TECHNOLOGY DEVELOPMENT ON EVOLUTIONARY SPACE STATION

SPACE STATION EVOLUTION SYMPOSIUM

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Assistant Director for SpaceTechnology
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OAET

SPACE R&T MISSION STATEMENT

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OAET SHALL PROVIDE TECHNOLOGY FOR FUTURE CIVIL SPACE MISSIONS AND PROVIDE A BASE OF RESEARCH AND TECHNOLOGY CAPABILITIES TO SERVE ALL NATIONAL SPACE GOALS

- *IDENTIFY, DEVELOP, VALIDATE AND TRANSFER TECHNOLOGY TO:*
  - INCREASE MISSION SAFETY AND RELIABILITY
  - REDUCE PROGRAM DEVELOPMENT AND OPERATIONS COST
  - ENHANCE MISSION PERFORMANCE
  - ENABLE NEW MISSIONS
- *PROVIDE THE CAPABILITY TO:*
  - ADVANCE TECHNOLOGY IN CRITICAL DISCIPLINES
  - RESPOND TO UNANTICIPATED MISSION NEEDS

LBF4194B

NASA ACTION PLAN

ADVISORY COMMITTEE ON THE FUTURE OF THE U.S. SPACE PROGRAM

RECOMMENDATION 8:

That NASA, in concert with the Office of Management and Budget and appropriate Congressional committees, establish an augmented and reasonably stable share of NASA's total budget that is allocated to advanced technology development. A two- to three-fold enhancement of the current modest budget seems not unreasonable.

In addition, we recommend that an agency-wide technology plan be developed with inputs from the Associate Administrators responsible for the major development programs, and that NASA utilize an expert, outside review process, managed from headquarters, to assist in the allocation of technology funds.

NASA ADMINISTRATOR ACTION:

Codes R/M/S/O/AA for Exploration (Code R lead): Provide an integrated agency-wide technology development plan (using the FY 91 appropriated budget as the base, and based on two- and three-fold budget increase); due at macro level 6/91; refined plan 11/91

RECOMMENDATION 7:

That Technology Be Pursued Which Will Enable A Permanent, Possibly Man-Tended Outpost To Be Established On The Moon For The Purposes of Exploration And For The Development Of The Experience Base Required For The Eventual Human Exploration Of Mars.

That NASA Should Initiate Studies Of Robotic Precursor Missions and Lunar Outposts.

NASA ADMINISTRATOR ACTION:

Include Technology Aspects in The Technology Planning Action Responding to Recommendation 8

INTEGRATED TECHNOLOGY PLAN FOR THE CIVIL SPACE PROGRAM

RESEARCH & TECHNOLOGY STRATEGY

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FLIGHT PROGRAMS FORECAST

● 5-YEAR FORECAST INCLUDES

'93 THRU '97: LIMITED NEW STARTS

- COMPLETION OF INITIAL SSF
- SOME SHUTTLE IMPROVEMENTS
- INITIAL EOS & EOSDIS
- SELECTED SPACE SCIENCE STARTS
- NLS DEVELOPMENT
- INITIAL SEI ARCHITECTURE SELECTION
- EVOLVING GEO COMMERCIAL COMMSATS
- MINOR UPGRADES OF COMMERCIAL ELVS

● 10-YEAR FORECAST INCLUDES

'98 THRU '03: MULTIPLE NEW STARTS TO BE LAUNCHED IN 2003 THRU 2010

- SSF EVOLUTION/INFRASTRUCTURE
- FINAL SHUTTLE ENHANCEMENTS
- ADVANCED LEO EOS PLATFORMS/FULL EOSDIS
- MULTIPLE SPACE SCIENCE STARTS
- NLS OPERATIONS/EVOLUTION
- EVOLVING LAUNCH/OPERATIONS FACILITIES
- INITIAL SEI/LUNAR OUTPOST START
- DSN EVOLUTION (KA-BAND COMMUNICATIONS)
- NEW GEO COMMERCIAL COMMSATS
- NEW COMMERCIAL ELVS

● 20-YEAR FORECAST INCLUDES

'04 THRU '11 MULTIPLE OPTIONS FOR NEW STARTS TO BE LAUNCHED IN 2009 THRU 2020

- SSF-MARS EVOLUTION
- BEGINNING OF AMLS/PLS DEVELOPMENT
- MULTIPLE SPACE SCIENCE STARTS
- DSN EVOLUTION (OPTICAL COMM)
- INITIAL MARS HLLV DEVELOPMENT
- EVOLVING LUNAR SYSTEMS
- MARS SEI ARCHITECTURE CHOSEN
- LARGE GEO COMMSATS
- NEW COMMERCIAL ELVS

