OAST — FLIGHT PROJECTS DIVISION

FLIGHT PROJECTS OVERVIEW

BY

JACK LEVINE

DIRECTOR,

OAST FLIGHT PROJECTS DIVISION

AIAA/OAST-L1 725/88

SPACE R&T STRATEGY

OAST

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

FLIGHT PROJECTS DIVISION

FUNCTIONS

- COLLABORATE WITH OAST DISCIPLINE DIVISIONS IN ANALYSES, FEASIBILITY STUDIES, EVALUATIONS, & SELECTION OF POTENTIAL FLIGHT RESEARCH & TECHNOLOGY PROJECTS
- IMPLEMENT & DIRECT CONCEPT DEFINITION STUDIES
- DIRECT APPROVED FLIGHT PROJECTS
  - EXPERIMENT DESIGN & DEVELOPMENT
  - INTEGRATION OF EXPERIMENTS WITH FLIGHT TEST VEHICLE SYSTEMS
  - FLIGHT OPERATIONS
  - DATA RETRIEVAL, ANALYSIS, DISSEMINATION

CURRENT SPACE FLIGHT EXPERIMENTS

FLIGHT EXPERIMENTS	HQ		LEAD CENTER
LONG DURATION EXPOSURE FACILITY	JOHN LORIA	—	LANGLEY
ORBITER EXPERIMENTS	RICHARD GUALDONI	—	JOHNSON
LIDAR IN-SPACE TECHNOLOGY EXPERIMENT	RICHARD GUALDONI	—	LANGLEY
ION AUXILIARY PROPULSION SYSTEM	JOHN LORIA	—	LEWIS
ARCJET FLIGHT EXPERIMENT	JOHN LORIA	—	LEWIS
TELEROBOT INTELLIGENT INTERFACE FLIGHT EXPERIMENT	CLOTAIRE WOOD	—	JPL
CRYOGENIC FLUID MANAGEMENT FLIGHT EXPERIMENT	JOHN LORIA	—	LEWIS
OUT-REACH (INDUSTRY/UNIVERSITY TECHNOLOGY EXPERIMENTS)	JON PYLE		
IN-REACH (NASA TECHNOLOGY EXPERIMENTS)	JON PYLE		
AEROASSIST FLIGHT EXPERIMENT	JOHN SMITH	—	MARSHALL

LDEF
LONG DURATION EXPOSURE FACILITY

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVES:

- DETERMINE LONG-TERM SPACE EXPOSURE EFFECTS ON MATERIALS, COATINGS, & OPTICS
- MEASURE SPACE ENVIRONMENTAL PHENOMENA OVER EXTENDED TIME

STATUS:

- 34 EXPERIMENTS ADVERSELY AFFECTED BY LDEF RECOVERY DELAY
- 23 EXPERIMENTS EITHER IMPROVED OR NOT AFFECTED
  - COMPOSITE MATERIALS
  - PHASED ARRAY ANTENNA MATERIALS
  - HOLOGRAPHIC DATA STORAGE CRYSTALS
  - SOLAR ARRAY MATERIALS
  - GLASS MATERIALS
- LDEF STRUCTURE AVAILABLE FOR STUDY OF ENVIRONMENTAL EROSION & DEBRIS IMPACT
- SCHEDULED FOR RETRIEVAL - NOVEMBER 1989

LEAD CENTER CONTACT:

- ROBERT L. JAMES, JR.
  LANGLEY RESEARCH CENTER
  PHONE NO. (804) 865-4987

OEX

OBITER EXPERIMENT PROGRAM

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVES:

- OBTAIN BASIC AEROTHERMODYNAMIC & ENTRY ENVIRONMENT DATA FROM R&D INSTRUMENTATION INSTALLED IN SPACE SHUTTLE ORBITER
- FLIGHT-VALIDATE GROUND TEST RESULTS TO IMPROVE BASIS FOR DESIGN OF ADVANCED SPACECRAFT

