data Compression
 - Ka-Band Phased Array Antenna
 - User Driven Data Selection And Delivery
- CALIBRATION REFERENCE FOR OTHER PLATFORMS
 - Lunar Calibration
and Solar
- AUTONOMOUS SPACECRAFT OPERATIONS
 - "Point And Click" User Control

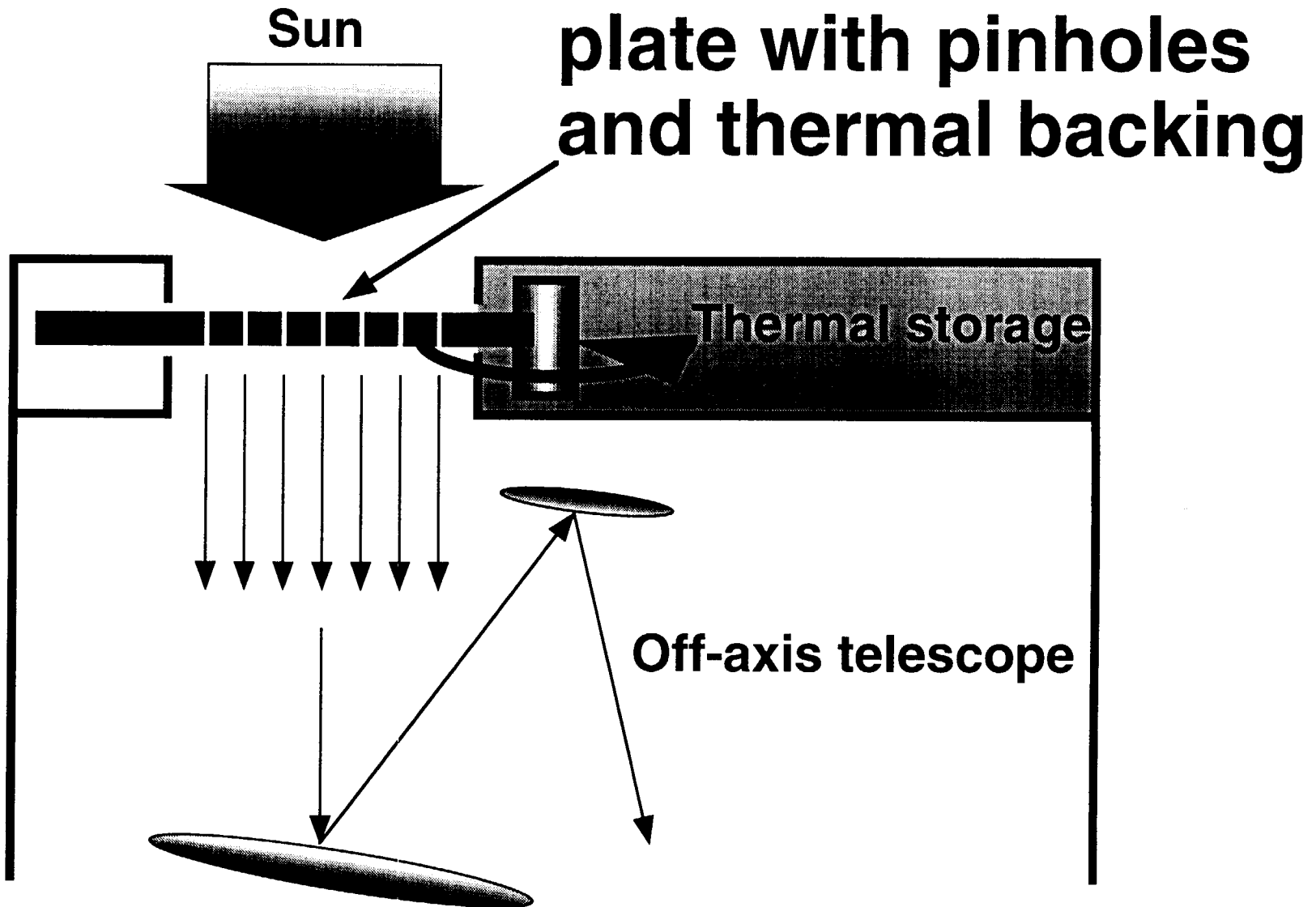
. . . Key to Next Generation GOES

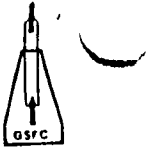
GOES-8 1995 August 12 17:45 UTC



NASA-GSFC

solar & infrared calibration





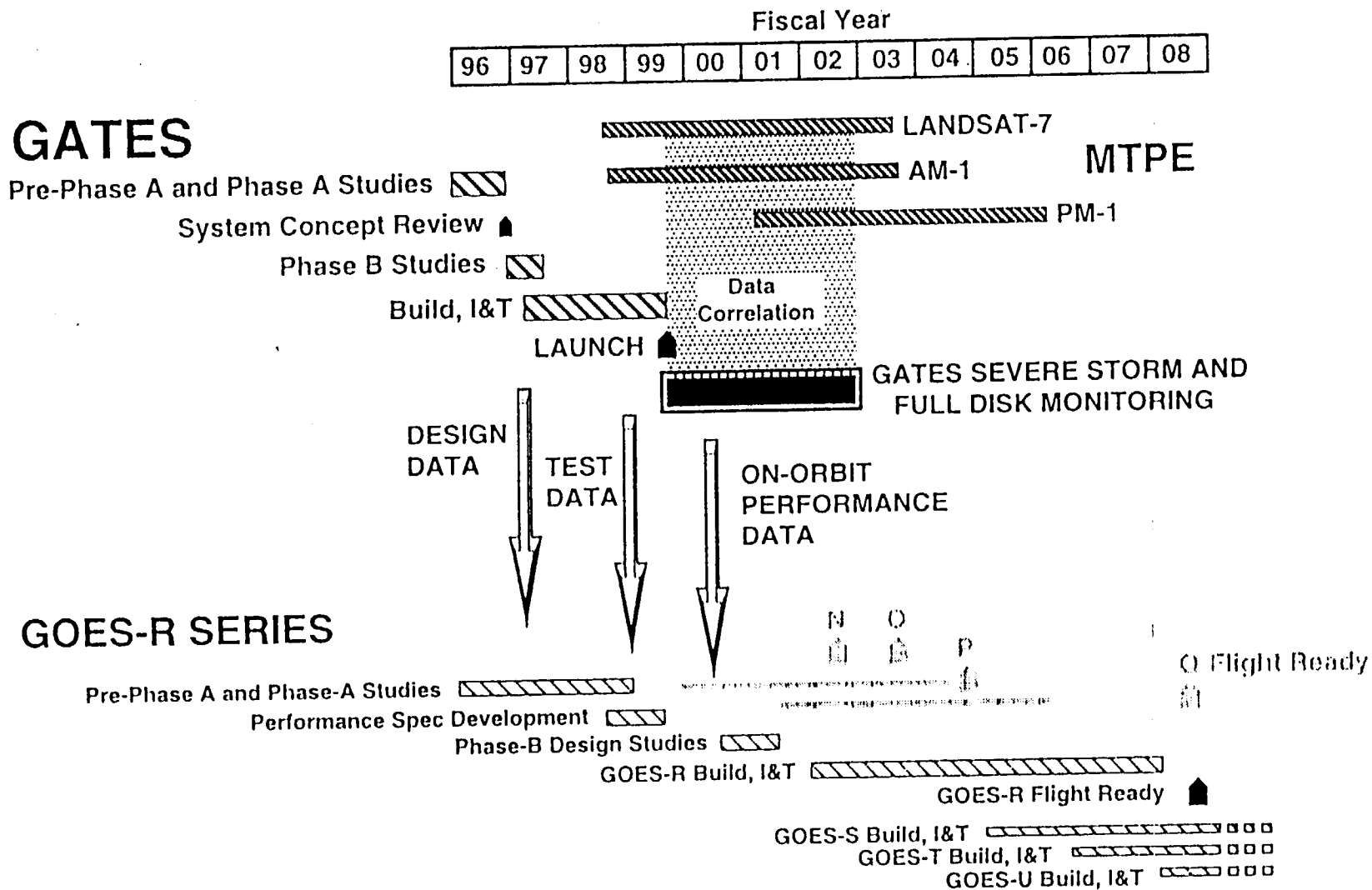
GATES Technology Provides . . .

- GATES Meets or Exceeds Draft GOES-R Imaging Requirements
 - 17 channels merging GOES and MTPE science
 - SNR's and NEdT's \leq GOES-R requirements
 - 0.5 km Vis, 1 & 2 km IR effective ground patch sizes
 - Ground registration \leq 1 km
 - Operates to spec through local midnight and eclipse
 - Full disk in \leq 6 minutes
 - Full disk in 13 minutes with simultaneous 1 minute storm coverage
- Compared to GOES I-M Imager
 - 3x number of channels
 - 5x to 8x faster coverage
 - 2x higher spatial resolution
 - Up to 2x lower noise
 - GOES I-M cannot do full disk with simultaneous 1 minute local storms