MAY 10, 1991
JCM-7692

TECHNOLOGY PLAN FOR THE CIVIL SPACE PROGRAM

NASA TECHNOLOGY MATURATION STRATEGY

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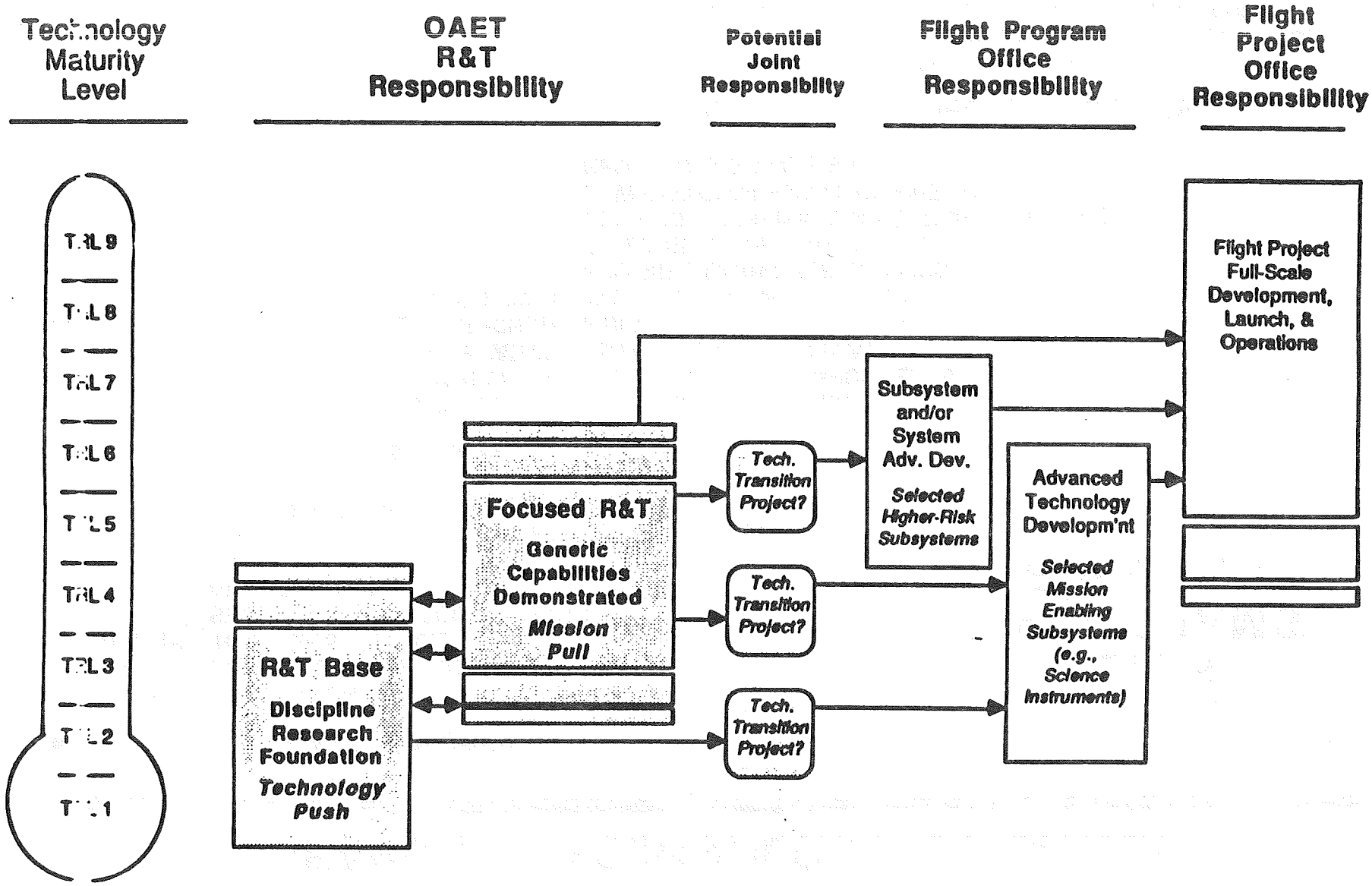