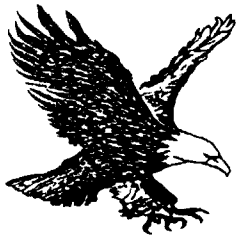
STATUS:

- DATA COLLECTION ON-GOING SINCE 1985 - WILL CONTINUE INTO 1990'S
- SOME EXPERIMENTS STILL TO BE DESIGNED & DEVELOPED

LEAD CENTER CONTACT:

- ROBERT SPANN
  JOHNSON SPACE CENTER
  PHONE # (713) 483-3022

OEX
OBITER EXPERIMENT PROGRAM

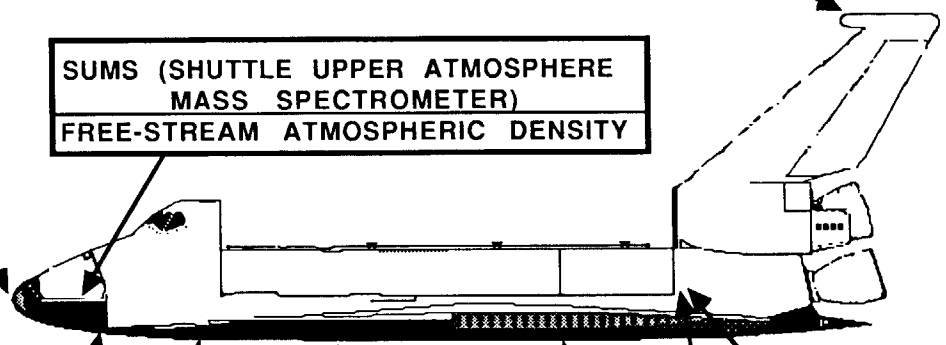


OAST — FLIGHT PROJECTS DIVISION

SEADS (SHUTTLE ENTRY AIR DATA SYSTEM)
PRECISE MEASUREMENT OF VEHICLE ATTITUDE, STATE

SILTS (SHUTTLE INFRARED LEESIDE TEMP. SENSING)
UPPER SURFACE AERO HEATING

SUMS (SHUTTLE UPPER ATMOSPHERE MASS SPECTROMETER)
FREE-STREAM ATMOSPHERIC DENSITY



ACIP (AERODYNAMIC COEFFICIENT IDENTIFICATION PKG)
HIRAP (HIGH RESOLUTION ACCELEROMETER PKG)
AERODYNAMIC DATA

ACTPS (ADVANCED CERAMIC THERMAL PROTECTION SYSTEM)
EVALUATE ADV. THERMAL PROTECTION MATERIALS

OARE (ORBITAL ACCELERATION RESEARCH EXPERIMENT)
ORBITAL DECELERATION FOR AERO-DYNAMICS IN FREE-MOLECULE FLOW

TGHE (TILE GAP HEATING EFFECTS)
DATA FOR TILE GAP OPTIMIZATION

CSE (CATALYTIC SURFACE EFFECTS)
VERIFY THERMAL PROTECTION SYSTEM DESIGN

AIP (AEROTHERMAL INSTRUMENTATION PKG.)
ENTRY TEMPERATURE, PRESSURES

LITE

LIDAR IN-SPACE TECHNOLOGY EXP.

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVE:

- EVALUATE CRITICAL ATMOSPHERIC PARAMETERS & VALIDATE OPERATION OF A SOLID-STATE LIDAR SYSTEM FROM A SPACEBORNE PLATFORM, MEASURING:
  - CLOUD DECK ALTITUDES
  - PLANETARY BOUNDARY-LAYER HEIGHTS
  - STRATOSPHERIC & TROPOSPHERIC AEROSOLS
  - ATMOSPHERIC TEMPERATURE & DENSITY (10KM TO 40KM)

STATUS:

- LASER TRANSMITTER MODULE, CASSEGRAIN TELESCOPE, & ENVIRONMENTAL MONITORING SYSTEM IN DEVELOPMENT
- FLIGHT MANIFESTED FOR 1993

LEAD CENTER CONTACT:

- RICHARD R. NELMS
  LANGLEY RESEARCH CENTER
  PHONE NO. (804) 865-4947

IAPS
ION AUXILIARY PROPULSION SYSTEM

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVES:

- EVALUATE & VALIDATE ION AUXILIARY PROPULSION SYSTEM ON A FUNCTIONAL SPACECRAFT
  - MERCURY PROPELLANT
  - 0.2 KW, 1mLB THRUST, Isp 2700
- DEMONSTRATE LONG-LIFE CONTROL OF A SPACECRAFT

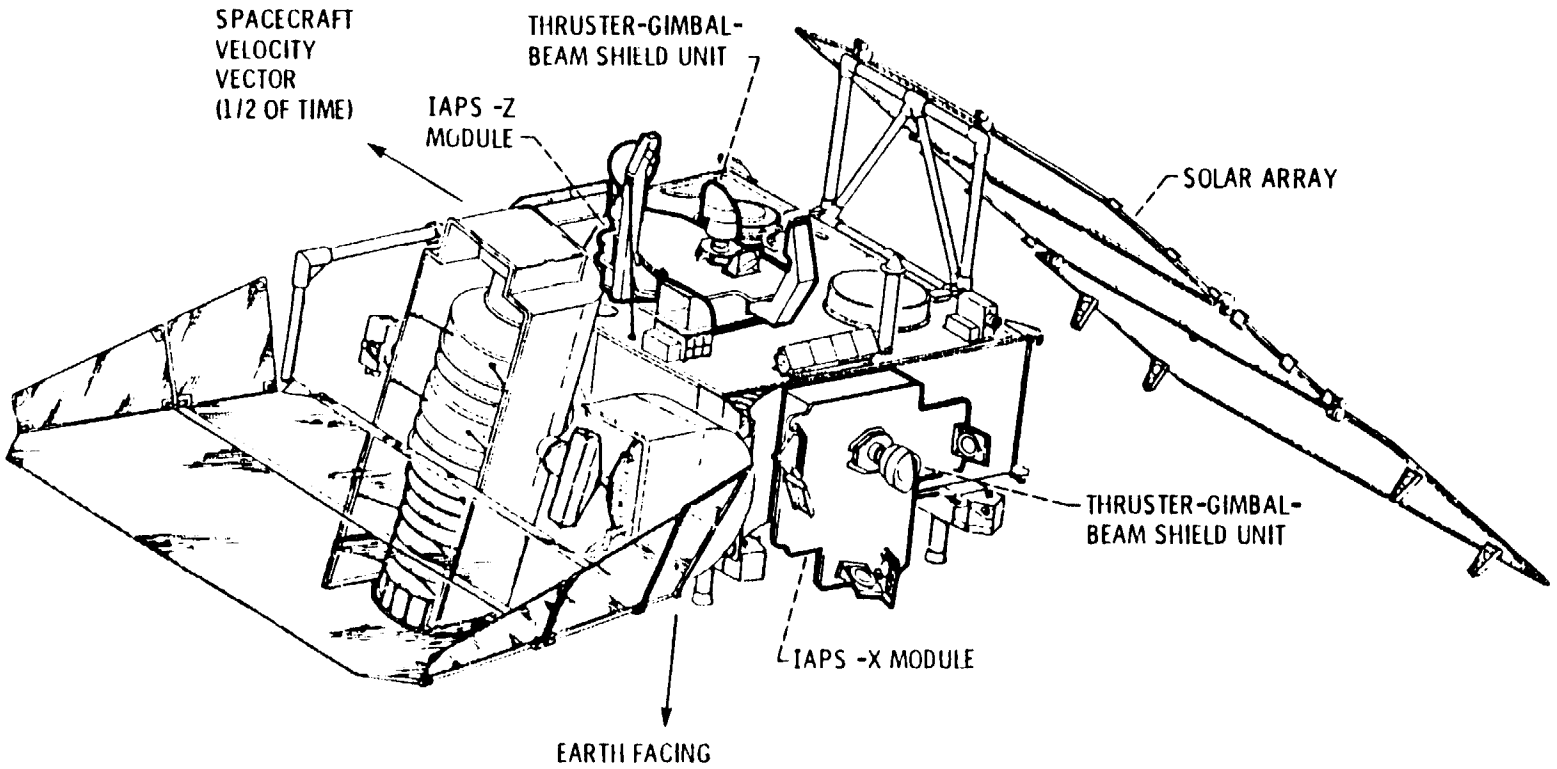
STATUS:

- ON MANIFEST FOR STS FLIGHT #37 (1990) ON TEAL RUBY SPACECRAFT
- SPACECRAFT INTEGRATION & TESTING COMPLETED

LEAD CENTER CONTACT:

- LOU IGNACZAK
  LEWIS RESEARCH CENTER
  PHONE NO. (216) 433-2848

IAPS
ION AUXILIARY PROPULSION SYSTEM



IAPS ON TEAL RUBY SATELLITE

ARCJET FLIGHT EXPERIMENT

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVES:

- ASSESS ARCJET AUXILIARY PROPULSION SYSTEM OPERATION IN SPACE ENVIRONMENT
  - HY DRAZINE PROPELLANT
  - 1.4 KW, 50 mLB THRUST, Isp 450
- EVALUATE PLUME EFFECTS & THRUSTER/THERMAL INTERACTIONS ON A COMMERICAL COMMUNICATIONS SATELLITE

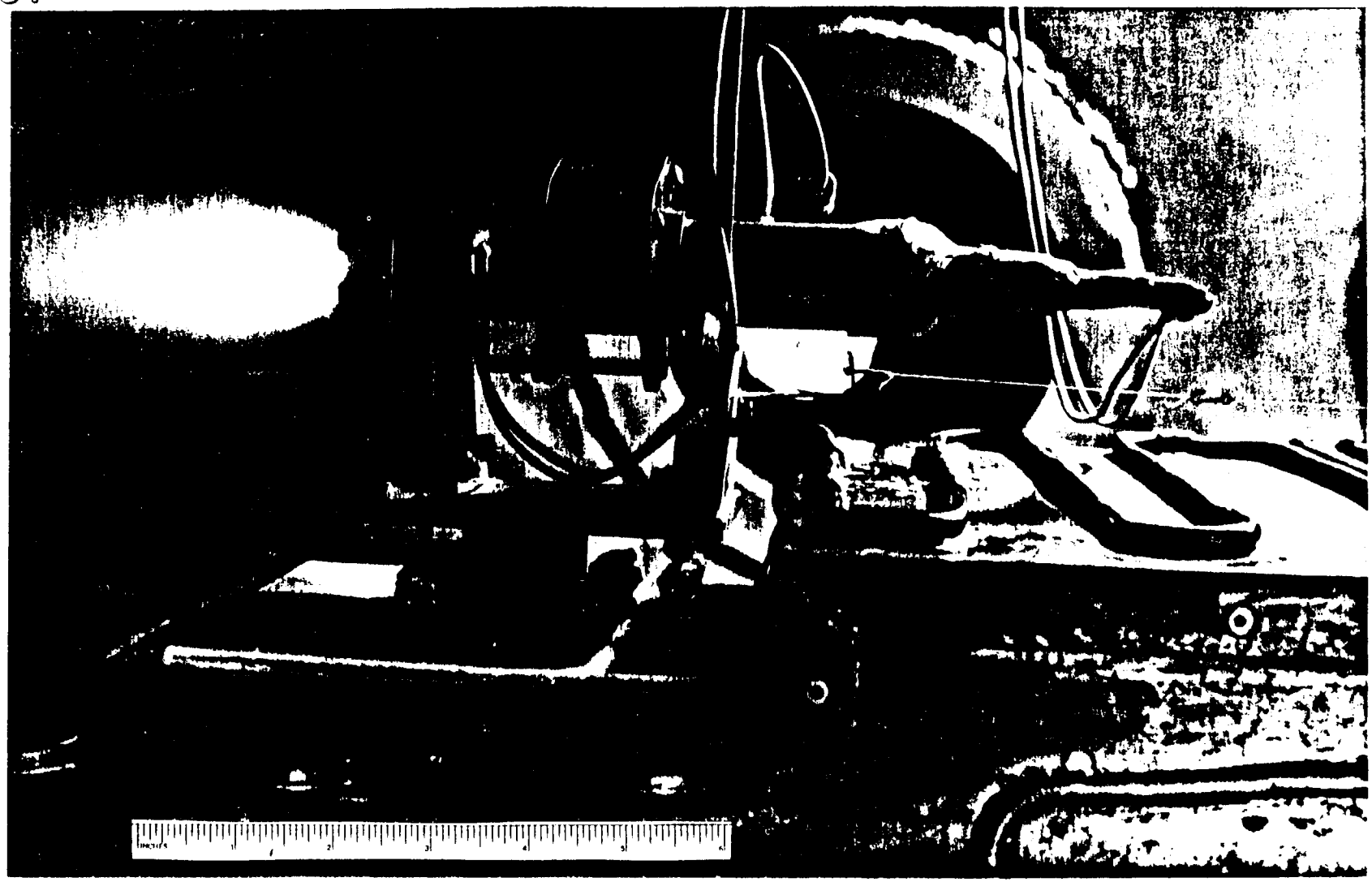
STATUS:

- PRELIMINARY DESIGN & ARCJET COMPONENT DEVELOPMENT COMPLETED
- FLIGHT HARDWARE DESIGN, DEVELOPMENT & TESTING SCHEDULED TO START IN 1989
- FLIGHT TEST TENTATIVELY PLANNED FOR 1991

LEAD CENTER CONTACT:

- JERRI S. LING
  LEWIS RESEARCH CENTER
  PHONE NO. (216) 433-2841

ARCJET FLIGHT EXPERIMENT



TRIIFEX

TELEROBOTIC INTELLIGENT INTERFACE FLIGHT EXPERIMENT

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVES:

- EVALUATE & VALIDATE TELEOPERATION OF A ROBOTIC MANIPULATOR UNDER CONDITIONS OF MICRO-G & COMMUNICATION TIME DELAYS
- VALIDATE ADVANCED SPACE TELEROBOT CONTROLS INCLUDING HIGH-FIDELITY HYBRID POSITION & FORCE CONTROL TECHNIQUES

STATUS:

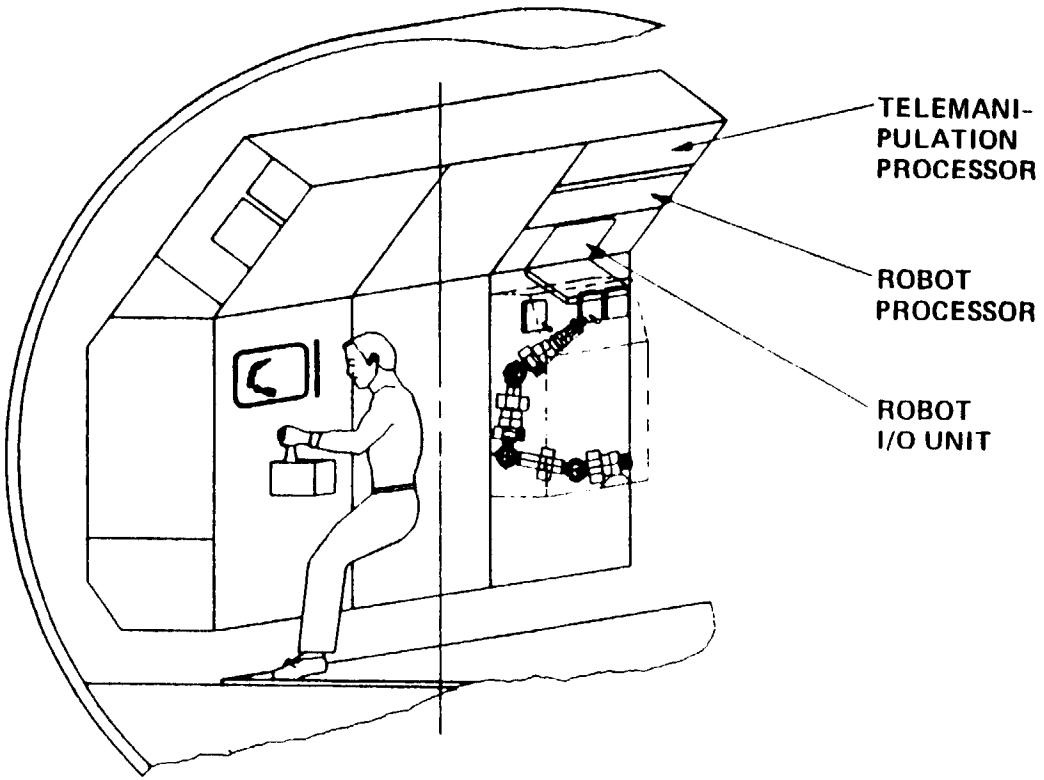
- CONCEPTUAL DESIGN IN PROGRESS AT JPL
- DEVELOPMENT & INTEGRATION SCHEDULED TO START IN LATE 1988
- FLIGHT TEST PLANNED IN COMBINATION WITH GERMAN ROTEX EXPERIMENT ON SPACELAB D-2 MISSION (1991)

LEAD CENTER CONTACT:

- DANIEL KERRISK
  JET PROPULSION LABORATORY
  PHONE NO. (818) 354-2566

TRIIFEX

TELEROBOTIC INTELLIGENT INTERFACE FLIGHT EXPERIMENT



MOCK-UP OF TRIIFEX HARDWARE ON SPACELAB D-2 MISSION

CFMFE

CRYOGENIC FLUID MGMT FLIGHT EXP.

OBJECTIVES:

- DEVELOP TECHNOLOGY REQUIRED FOR EFFICIENT STORAGE, SUPPLY & TRANSFER OF SUBCRITICAL CRYOGENIC LIQUIDS IN LOW-GRAVITY SPACE ENVIRONMENT
- FLIGHT VALIDATE NUMERICAL MODELS OF THE PHYSICS INVOLVED

STATUS:

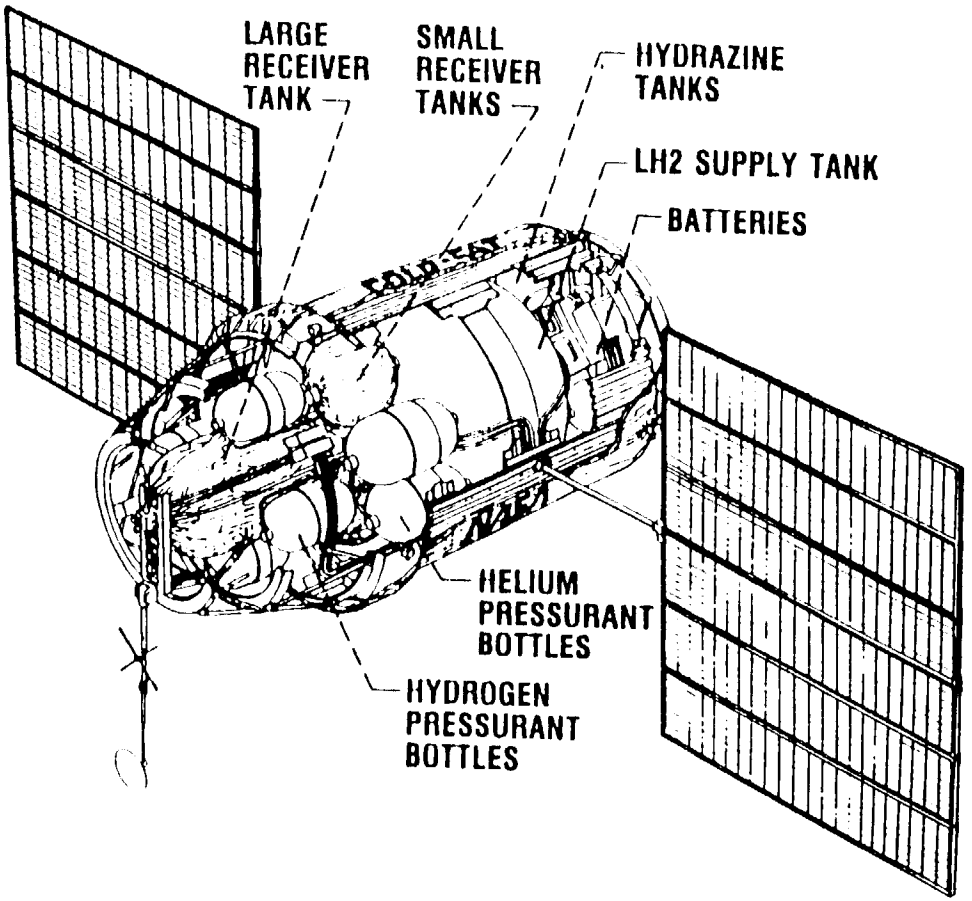
- CONTRACTOR FEASIBILITY STUDIES CURRENTLY UNDER WAY
- 1992 NEW START PROPOSED

LEAD CENTER CONTACT:

- E. PAT SYMONS
  LEWIS RESEARCH CENTER
  PHONE NO. (216) 433-2853

CFMFE

CRYOGENIC FLUID MGMT FLIGHT EXP.



COLD-SAT SPACECRAFT

INDUSTRY/UNIVERSITY IN-SPACE TECHNOLOGY EXPERIMENTS

OAST — FLIGHT PROJECTS DIVISION

OUT-REACH PROGRAM

OBJECTIVES:

- PROVIDE FOR IN-SPACE FLIGHT RESEARCH EVALUATION & VALIDATION OF ADVANCED SPACE TECHNOLOGIES FOR THE INDUSTRY & UNIVERSITY COMMUNITY

STATUS:

- 7 MAJOR THEME AREAS
- 41 FLIGHT EXPERIMENT PROPOSALS SELECTED

PROGRAM CONTACT:

JON PYLE
NASA HEADQUARTERS
PHONE NO. (202) 453-2831

NASA IN-SPACE TECHNOLOGY EXPERIMENTS

OAST — FLIGHT PROJECTS DIVISION

IN-REACH PROGRAM

OBJECTIVES:

- EXPAND THE NASA IN-SPACE R&T PROGRAM BY THE PROMOTION OF SPACE FLIGHT EXPERIMENTS WITHIN THE NASA CENTERS
- FORMALIZE THE PROCESS FOR SELECTION OF CANDIDATE EXPERIMENTS IN THE SPACE STATION ERA

STATUS:

- 58 EXPERIMENT PROPOSALS SUBMITTED
- 7 FLIGHT EXPERIMENTS SELECTED FOR DEFINITION & DEVELOPMENT

PROGRAM CONTACT:

JON PYLE
NASA HEADQUARTERS
PHONE NO. (202) 453-2831

AFE

AEROASSIST FLIGHT EXPERIMENT

OAST — FLIGHT PROJECTS DIVISION

OBJECTIVE:

- INVESTIGATE CRITICAL VEHICLE DESIGN & ENVIRONMENTAL TECHNOLOGIES APPLICABLE TO THE DESIGN OF AEROASSISTED SPACE TRANSFER VEHICLES

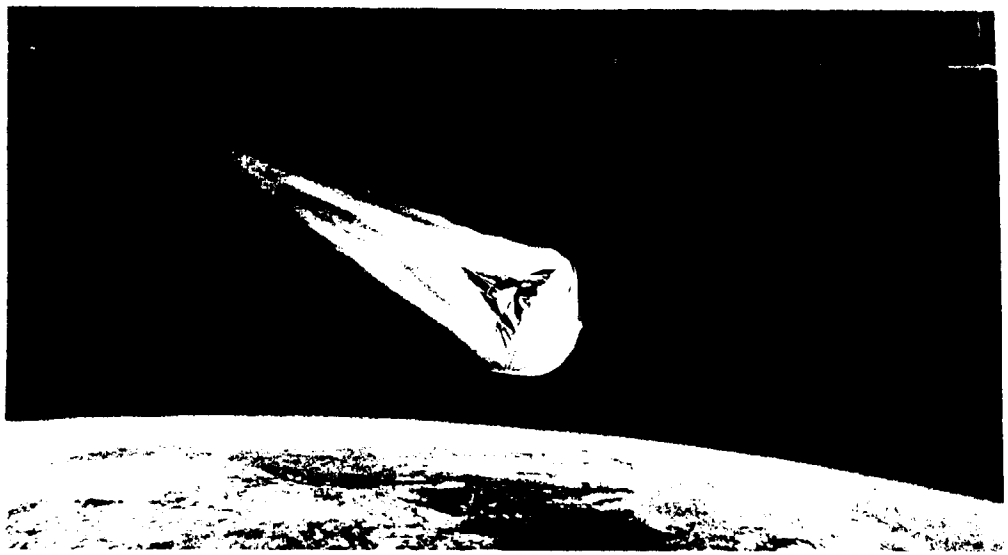
STATUS:

- PHASE B DEFINITION COMPLETE
- EXPERIMENT/INSTRUMENT COMPLEMENT ESTABLISHED
- PRELIMINARY DESIGN INITIATED

LEAD CENTER CONTACT:

- LEON B. ALLEN
  MARSHALL SPACE FLIGHT CENTER
  PHONE NO. (205) 544-1917

AFE
AEROASSIST FLIGHT EXPERIMENT



SCIENCE & TECHNOLOGY OBJECTIVES:

- UNDERSTAND RADIATIVE HEATING WHERE THE SHOCK LAYER IN CHEMICAL NON-EQUILIBRIUM
- DETERMINE CATALYTIC EFFICIENCY WHERE NITROGEN IS MOSTLY DISASSOCIATED & SOME IONIZATION IS PRESENT IN THE SHOCK LAYER
- EVALUATE ADVANCED THERMAL PROTECTION SYSTEM MATERIALS
- VERIFY PREDICTIVE TECHNIQUES FOR THE BASE FLOW & WAKE REGION
- ASSESS CONTROL ISSUES RELATED TO ATMOSPHERIC VARIABLES WHICH AN ASTV MIGHT ENCOUNTER
- VERIFY COMPUTATIONAL CODES FOR PREDICTION OF ASTV HEATING ENVIRONMENT & AERODYNAMIC PERFORMANCE

SUMMARY

- LONG & SUCCESSFUL HISTORY IN THE CONDUCT OF SPACE FLIGHT TECHNOLOGY EXPERIMENTS
- PROGRAM IS BEING EXPANDED TO EMPHASIZE THE DEVELOPMENT OF ADVANCED SPACE FLIGHT TECHNOLOGIES
- OAST PLANS TO PROVIDE ACCESS TO SPACE FOR THE AEROSPACE TECHNOLOGY COMMUNITY (NASA, DOD, INDUSTRY & UNIVERSITIES)