SPACE R&T STRATEGY

REVITALIZE TECHNOLOGY FOR LOW EARTH ORBIT APPLICATIONS

DEVELOP TECHNOLOGY FOR EXPLORATION OF THE SOLAR SYSTEM

MAINTAIN FUNDAMENTAL R&T BASE

BROADEN PARTICIPATION OF UNIVERSITIES

EXTEND TECHNOLOGY DEVELOPMENT TO IN-SPACE EXPERIMENTATION

FACILITATE TECHNOLOGY TRANSFER TO USERS
MISSION NEEDS

• TRANSPORTATION TO LOW EARTH ORBIT
  - PROPULSION
  - AEROBRAKING

• OPERATIONS IN LOW EARTH ORBIT
  - AUTONOMOUS SYSTEMS
  - TELEROBOTICS
  - POWER

• SCIENCE
  - STRUCTURES
  - SENSORS
  - DATA SYSTEMS
BACKGROUND

- THE FIRST STEP IN REVITALIZING THE NATION'S CIVIL SPACE TECHNOLOGY BASE

- WILL FILL GAPS IN MANY TECHNOLOGY AREAS

- FOCUSED TECHNOLOGY EFFORT, WILL RESULT IN DEMONSTRATED / VALIDATED TECHNOLOGIES
EARTH TO ORBIT PROPULSION

OBJECTIVE:

PROVIDE A VALIDATED TECHNOLOGY BASE FOR THE DESIGN OF HIGH PERFORMANCE, LONG LIFE LOX/H2 AND LOX /HC ENGINES

- ENABLE FULLY REUSABLE VEHICLES TO REDUCE TRANSPORTATION COSTS

APPROACH:

EXTEND KNOWLEDGE AND UNDERSTANDING OF ROCKET ENGINE CHEMICAL AND PHYSICAL PROCESSES BY BUILDING AND VALIDATING COMPONENTS AND HEALTH MONITORING DEVICES
EARTH TO ORBIT PROPULSION

MANAGEMENT

- LEAD OAST DIVISION
  PROPULSION, POWER AND ENERGY DIVISION

- LEAD NASA FIELD CENTER
  MARSHALL SPACE FLIGHT CENTER

- PARTICIPATING CENTER
  LEWIS RESEARCH CENTER

- FY 1989 BUDGET : $ 29.1 M
EARTH-TO-ORBIT PROPULSION

CRITICAL COMPONENTS IN AN ADVANCED BOOSTER ENGINE WHICH INCLUDE THE TURBOMACHINERY, MAIN COMBUSTOR AND TURBINE DRIVE GAS GENERATORS
OBJECTIVE:
DEVELOP THE ENGINE TECHNOLOGY FOR ALTERNATE PROPULSION CONCEPTS FOR THE SPACE SHUTTLE SOLID ROCKET BOOSTER (SRB)

- PROVIDE A SAFE ABORT OPTION
- PROVIDE THE ABILITY TO TAILOR THRUST
- PROVIDE THE POTENTIAL FOR ADDITIONAL IMPULSE

APPROACH:
EXPLORE ALTERNATIVE BOOSTER TECHNOLOGIES INCLUDING LIQUID AND HYBRID CONCEPTS
BOOSTER TECHNOLOGY

MANAGEMENT

- LEAD OAST DIVISION
  PROPULSION, POWER, AND ENERGY DIVISION

- LEAD NASA FIELD CENTER
  MARSHALL SPACE FLIGHT CENTER

- FY 1989 BUDGET: $ 9.0 M
AEROASSIST FLIGHT EXPERIMENT

OBJECTIVE:

INVESTIGATE THE CRITICAL VEHICLE TECHNOLOGIES AND UPPER ATMOSPHERIC CHARACTERISTICS APPLICABLE TO THE DESIGN OF AN AEROASSISTED ORBITAL TRANSFER VEHICLE

- PROVIDE A LARGE SAVING IN PROPELLANT WHICH COULD DOUBLE THE PAYLOAD WEIGHT

APPROACH:

CONDUCT A REENTRY FLIGHT EXPERIMENT THROUGH THE UPPER ATMOSPHERE TO VALIDATE DESIGN CODES
AEROASSIST FLIGHT EXPERIMENT

MANAGEMENT

- LEAD OAST DIVISION
  FLIGHT PROJECTS DIVISION

- LEAD NASA FIELD CENTER
  MARSHALL SPACE FLIGHT CENTER

- PARTICIPATING CENTERS
  LANGLEY RESEARCH CENTER
  JOHNSON SPACE FLIGHT CENTER
  AMES RESEARCH CENTER

- FY 1989 BUDGET: $ 13.3 M
OBJECTIVE:

DEVELOP THE TECHNOLOGY BASE REQUIRED TO EVOLVE FROM TELEOPERATIONS TO TELEROBOTICS

- PERFORM SPACE ASSEMBLY AND CONSTRUCTION, SATELLITE SERVICING, AND PLATFORM MAINTENANCE AND REPAIR EFFICIENTLY AND SAFELY

APPROACH:

DEVELOP COMPONENTS TO BE EVALUATED IN AN INTEGRATED TESTBED THAT WILL DEMONSTRATE CAPABILITIES SUCH AS STOPPING SLOWLY SPINNING SPACECRAFT, PERFORMING SIMPLE SERVICING, ETC.
ROBOTICS

MANAGEMENT

- LEAD OAST DIVISION
  INFORMATION SCIENCES AND HUMAN FACTORS DIVISION

- LEAD NASA FIELD CENTER
  JET PROPULSION LABORATORY

- PARTICIPATING CENTERS
  GODDARD SPACE FLIGHT CENTER
  LANGLEY RESEARCH CENTER
  JOHNSON SPACE CENTER

- FY 1989 BUDGET: $13.8 M
ROBOTICS

ADVANCED DUAL ARM MANIPULATOR WITH DEMONSTRATED VISUAL TRACKING CAPABILITY
OBJECTIVE:

DEVELOP AN ADVANCED SENSOR TECHNOLOGY BASE FOR SCIENTIFIC SENSING INVESTIGATION OF EARTH SYSTEMS, THE SOLAR SYSTEM, AND THE UNIVERSE

- DEVELOP PASSIVE, SENSITIVE, RELIABLE, AND IMPROVED IMAGING CAPABILITY OF SPACE-BASED ADVANCED DETECTORS

- KEEP COSTS TO A MINIMUM

APPROACH:

DEVELOP ADVANCED TUNABLE SOLID STATE AND GAS LASERS AND ACCOMPANYING ADVANCED TECHNOLOGY
SCIENCE SENSOR TECHNOLOGY

MANAGEMENT

● LEAD OAST DIVISION
  INFORMATION SCIENCES AND HUMAN FACTORS DIVISION

● LEAD NASA CENTER
  LANGLEY RESEARCH CENTER

● PARTICIPATING CENTERS
  GODDARD SPACE FLIGHT CENTER
  JET PROPULSION LABORATORY
  MARSHALL SPACE FLIGHT CENTER
  Ames Research Center
  Lewis Research Center

● FY 1989 BUDGET: $ 7.8M
SCIENCE SENSOR TECHNOLOGY

ADVANCED EARTH SENSING INCLUDES
THE DIFFERENTIAL ABSORPTION
DETECTOR AND SCANNING
INSTRUMENT (SIS)
AUTONOMOUS SYSTEMS

OBJECTIVE:

DEVELOP AN ARTIFICIAL INTELLIGENCE TECHNOLOGY BASE FOR EFFICIENT AUTONOMOUS OPERATIONS IN SPACE AND ON THE GROUND

- FREE HUMAN RESOURCES FROM ROUTINE OPERATIONS
- DECREASE COSTS OF SPACE OPERATIONS

APPROACH:

DEMONSTRATE KNOWLEDGE BASED DECISION MAKING, MACHINE LEARNING, UNCERTAINTY PLANNING AND SIMILAR ADVANCED CONCEPTS
AUTONOMOUS SYSTEMS

MANAGEMENT

- LEAD OAST DIVISION
  INFORMATION SCIENCES AND HUMAN FACTORS DIVISION

- LEAD NASA FIELD CENTER
  AMES RESEARCH CENTER

- PARTICIPATING CENTER
  JOHNSON SPACE CENTER

- FY 1989 BUDGET: $ 12.1 M
AUTONOMOUS SYSTEMS APPLICATIONS
AIDING THE INTEGRATED COMMUNICATIONS OFFICER (INCO) IN MISSION CONTROL CENTER
DATA: HIGH RATE/CAPACITY

OBJECTIVE:

DEVELOP HIGH SPEED, HIGH VOLUME DATA HANDLING TECHNOLOGIES AND SYSTEMS NEEDED TO MEET THE SCIENTIFIC AND OPERATIONAL REQUIREMENTS OF FUTURE MISSIONS

- PERFORM RECOGNITION, EXTRACTION, AND TRANSMISSION OF SIGNIFICANT OBSERVATIONS ON-BOARD THE SPACECRAFT

- ENSURE HIGH SCIENTIFIC RETURNS WHILE KEEPING OPERATIONAL COSTS LOW

APPROACH:

PRODUCE, TEST AND VALIDATE FLIGHT QUALIFIABLE COMPONENTS FOR ON-BOARD DATA PROCESSING AND STORAGE
DATA : HIGH RATE /CAPACITY

MANAGEMENT

- LEAD OAST DIVISION
  INFORMATION SCIENCES AND HUMAN FACTORS DIVISION

- LEAD NASA FIELD CENTER
  LANGLEY RESEARCH CENTER

- PARTICIPATING CENTERS
  GODDARD SPACE FLIGHT CENTER
  JET PROPULSION LABORATORY

- FY 1989 BUDGET : $ 8.1 M
FOR SPACE APPLICATIONS
SYSTEM RECENTLY DEMONSTRATED
OPTICAL DISK TECHNOLOGY

DATA: HIGH RATE/CAPACITY
CONTROL OF FLEXIBLE STRUCTURES

OBJECTIVE:

DEVELOP STRUCTURES AND CONTROLS TECHNOLOGY THAT WILL ENABLE THE DESIGN VERIFICATION AND QUALIFICATION OF PRECISION SPACE STRUCTURES AND LARGE FLEXIBLE SPACE SYSTEMS

- INCREASE SURFACE AND POINTING PRECISION AND USE OF ARTICULATED MOVING COMPONENTS

APPROACH:

VERIFY THE ANALYSIS AND DESIGN METHODS THROUGH GROUND TESTS AND IN-SPACE FLIGHT EXPERIMENTS
CONTROL OF FLEXIBLE STRUCTURES

MANAGEMENT

- LEAD OAST DIVISION
  MATERIALS AND STRUCTURES DIVISION

- LEAD NASA FIELD CENTER
  LANGLEY RESEARCH CENTER

- PARTICIPATING CENTERS
  MARSHALL SPACE FLIGHT CENTER
  JET PROPULSION LABORATORY
  GODDARD SPACE FLIGHT CENTER

- FY 1989 BUDGET: $15.7 M
CONTROL OF FLEXIBLE STRUCTURES

CONTROL AND STRUCTURES EXPERIMENT IN SPACE
OBJECTIVE:

DEVELOP THE MATERIALS, STRUCTURES, AND CONTROL TECHNOLOGY TO ENABLE THE DESIGN OF LARGE, LIGHT-WEIGHT, HIGH PRECISION ORBITING ASTRONOMICAL INSTRUMENTS

- DEVELOP LIGHT-WEIGHT AND SPACE ERECTABLE/DEPLOYABLE SYSTEMS FOR MAKING DEEP SPACE OBSERVATIONS IN THE SUB-MILLIMETER AND SMALLER PORTION OF THE SPECTRUM

APPROACH:

FABRICATE HIGH SURFACE PRECISION PANELS AND CONDUCT SYSTEM LEVEL VALIDATION TESTING
PRECISION SEGMENTED REFLECTORS

MANAGEMENT

- LEAD OAST DIVISION
  MATERIALS AND STRUCTURES DIVISION

- LEAD NASA FIELD CENTER
  JET PROPULSION LABORATORY

- FY 1989 BUDGET: $4.9 M
PRECISION SEGMENTED REFLECTORS

ADVANCED PRECISION SEGMENTED REFLECTOR STRUCTURE
HIGH CAPACITY POWER

OBJECTIVE:

DEVELOP THE TECHNOLOGY BASE NEEDED TO MEET THE LONG DURATION, HIGH CAPACITY POWER REQUIREMENTS FOR FUTURE NASA SPACE INITIATIVES

- INCREASE SYSTEM THERMAL ELECTRICAL ENERGY CONVERSION EFFICIENCY AT LEAST FIVEFOLD
- ACHIEVE SYSTEMS COMPATIBLE WITH SPACE NUCLEAR REACTORS

APPROACH:

EXPERIMENTAL VERIFICATION OF ADVANCED ENERGY CONVERSION TECHNOLOGIES, SUCH AS THE FREE-PISTON STIRLING ENGINE AND HIGH EFFICIENCY THERMOELECTRIC MATERIALS
HIGH CAPACITY POWER

MANAGEMENT

- LEAD OAST DIVISION
  PROPULSION, POWER, AND ENERGY DIVISION

- LEAD NASA FIELD CENTER
  LEWIS RESEARCH CENTER

- PARTICIPATING CENTER
  JET PROPULSION LABORATORY

- FY 1989 BUDGET: $ 11.1 M
FREE-PISTON STERLING ENGINE
## CSTI PROGRAM BUDGET

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TECHNOLOGY TRANSFER TO THE USER

- Include NASA user representatives in advisory groups and working groups.

- Include industry and university representatives as appropriate.

- Disseminate information to the space community via reports, papers, and presentations.