APRIL 15, 1991
JCM-7079b

OSF Technology Requirements Evaluation

Technology Areas

Program Unique Technologies

1	Vehicle Health Management
2	Advanced Turbomachinery Components and Models
3	Combustion Devices
4	Advanced Heat Rejection Devices
5	Water Recovery and Management
6	High Efficiency Space Power Systems
7	Advanced Extravehicular Mobility Unit Technologies
8	Electromechanical Control Systems/Electrical Actuation
9	Crew Training Systems
10	Characterization of Al-Li Alloys
11	Cryogenic Supply, Storage, and Handling
12	Thermal Protection Systems for High Temperature Applications
13	Robotic Technologies
14	Orbital Debris Protection
15	Guidance, Navigation and Control
16	Advanced Avionics Architectures

Industry Driven Technologies

- Signal Transmission and Reception
- Advanced Avionics Software
- Video Technologies
- Environmentally Safe Cleaning Solvents, Refrigerants and Foams
- Non-Destructive Evaluation

Figure 3-1

INTEGRATED TECHNOLOGY PLAN FOR THE CIVIL SPACE PROGRAM

EXTERNAL TECHNOLOGY PERSPECTIVES SUMMARY

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SPACE SCIENCE

Precision Space Structures and Pointing Accuracy

PLANETARY SURFACE EXPLORATION

Regnerative Life Support Systems
Radiation Protection for Long Missions
Utilization of In Situ Materials/Propellants
Artificial Intelligence Techniques
Robotic & Microrobotic Systems
Advanced EMUs
Surface Rover Technologies (Pressurized and Unpressurized)
Nuclear Electric Power
High-Efficiency Lunar Radiators & Thermal Energy Storage
Power Beaming
Human Health Maintenance
Reduced Gravity Countermeasures/Artificial Gravity
Bioprocess-Grade Fluid Management Systems

SPACE PLATFORMS

Composite Lightweight Structures
Micrometeoroid and Debris Protection
Long-Life Structures and Mechanisms
Regnerative Life Support Systems
Advanced EMUs
Expanded Atomic Oxygen Database
High-Efficiency, Radiation-Resistant, Lightweight PV Arrays
High-Efficiency Power Processing Units
Lightweight Batteries

TRANSPORTATION

Economical Launch Systems (Manned and Unmanned)
Software Productivity Enhancers
Integrated Vehicle Health Monitoring and Maintenance
Advanced Cryogenic (Oxygen/Hydrogen) Engines
Fault-Tolerant Advanced Avionics with Open Architectures
High-Performance/Composite Lightweight Structures
Long-Life Structures and Mechanisms
High-Performance, Storable Space Thrusters
High-Power Electric Propulsion
Nuclear Thermal Propulsion for Manned Interplanetary Missions
Cryogenics Long-Duration Storage and Management
Gun-Type Launch Systems
Aerobraking (Thermal Protection Systems)
Integrated RCS/Auxiliary Propulsion
Lightweight, Fuel-Efficient Airbreather Propulsion Systems

OPERATIONS

Data Management System Architecture and Software
Systems Integration technologies (Software, etc.)
Artificial Intelligence Techniques
Safe Robotic Systems
Advanced Communications (e.g., Laser & Millimeter Wave Technology)

JUNE 24, 1991
JCM-7660d

INTEGRATED TECHNOLOGY PLAN FOR THE CIVIL SPACE PROGRAM

WORK BREAKDOWN STRUCTURE

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SPACE RESEARCH & TECHNOLOGY

RESEARCH & TECHNOLOGY BASE

DISCIPLINE RESEARCH
- Aerothermodynamics
- Space Energy Conversion
- Propulsion
- Materials & Structures
- Information and Controls
- Human Support
- Adv. Communications

UNIVERSITY PROGRAMS

SPACE FLIGHT R&T
- Flight Experiment Studies
- IN-STEP

SYSTEMS ANALYSIS

CIVIL SPACE TECHNOLOGY INITIATIVE

SPACE SCIENCE TECHNOLOGY
- Science Sensing
- Observatory Systems
- Science Information
- In Situ Science
- Technology Flight Expts.

PLANETARY SURFACE EXPLORATION TECHNOLOGY
- Surface Systems
- Human Support
- Technology Flight Expts.

