GEOLGY TEAM
PRESENTED BY: MARK SETTLE
MULTISPECTRAL IMAGING SCIENCE WORKING GROUP

GEOLOGY TEAM

LONG TERM RESEARCH RECOMMENDATIONS

- LABORATORY RESEARCH
  - NEW METHODS OF FIELD SAMPLING
  - THEORETICAL MODELS OF MICROSCALE SPECTRAL MIXING

- UTILITY OF IMPROVED SPATIAL RESOLUTION
  - MULTISTAGE FIELD EXPERIMENTATION EMPLOYING PORTABLE SPECTROMETERS, AIRBORNE SCANNERS, AND ORBITAL IMAGING INSTRUMENTS (MACROSCELE MIXING)

- UTILITY OF IMPROVED SPECTRAL RESOLUTION
  - DEFINE SPECTRAL THRESHOLD FOR THE IDENTIFICATION OF SPECIFIC MINERAL SPECIES THROUGH HIGH RESOLUTION SURVEYS OF SELECTED TEST SITES

- UTILITY OF IMPROVED RADIOMETRIC SENSITIVITY
  - CONDUCT MULTISPECTRAL SURVEYS OF SELECTED TEST SITES WITH VARIABLE SIGNAL QUANTIZATION (8-12 BIT)

- 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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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
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$_2$O$_3$]
GOETHITE [FeO(OH)]

SHORTWAVE IR (2.0-2.5 MICROMETERS)

CLAY MINERALS

MONTMORILLONITE [Al$_2$Si$_4$O$_{10}$(OH)$_2$·nH$_2$O]
KAOLINITE [Al$_4$Si$_4$O$_{10}$(OH)$_8$]
ALUNITE [KAl$_3$(SO$_4$)$_2$(OH)$_6$]
JAROSITE [KFe$_3$(SO$_4$)$_2$(OH)$_6$]

THERMAL IR (8-12 MICROMETERS)

SEDIMENTARY ROCKS  SILICATE VS. NON-SILICATE ROCKS
[SANDSTONES]  [CARBONATES]
[SILTSTONES]
[SHALE]

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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