IN-SPACE TECHNOLOGY EXPERIMENTS

IN-REACH & OUT-REACH PROGRAMS

- FORMALIZED PROCESS OF IDENTIFYING ADVANCED SPACE TECHNOLOGIES
  - TECHNOLOGIES MUST BE FULLY DEVELOPED ON GROUND
  - REQUIRES SPACE FLIGHT ENVIRONMENT FOR VALIDATION OR VERIFICATION

- PROGRAMS INCLUDE:
  - EXPERIMENT DEFINITION
  - HARDWARE DEVELOPMENT
  - EXPERIMENT INTEGRATION
  - FLIGHT SUPPORT
  - REPORTING
IN-SPACE TECHNOLOGY EXPERIMENTS

OBJECTIVES

- PROVIDE FOR IN-SPACE FLIGHT RESEARCH EVALUATION & VALIDATION OF ADVANCED SPACE TECHNOLOGIES

OUT-REACH PROGRAM

- INDUSTRY/UNIVERSITY FLIGHT TECHNOLOGY EXPERIMENTS

IN-REACH PROGRAM

- NASA FLIGHT TECHNOLOGY EXPERIMENTS
IN-REACH
NASA IN-SPACE TECHNOLOGY EXP.

- CENTERS REPRESENTED:
  ARC, GSFC, JPL, JSC, LaRC, LeRC, MSFC

- 58 PROPOSALS SUBMITTED
- 7 PROPOSALS SELECTED

- FLIGHT EXPERIMENT DEFINITION:
  - DEBRIS COLLISION SENSOR
  - SPACE STATION STRUCTURAL CHARACTERIZATION
  - LASER COMMUNICATION
  - LASER SENSOR
  - CONTAMINATION SENSOR
  - EXPOSURE OF THIN-FOIL MIRRORS

- FLIGHT EXPERIMENT DEVELOPMENT
  - THERMAL ENERGY STORAGE MATERIALS TECHNOLOGY
IN-REACH
FLIGHT EXPERIMENT DEVELOPMENT

THERMAL ENERGY STORAGE (TES) MATERIALS TECHNOLOGY

CONCEPT:
- IN-SPACE THERMAL CYCLING OF A VARIETY OF PHASE CHANGE TES MATERIALS (VARING TEMPERATURE RANGES) TO UNDERSTAND VOID CHARACTERIZATION IN MICRO-G

COMPUTER ENHANCED SCAN OF TES CANISTER CROSS-SECTION
IN-REACH
FLIGHT EXPERIMENT DEVELOPMENT

THERMAL ENERGY STORAGE (TES) MATERIALS TECHNOLOGY

OBJECTIVES:

- IDENTIFY VOID LOCATION, VOID SIZE & MELT/FREEZE PATTERNS FOR VARIOUS TEMPERATURE RANGE TES MATERIALS UNDER MICRO-GRAVITY CONDITIONS
- VERIFY ANALYTICAL & GROUND EXPERIMENTAL PREDICTED BEHAVIOR OF TES MATERIALS SUBJECTED TO THE MICRO-GRAVITY ENVIRONMENT

BENEFITS/PAYOFFS:

- CRITICAL TO DESIGN OF ADVANCED, LONGER LIFE, HIGHLY RELIABLE INTEGRAL THERMAL STORAGE HEAT RECEIVERS
- SIGNIFICANT REDUCTION IN WEIGHT POSSIBLE OVER PHOTOVOLTAIC SYSTEM

LEAD CENTER CONTACT:

- DR. LYNN ANDERSON
  LEWIS RESEARCH CENTER
  (216) 433-2874
OUT-REACH
INDUSTRY/UNIVERSITY IN-SPACE
TECHNOLOGY EXPERIMENTS

PARTICIPATION:
- 231 PROPOSALS SUBMITTED (91 UNIVERSITY & 140 INDUSTRY)