TRANSPORTATION TECHNOLOGY
- ETO Transportation
- Space Transportation
- Technology Flight Expts.

SPACE PLATFORMS TECHNOLOGY
- Earth-Orbiting Platforms
- Space Stations
- Deep-Space Platforms
- Technology Flight Expts.

OPERATIONS TECHNOLOGY
- Automation & Robotics
- Infrastructure Operations
- Info. & Communciations
- Technology Flight Expts.

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(JCM-7650a)

INTEGRATED TECHNOLOGY PLAN FOR THE CIVIL SPACE PROGRAM

Critical User Requirements/Strategic Plan Element Categorization

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Space Science Technology	Submillimeter Sensing	Direct Detectors	Active µwave Sensing	Sample Acq., Analysis & Preservation	Passive Microwave Sensing	----	Optoelectmcs Sensing & Processing	Probes and Penetrators	----
		Sensor Electronics	Laser Sensing						
	Cooler and Cryogenics	Microprecision CSI	Telescope Optical Systems	Data Archiving and Retrieval	Data Visualization	----	Precision Instrument Pointing	Sensor Optical Systems	----
Planetary Surface Exploration Technology	Radiation Protection	Regenerative Life Support (Phys-Chem.)	Space Nuclear Power (SP-100)	High Capacity Power	Planetary Rovers	Surface Habitats and Construction	Exploration Human Factors	----	Artifical Gravity
	-----	----	Extravehicular Activity Systems	Surface Solar Power and Thermal Mgt.	In Situ Resource Utilization	Laser-Electric Power Beaming	Medical Support Systems	----	----
Transportation Technology	ETO Propulsion	Aeroassist Flight Expt	Aeroassist/ Aerobraking	Transfer Vehicle Avionics	ETO Vehicle Avionics	ETO Vehicle Structures & Materials	Autonomous Rendezvous & Docking	COHE	Auxiliary Propulsion
		Nuclear Thermal Propulsion							
	Cryogenic Fluid Systems	Adv. Cryo. Engines	Low-Cost Commercial ETO XPort	Nuclear Electric Propulsion	CONE	SEPS TFE	Autonomous Landing	TV Structures and Cryo Tankage	HEAb
Space Platforms Technology	Platform Structures & Dynamics	Platform Power and Thermal Mgt.	Zero-G Life Support	Platform Materials & Environ. Effects	Station-Keeping Propulsion	----	Spacecraft On-Board Propulsion	Earth-Orbiting Platform Controls	Advanced Refrigerator Systems
	----	----	Zero-G Advanced EMU	Platform NDE-NDI	Deep-Space Power and Thermal	----	Spacecraft GN&C	Debris Mapping Experiment	----
Operations Technology	Space Data Systems	High-Rate Comm.	Artificial Intelligence	Ground Data Systems	Optical Comm Flight Expt	Flight Control and Operations	Space Assembly & Construction	Space Processing & Servicing	Photonics Data Systems
					Navigation & Guidance				
	----	CommSat Communicat'ns	TeleRobotics	FTS DTF-1	Operator Syst./Training	CommSat Communicat'ns Flight Expts	----	Ground Test and Processing	----
	HIGHEST PRIORITY ◊◊◊			2nd-HIGHEST PRIORITY ◊◊			3rd-HIGHEST PRIORITY ◊		

LBF40343
(JCM-6800f)

TECHNOLOGY FLIGHT EXPERIMENTS

OAET — PURPOSE

- IN-SPACE EXPERIMENTS HAVE ALWAYS BEEN PART OF OAET'S PROGRAM
  - TO OBTAIN DATA THAT CAN NOT BEEN ACQUIRED ON THE GROUND
  - TO DEMONSTRATE FEASIBILITY OF CERTAIN ADVANCED TECHNOLOGIES
- CONDUCTING TECHNOLOGY EXPERIMENTS IN SPACE IS A VALUABLE AND COST EFFECTIVE WAY TO INTRODUCE ADVANCED TECHNOLOGIES INTO FLIGHT PROGRAMS
- UTILIZING THE SHUTTLE HAS DEMONSTRATED THE FEASIBILITY AND TIMELY BENEFITS OF CONDUCTING HANDS-ON EXPERIMENTS IN SPACE
- SPACE STATION FREEDOM WILL BE A PERMANENT LABORATORY IN SPACE THAT WILL PROVIDE THE LOGICAL AND EVOLUTIONARY EXTENSION OF GROUND BASED R&T