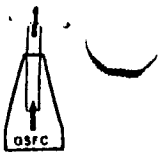
. . . A Leap Frog in Performance



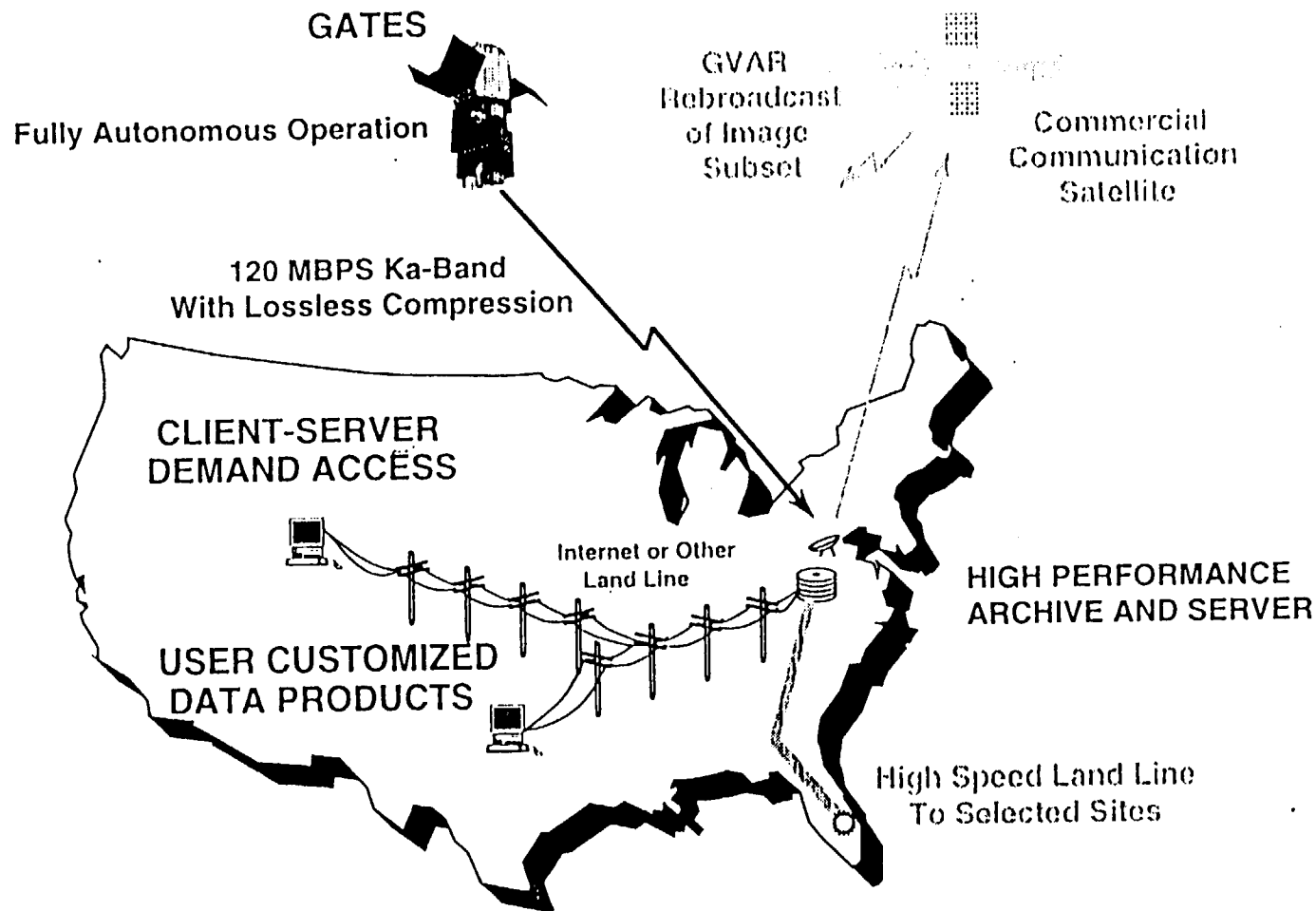
GATES is Optimally Placed in Time . . .



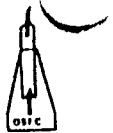
. . . To Support GOES and MTPE



GATES Provides a Flexible . . .



. . . Communications Architecture



GATES

GATES Gathers . . .

- MEETS NOAA WEATHER IMAGING NEEDS NOW
 - Continuous Realtime Images Of Developing Storms Plus Full Disk Coverage In All Desired Bands
- CLOUD PHASE AS WELL AS CLOUD COVER AND CLOUD MOTION
 - Ice/Water Cloud Evolution
- COMPLEMENTARY NOAA AND NASA PROGRAMS
 - National Observatory For Weather and Climate
- SPACE-TIME INTERPOLATION FOR WEATHER & CLIMATE
 - Diurnal Cycles
- TRANSFER UTILITY AMONG DIFFERENT SATELLITES AND GENERATIONS
 - Spectral Bi-Reflectance, Lunar Calibration
- REMOTE SENSING DATABASE FOR REGIONAL CLIMATE STUDIES
 - On-Line 10-Bit Data

. . . Needed Science Data