36 FLIGHT EXPERIMENT DEFINITION STUDIES:
- 5 SPACE STRUCTURES
- 7 FLUID MANAGEMENT
- 3 INFORMATION SYSTEMS
- 5 ENERGY SYSTEMS & THERMAL MANAGEMENT
- 2 SPACE ENVIRONMENTAL EFFECTS
- 10 IN-SPACE OPERATIONS
- 4 AUTOMATION & ROBOTICS

5 FLIGHT EXPERIMENT HARDWARE DEVELOPMENTS:
- HEAT PIPE THERMAL PERFORMANCE & FLUID BEHAVIOR
- TANK PRESSURE CONTROL
- INVESTIGATION OF SPACECRAFT GLOW
- MID-DECK ZERO-GRAVITY DYNAMICS EXPERIMENT
- EMULSION CHAMBER TECHNOLOGY
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

HEAT PIPE PERFORMANCE & WORKING FLUID BEHAVIOR

CONCEPT:
• SPACE SHUTTLE MID-DECK LOCKER OR COMPLEX SELF-CONTAINED PAYLOAD
• TWO SETS OF HEAT PIPES (4 EACH) MOUNTED ON A CRUCIFORM STRUCTURE
• ARTIFICIAL ACCELERATION LEVELS (VARIABLE G) APPLIED TO HEAT PIPES BY CONTROLLED SPINNING
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

HEAT PIPE PERFORMANCE & WORKING FLUID BEHAVIOR

OBJECTIVES:

• STUDY EFFECTS OF MICRO-GRAVITY ON WORKING FLUIDS IN HEAT PIPES
• DETERMINE RECOVERY RATES FOR DEPRIMED VARIABLE CONDUCTANCE HEAT PIPES IN 0-G
• VALIDATE ANALYTICAL MODELS & UPGRADE GROUND TEST TECHNIQUES

BENEFITS/PAYOFFS:

• SPACECRAFT LIQUID INVENTORIES COULD BE REDUCED THROUGH BETTER UNDERSTANDING OF 0-G FLUID BEHAVIOR
• IMPROVE POWER SYSTEM HEAT DISIATION & REDUCE ADVANCED SPACECRAFT SYSTEM DESIGN RISKS

LEAD CENTER CONTACT:

• DON FRIEDMAN
  GODDARD SPACE FLIGHT CENTER
  (301) 286-6242

AIAA/OAST P-5a 9/1/88
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

TANK PRESSURE CONTROL EXPERIMENT

CONCEPT:

- VISUAL & THERMAL EVALUATION OF FLUID MIXING BY MEANS OF A JET INDUCED FLOW

- PLEXIGAS CANNISTER USING LIQUID FREON MOUNTED IN A GET AWAY SPECIAL (GAS) PAYLOAD (MANIFESTED 7/90)
OUT-REACH

FLIGHT EXPERIMENT DEVELOPMENT

TANK PRESSURE CONTROL EXPERIMENT

OBJECTIVES:

- DETERMINE THERMAL STRATIFICATION OF FLUIDS IN 0-G
- STUDY EFFECTIVENESS OF JET INDUCED MIXING
- VALIDATE OR UPGRADE EXISTING ANALYTICAL MODELS

BENEFITS/PAYOFFS:

- REDUCES TANK OVERPRESSURE RISKS CAUSED BY HIGH THERMAL GRADIENTS IN LIQUIDS
- PROVIDES BETTER DESIGN TECHNIQUES FOR FUTURE SPACECRAFT SYSTEMS

LEAD CENTER CONTACT:

- DR. LYNN ANDERSON
  LEWIS RESEARCH CENTER
  (216) 433-2874
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

INVESTIGATION OF SPACECRAFT GLOW

CONCEPT:

- PLATE WITH MATERIAL SAMPLES MOUNTED TOWARD RAM (NORMAL INCIDENCE) DIRECTION
- OPTICAL MEASUREMENTS USED TO CHARACTERIZE THE GLOW
- OBTAIN MEASUREMENTS OF GLOW ABOVE MATERIAL SURFACE OVER TEMPERATURE RANGE & SPECTRAL REGIONS
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