TECHNOLOGY FLIGHT EXPERIMENTS

OAET

TECHNOLOGY CATEGORIES

- SPACE STRUCTURES
  - ASSEMBLY, 0N-ORBIT NDE, REPAIR
  - DYNAMICS
- FLUID MANAGEMENT & PROPULSION
  - STORABLE AND CRYOGENIC
- POWER SYSTEMS & THERMAL MANAGEMENT
  - SOLAR CELLS, ENERGY STORAGE
  - TWO PHASE THERMAL MANAGEMENT DEVICES
- HUMANS IN SPACE
  - ENVIRONMENTAL CONTROL AND LIFE SUPPORT
  - HEALTH MAINTENANCE DEVICES
- SENSORS & INFORMATION SYSTEMS
- AUTOMATION AND ROBOTICS
- SPACE ENVIRONMENTAL EFFECTS
  - PLASMA, EMI, VIBROACUSTICS, MICROGRAVITY
  - MATERIALS

TECHNOLOGY FLIGHT EXPERIMENTS

OAET

SSF UTILIZATION PLANNING

- **SSF FLIGHT EXPERIMENTS TRAFFIC MODEL**

  - WITH COLLABORATION OF PIs OF CURRENT FLIGHT EXPERIMENT S
  - BALANCED BY TECHNOLOGY CATEGORY
  - USER NEED OF TECHNOLOGIES
  - SSF CAPABILITIES
  - OTHER SSF USER INTERACTIONS
  - UTILIZATION FLIGHT SEQUENCE

- **REPRESENTS BEST ESTIMATES OF RESOURCE ENVELOPES**

- **EXPERIMENT SELECTION BY AO AND ESTABLISHED PROCEDURES**

- **EXTENT OF UTILIZATION DEPENDENT ON BUDGET**

TECHNOLOGY FLIGHT EXPERIMENTS

OAET

JOINT PLANNING WITH DOD

- OAET HAS LONG STANDING TECHNOLOGY COORDINATION EFFORT WITH AIR FORCE THROUGH SPACE TECHNOLOGY INTERDEPENCY GROUP (STIG)

- IN 1990 THE STEERING GROUP AUTHORIZED FORMATION OF NEW COMMITTEE IN SPACE FLIGHT EXPERIMENTS

  - TO EXCHANGE DATA ON ON-GOING FLIGHT EXPERIMENTS
  - TO MAXIMIZE UTILIZATION OF RESOURCES
  - TO SHARE INFORMATION ON FLIGHT OPPORTUNITIES
  - TO JOINTLY PLAN FOR THE FUTURE

- THE COORDINATION HAS NOW BEEN EXPANDED TO INCLUDE THE ARMY AND NAVY

- OAET HAS AGREED TO REPRESENT THE POTENTIAL SSF USERS FROM DOD

  - TO TRANSMIT REQUIREMENTS
  - TO SHARE SSF RESOURCES

TECHNOLOGY FLIGHT EXPERIMENTS

OAET

INDUSTRY AND UNIVERSITY PARTICIPATION

- SPACE TECHNOLOGY DEVELOPMENT IS AN ISSUE OF NATIONAL COMPETITIVENESS

  - INDUSTRY PARTICIPATES THROUGH THE IR&D PROCESS

  - UNIVERSITIES ARE THE MAJOR RESOURCE FOR INNOVATIVE TECHNOLOGIES AND TRAINED PROFESSIONALS

- PLANS ARE UNDERWAY TO FORMALIZE THE INTERACTIONS WHICH WILL LEAD TO ACTIVE PARTICIPATION IN TECHNOLOGY FLIGHT EXPERIMENTS PROGRAM

