GEOLOGY TEAM

PRESENTED BY: MARK SETTLE

MULTISPECTRAL IMAGING SCIENCE WORKING GROUP

GEOLOGY TEAM

LONG TERM RESEARCH RECOMMENDATIONS

- o LABORATORY RESEARCH
  - NEW METHODS OF FIELD SAMPLING
  - THEORETICAL MODELS OF MICROSCALE SPECTRAL MIXING
- o UTILITY OF IMPROVED SPATIAL RESOLUTION
  - MULTISTAGE FIELD EXPERIMENTATION EMPLOYING PORTABLE SPECTROMETERS, AIRBORNE SCANNERS, AND ORBITAL IMAGING INSTRUMENTS (MACROSCALE MIXING)
- o UTILITY OF IMPROVED SPECTRAL RESOLUTION
  - DEFINE SPECTRAL THRESHOLD FOR THE IDENTIFICATION OF SPECIFIC MINERAL SPECIES THROUGH HIGH RESOLUTION SURVEYS OF SELECTED TEST SITES
- o UTILITY OF IMPROVED RADIOMETRIC SENSITIVITY
  - CONDUCT MULTISPECTRAL SURVEYS OF SELECTED TEST SITES WITH VARIABLE SIGNAL QUANTIZATION (8-12 BIT)
- o GEOBOTANICAL REMOTE SENSING RESEARCH
  - SEPARATION OF GEOLOGICAL AND BOTANICAL SPECTRAL SIGNATURES IN INDIVIDUAL PICTURE ELEMENTS
  - EXPERIMENTAL LAB STUDIES OF GEOBOTANICAL CORRELATIONS THAT MORE FULLY SIMULATE NATURAL CONDITIONS
  - TEST SITE STUDIES DESIGNED TO TEST SPECIFIC GEOBOTANICAL HYPOTHESES

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DESIRED MEASUREMENT CAPABILITIES OF THE NEXT GENERATION OF ORBITAL IMAGING SENSORS

	SPECTRAL REGION (WAVELENGTH, MICROMETERS)			
	0.4-1.0	1.0-2.0	2.0-2.5	8-14
SPECTRAL RESOLUTION	0.05um (selected 0.01um bands)	0.05um	0.02um	0.5um
SPATIAL RESOLUTION	30m	30m	30m	30m
RADIOMETRIC SENSITIVITY	1% of the incoming signal			NEDT=0.2K at 300K
RADIOMETRIC CALIBRATION	RELATIVE			ABSOLUTE

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NEAR TERM RECOMMENDATIONS CONCERNING FUTURE ORBITAL IMAGING CAPABILITIES

EXPERIMENTAL OBJECTIVES

- EVALUATE THE COMBINED UTILITY OF NARROWBAND MULTISPECTRAL IMAGING IN BOTH THE VISIBLE AND INFRARED FOR LITHOLOGIC IDENTIFICATION OF GEOLOGIC MATERIALS
- EVALUATE THE COMBINED UTILITY OF MULTISPECTRAL IMAGING IN THE VISIBLE AND INFRARED FOR LITHOLOGIC MAPPING ON A GLOBAL BASIS

GROUND RULES

- RECOMMENDATIONS ARE FIRMLY BASED ON PAST RESEARCH RESULTS
- RECOMMENDATIONS FOCUS ON DESIRED RESOLUTION AND SENSITIVITY, NOT ON SPECIFIC MEASUREMENT BANDS
- RECOMMENDATIONS SPECIFY GENERIC MEASUREMENT CAPABILITIES DESIRED IN DIFFERENT SPECTRAL REGIONS, AND DO NOT REPRESENT A PROPOSAL FOR A MONOLITHIC SENSOR
- TEAM DID NOT CONSIDER TECHNICAL DESIGN CHALLENGES OR ASSOCIATED DATA REDUCTION PROBLEMS

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CURRENT LITHOLOGIC MAPPING CAPABILITIES

- DISCRIMINATION OF IRON OXIDES BASED ON REFLECTANCE VARIATIONS IN THE VISIBLE AND NEAR INFRARED (0.5-1.0 MICROMETER WAVELENGTH REGION)
- DISCRIMINATION OF CLAY MINERALS BASED ON REFLECTANCE VARIATIONS IN THE SHORTWAVE INFRARED (2.0-2.5 MICROMETER REGION)
- DISCRIMINATION OF QUARTZ-BEARING ROCKS BASED ON EMISSIVITY VARIATIONS IN THE THERMAL INFRARED (8-12 MICROMETER REGION)
- EXPERIMENTAL DETECTION OF GEOBOTANICAL STRESS BASED ON REFLECTANCE VARIATIONS IN THE VISIBLE AND REFLECTED INFRARED (0.5-2.0 MICROMETER REGION)

CURRENT LITHOLOGIC MAPPING CAPABILITIES

VISIBLE-NEAR IR (0.5-1.0 MICROMETERS)

IRON OXIDES	HEMATITE [FE_2O_3]
	GOETHITE [FE O (OH)]

SHORTWAVE IR (2.0-2.5 MICROMETERS)

CLAY MINERALS	MONTMORILLONITE [AL_2 SI_4 O_{10} $(OH)_2 \cdot N$ H_2O]
	KAOLINITE [AL_4 SI_4 O_{10} $(OH)_8$]
	ALUNITE [KAL_3 $(SO_4)_2$ $(OH)_6$]
	JAROSITE [K FE_3 $(SO_4)_2$ $(OH)_6$]

THERMAL IR (8-12 MICROMETERS)

SEDIMENTARY ROCKS	SILICATE VS. NON-SILICATE ROCKS
	[SANDSTONES] [CARBONATES]
	[SILTSTONES]
	[SHALES]
IGNEOUS ROCKS	OCCURRENCE AND RELATIVE PROPORTIONS OF
	QUARTZ [SIO_4]

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WORKSHOP OUTCOME

- SUMMARY OF THE CURRENT STATE-OF-THE-ART
- RECOMMENDATIONS CONCERNING NEAR-TERM EXPERIMENTAL IMAGING CAPABILITIES FROM ORBIT
- LONGER TERM RESEARCH REQUIRED FOR THE DEVELOPMENT OF ADVANCED SENSORS DURING THE 1990'S

WORKSHOP ON THE USE OF FUTURE MULTISPECTRAL IMAGING CAPABILITIES FOR LITHOLOGIC MAPPING
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