INVESTIGATION OF SPACECRAFT GLOW

OBJECTIVES:

- Measure the intensity, spatial distribution & spectrum of space glow
- Determine the glow intensity as a function of surface temperature & materials
- Identify mechanisms producing glow & approaches to minimize its effects

BENEFITS/PAYOFFS:

- Eliminate interference of glow on space flight experiments (such as optics)
- May provide techniques for spacecraft detection & identification

LEAD CENTER CONTACT:

- Keith Henderson
  Johnson Space Center
  (713) 282-1807
CONCEPT:

- USES SKEWED-SCALE ERECTABLE STRUCTURE WITH SPACE STATION TYPE JOINTS
- ELECTRONICALLY CONTROLLED EXCITER DYNAMICS TO PROVIDE PREDICTABLE INTERACTION
- REUSABLE EXCITER/CONTROLLER & DATA RETREIVAL SYSTEM IN MID-DECK LOCKERS
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

MID-DECK ZERO-GRAVITY DYNAMICS EXPERIMENT

OBJECTIVES:

- INVESTIGATE DYNAMICS OF NONLINEAR SPACECRAFT SYSTEMS IN A MICRO-GRAVITY ENVIRONMENT
- PROVIDE LONG DURATION 0-G FLIGHT DATA TO CORRELATE WITH GROUND TEST RESULTS & ANALYTICAL PREDICTIONS

BENEFITS/PAYOFFS:

- REDUCE RISKS OF SPACECRAFT DESTABILIZATION DUE TO LIMITED UNDERSTANDING OF COMPLEX DYNAMIC INTERACTIONS
- IMPROVED DESIGN TECHNIQUES & GREATER RELIABILITY ALLOW REDUCTIONS IN SPACECRAFT WEIGHTS

LEAD CENTER CONTACT:

- LENWOOD CLARK
  LANGLEY RESEARCH CENTER
  (804) 865-4834
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

EMULSION CHAMBER TECHNOLOGY

CONCEPT:

- 300 LAYER NUCLEAR TRACK EMULSION IN SHIELDED HERMETIC ENCLOSURE
- LONG TERM EXPOSURE TO SPACE ENVIRONMENT IN SPACE SHUTTLE BAY
OUT-REACH
FLIGHT EXPERIMENT DEVELOPMENT

EMULSION CHAMBER TECHNOLOGY

OBJECTIVES:
• VALIDATION OF EMULSION CALORIMETER TO BE USED FOR HIGH ENERGY COSMIC RAY DETECTION
• STUDY OF SHIELDING TECHNIQUES FOR EMULSION CALORIMETERS
• VERIFY PREDICTED HIGH ENERGY PARTICLE DATA

BENEFITS/PAYOFFS:
• ENABLES EXTENSION OF COSMIC RAY COMPOSITION & NUCLEAR INTERACTION CHARACTERISTICS
• POTENTIAL IMPROVEMENTS IN SHIELDING APPLICATIONS FOR FUTURE MANNED SPACECRAFT

LEAD CENTER CONTACT:
• JON HAUSSLER
  MARSHALL SPACE FLIGHT CENTER
  (205) 544-1762
IN-REACH & OUT-REACH PROGRAMS

IN-SPACE TECHNOLOGY EXPERIMENTS

WORKSHOP

HYATT REGENCY HOTEL
ATLANTA, GA

DECEMBER 6, 7, 8, & 9, 1988
IN-SPACE TECHNOLOGY EXPERIMENTS WORKSHOP

WORKSHOP PURPOSE

- REVIEW OF CURRENT PROGRAMS & DISCUSSION OF FUTURE PLANS
- DESCRIPTION OF FLIGHT OPPORTUNITIES & INTEGRATION PROCESS
- IDENTIFICATION OF CRITICAL TECHNOLOGY NEEDS IN EACH THEME AREA