PROPOSED STATION PAYLOADS BY THRUST

SCIENCE	PLATFORMS	TRANSPORTATION
MANNED OBSERVATION TECHNIQUES ADVANCED SENSOR DEVELOPMENT LARGE DEPLOYABLE REFLECTOR STRUCTURAL EXPERIMENT	MODAL IDENTIFICATION EXPERIMENT S/C STRAIN AND ACOUSTIC SENSORS THERMAL INTERFACE TECHNOLOGY FLIGHT DYNAMICS IDENTIFICATION MICROBIOLOGICAL MONITOR FOR S/C ADV. STRUCTURAL DYN. AND CONTROL SOLAR ARRAY ENERGY STORAGE TECH. ADVANCED RADIATOR CONCEPTS THERMAL SHAPE CONTROL RISK-BASED FIRE SAFETY ACOUSTIC CONTROL TECHNOLOGY IN-SITU TRACE CONTAMINANTS ANALYSIS LIQUID STREAM TECHNOLOGY TEST BED ADVANCED AUTOMATION TECHNOLOGY ADVANCED ADAPTIVE CONTROL TWO PHASE FLUID BEHAVIOR AND MGT. POLYMER MATRIX COMPOSITES S/C MATERIALS AND COATINGS	LOW ACCELERATION AND PROPULSION TECHNOLOGY

EXPLORATION	OPERATIONS	ALL
FLIGHT CREW HEALTH REGENERATIVE LIFE SUPPORT SUBSYSTEM TESTING CRYO-TANK REPLACEMENT AND SERVICING EXPERIMENT	LASER COMMUNICATION TERMINAL FTS FORCE REACTION SYSTEM SPATIAL PERCEPTION AUDITORY REFLEX SEI VEHICLE SERVICING ROBOT FOR SCIENCE LABORATORIES ADVANCED OPTICAL RECEIVING STATION	HIGH STABILITY HYDROGEN MASER CLOCKS VHSIC FAULT TOLERANT PROCESSOR TRANSIENT UPSET PHENOMENA IN VLSIC INTERNAL IN-STEP EXTERNAL IN-STEP MICROELECTRONICS DATA SYSTEM EXP. GROWTH OF COMPOUND SEMICONDUCTOR CRYSTALS QUANTIZED VORTEX STRUCTURES IN SUPERFLUID He

INTEGRATED TRAFFIC MODEL

CARRIER	1991	1992	1993	1994	1995
SHUTTLE					
MIDDECK	MIDDECK 0-g DYNAMIC EXP.	ELECTROLYSIS EXP HEAT PIPE PERFORMANCE	MIDDECK ACTIVE CNTRL EXP LIQUID MOTION IN A ROTATING TANK		
GAS/CAP	TANK PRESS. CONTROL EXP.		THIN FOIL MIRROR MEAS. AND MOD. OF JOINT DAMP. PERM MEMBRANE TECH. EXP.	TWO-PHASE FLOW SPACE CRYOGENIC SYS. EXP.	
HITCHHIKER			THERMAL ENERGY STORAGE IN-FLIGHT CONTAMINATION EXP. EMULSION CHAMBER TECH. EXP. INVESTIG. OF S/C GLOW	THERMAL ENERGY STORAGE SOLAR ARRAY MOD. PLASMA INTERACTION EXPERIMENT JITTER SUPPRESSION	TANK VENTING SODIUM-SULFER BATTERY
CARGO BAY			LIDAR IN-SPACE TECH. EXP. FTS DTF-1		
SPACE HAB					
ELV					INFLATABLE PARABOLOID
NLS					
FREE FLYERS					
COMET					
EURECA				OPTICAL PROP. MONITOR	
SPARTAN				RETURN FLUX EXPERIMENT LASER OSCILLATOR SENSOR	
SPACE STATION					MODAL ID. EXP

INTEGRATED TRAFFIC MODEL

CONCLUDED

CARRIER	1996	1997	1998	1999	2000
SHUTTLE MIDDECK GAS/CAP HITCHHIKER CARGO BAY SPACEHAB	AEROASSISTED FLIGHT EXP. ACCELERATION MEASUREMENT DEBRIS COLLISION WARNING SENSOR	RISK BASED FIRE SAFETY CRYOGENIC ORB. NITROGEN EX.			
ELV	HYDROGEN MASER CLOCK SOLAR ELECTRIC PROP. EXP.	OPTICAL COMM. FLIGHT EXP.			
NLS					
FREE FLYERS COMET EURECA SPARTAN					
SPACE STATION	MANNED OBSERV. TECH. IN-SITU TRACE CONTAM. TRANSIENT UPSET PHENOMENA IN VLSIC VHSIC FAULT TOLERANT PROCESSOR ON-ORBIT DYN. MEAS. EXP MTC	S/C STRAIN & ACOUSTIC S. S/C MATERIALS & COAT. MICROELECTRONICS DATA SYSTEM LASER COMM TERMINAL* ACOUSTIC CONTROL TECH. INTERNAL IN-STEP ADVANCED SENSOR DEV. RESISTOJET EXP	EXTERNAL IN-STEP THERMAL INTERFACE TECH. FLIGHT DYNAMICS IDENT. POLYMER MATRIX COMPOSITES FLIGHT CREW HEALTH	LARGE DEPLOYABLE REFLECTOR STRUCT. EXP. LIQUID STREAM TECHNOLOGY CRYO-TANK REPLACEMENT AND SERVICING EXP. MICROBIOLOGICAL MONITOR FOR S/C REGENERATIVE LIFE SUPPORT DEBRIS MAPPING SENSOR PMC	ADVANCED ADAPTIVE CONTROL FTS FORCE REACT. SYS. SPATIAL PERCEPTION AUDITORY REFLEX EXP. ROBOT FOR SCI. LAB QUANTIZED VORTEX STRUCT IN He TWO PHASE FLUID BEHV. AND MANAGEMENT

*JOINT PROGRAM W/CODE S. CODE R DEVELOPING LASER COMPONENT
CODE S RESPONSIBLE FOR PAYLOAD DEVELOPMENT

TECHNOLOGY FLIGHT EXPERIMENTS

OAET

ADVISORY COMMITTEE MEMBERSHIP

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AUBURN UNIVERSITY

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SSF, NASA/OSF

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SPARTA INC.

TECHNOLOGY FLIGHT EXPERIMENTS

OAET — ADVISORY COMMITTEE

- THE SPACE SYSTEMS AND TECHNOLOGY ADVISORY COMMITTEE (SSTAC) CHARTERED A SUBCOMMITTEE ON THE UTILIZATION FOR SPACE STATION FOR TECHNOLOGY DEVELOPMENT

  - TO REVIEW AND EVALUATE THE SSF FACILITIES FROM THE STANDPOINT OF THEIR USEFULNESS FOR RESEARCH AND ADVANCED TECHNOLOGY DEVELOPMENT AND VALIDATION

  - TO REVIEW AND EVALUATE OAET PLANNED EXPERIMENTS AND PROCEDURES FOR SELECTING ADDITIONAL PAYLOADS FOR SSF

  - TO EVALUATE THE PLANNED SSF UTILIZATION AND OPERATIONS PROCEDURES (MANIFESTING, INTEGRATION, CREW TRAINING, DATA TRANSMISSION, ETC) FROM THE VIEWPOINT OF TECHNOLOGY DEVELOPMENT NEEDS

TECHNOLOGY FLIGHT EXPERIMENTS

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SPECIAL ISSUES

- THE TECHNOLOGY FLIGHT EXPERIMENTS EMPHASIS ARE LIKELY TO BE ON SMALL, INEXPENSIVE EXPERIMENTS

  - MIDDECK LOCKER OR GAS CAN ON SHUTTLE HAS PROVEN TO BE VERY COST EFFECTIVE

- THE TECHNOLOGY DEVELOPMENT COMMUNITY IS HAS MAJOR INTEREST IN REDUCING COST AND INCREASING FREQUENCY OF EXPERIMENTATION

  - STANDARD DRAWERS WITH SIMPLE INTERFACES
  - SIMPLE, INEXPENSIVE ANALYTICAL INTEGRATION
  - SIMPLE COMMUNICATIONS LINK BETWEEN PI AND EXPERIMENT

TECHNOLOGY FLIGHT EXPERIMENTS

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SUMMARY

- TECHNOLOGY FLIGHT EXPERIMENTS ARE AN IMPORTANT AND INTEGRAL PART OF TECHNOLOGY DEVELOPMENT AND VERIFICATION
- SPACE STATION FREEDOM IS RECOGNIZED AS A KEY FACILITY TO UTILIZE FOR THIS PURPOSE
- THE STRESS WILL BE ON SMALL EXPERIMENTS, SIMPLE INTERFACES AND SIMPLE INTEGRATION PROCEDURES
- TECHNOLOGY DEVELOPMENT AND VERIFICATION IS EXPECTED TO USE AT LEAST 15-20% OF SSF RESOURCES AND WILL INCLUDE
  - OAET EXPERIMENTS
  - INDUSTRY (IR&D DEVELOPED) EXPERIMENTS
  - UNIVERSITY EXPERIMENTS
  - DOD EXPERIMENTS