Appendixes

Appendix A

U.S. Cooperative Projects in Space Science and Applications

Launch year	Mission name	Cooperating countries	Science/ applications	Objectives
Part 1: Joint Development				
1962	Airel-I	US/UK	S	Measure energy spectrum of cosmic rays, solar x-rays
1962	Ariel-11	US/UK	S	Measure galactic radio noise, micrometeoroid flux
1978	Int'l Ultraviolet Explorer (IUE)	USESA/UK	S	UV spectroscopy
1982	COSPAS/SARSAT	US/Can/Fr/USSR	A	Satellite-aided global search and rescue system
1983	Infrared Astronomical Satellite (IRAS)	Neth/US/UK	S	Conduct IR sky survey
1984	Active Magnetospheric Particle Tracer Explorer (AMPTE)	US/FRG	S	Study solar wind, identify particle entry windows, energization and transport processes into magnetosphere
1985	Space Telescope	US/ESA	S	High-resolution coverage of optical and UV wavelengths
1986	Galileo	US /FRG	S	Broad investigation of Jupiter environment
Part 2: Hosted Experiments				
1964	Explorer-20	UK[a]	A	Measure ion mass composition and temperature
1965	Explorer-31	UK[a]	A	Measure ion mass composition and temperature
1965	Alouette-II	Can[b]	A	Measure electron densities and VLF noise
1965	Orbiting Geophysical Observatory-2 11(OGO-2)	Fr[a]	A	Measure airglow
1967	OGO-4	Fr[a]	A	Measure airglow
1967	Orbiting Solar Observatory-4 **(0S0-4)**	UK[a]	S	Measure solar x-ray distribution, He emission
1968	Orbiting Geophysical Observatory-5 (OGO-5)	UK,[a]Fr,[a]Neth[a]	S	Determine direction of incidence of primary cosmic rays, density, and temp. of H in geocorona, and CR, flux/energy spectrum
1969	OGO-6	Fr[a]	A	Spectrometry in airglow and aurora; atmospheric temperature and excitation
1969	International Satellite for Ionospheric Studies (ISIS-I)	Can[b]	A	Ionospheric sounders
1969	0S0-5	UK, [a]Fr[a]	S	Measure solar x-ray flux and self-reversal of Lyman-Alpha line
1969	**0S0-6**	UK, [a]It[a]	S	Study solar He resonance, x-ray and gamma radiation
1969	Apollo-II	Switz[a]	S	Measure composition of solar wind
1969	Apollo-12	Switz[a]	S	Measure composition of solar wind
1971	Ariel-IV	UK[c]	S	Measure low energy proton and electron intensities
1971	Barium Ion Cloud Probe	FRG[b]	S	Barium release to stimulate action of solar wind on comet tail
1971	Apollo-14	Switz[a]	S	Measure composition of solar wind
1971	Apollo-15	Switz[a]	S	Measure composition of solar wind
1971	Ariel-IV	UK[h]	A	Proton and electron densities
1971	ISIS-II	Can[h]	A	Ionospheric sounders

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1971	San Marcos-III	It[b]	A	Density of elements in equatorial upper atmosphere
1971	Nimbus-4	FRG[a]	A	Stratospheric height and temperature measurements using UV
1972	Apollo-16	Switz[a]	S	Measure composition of solar wind
1972	Orbiting Astronomical Observatory-3 (OAO-3)	UK[a]	S	Study stellar ultraviolet and x-ray emissions (project also known as Copernicus)
1972	AEROS	FRG[b]	S	Measure solar extreme UV and correlate with upper atmosphere components
1972	Apollo-16	FRG, [a]Fr[a]	S	BIOSTACK I (effects of CR on selected biosystems)
1972	Apollo-17	FRG, [a]Fr[a]	S	BIOSTACK II (effects of CR on selected biosystems)
1972	Nimbus-5	UK[a]	A	Water vapor, cloud, and atmospheric temperature soundings
1973	Skylab	Bel[a]	A	Smelting silver in space
1973	Skylab	Fr, [a]Switz, [a]Jap[a]	S	Sky survey, distribution of galaxies and ionized hydrogen; solar wind analysis; and manufacturing of composite metals in space
1974	Astronomical Netherlands Satellite (ANS)	Neth[b]	S	UV photometry and x-ray emissions
1974	Ariel-V	UK[b]	S	Conduct x-ray sky survey and locate sources
1974	Helios-1	FRG[b]	S	Measure micrometeoroid flux, study solar x-rays and mass, and planetary orbits
1974	San Marcos-III-2	It[b]	A	Measure composition and temperature of equatorial thermosphere
1974	AEROS-B	FRG[b]	A	Neutral atmosphere temperature experiment
1975	Apollo-Soyuz Test Project (ASTP)	US/USSR	S	Rendezvous and docking test included joint biological studies
1975	Apollo-18 (U.S. ASTP Craft)	FRG[a]	S	BIOSTACK-111 (CR effects on biosystems), blood electrophoresis
1975	Cosmos 782	USSR[b]	S	Eleven U.S. experiments aboard (including centrifugation)
1975	0S0-8	Fr[a]	S	Spectrographic study of solar chromosphere
1975	Radio Beacon	India[a]	A	Applications technology satellite experiment to measure electron content and scintillation phenomena
1975	Nimbus-6	UK[a]	A	Upper atmosphere temperature sounding
1976	Communications Technology Satellite (CTS)	Can[b]	A	Broadcast experiments
1976	Helios-2	FRG[b]	S	Measure micrometeoroid flux, study solar x-rays and mass, and planetary orbits
1977	Int'l Sun-Earth Explorer-1 (ISEE-1)	ESA, [a]Fr, [a]FRG, [a]Switz, [a]UK[a]	S	Coordinated spacecraft studied magnetosphere, interplanetary space, and their interaction
1977	ISEE-2	ESA[b]	S	Coordinated spacecraft studied magnetosphere, interplanetary space, and their interaction
1977	Cosmos 936	USSR[b]	S	Seven US biological experiments
1978	ISEE-3 (NASA Heliocentric Mission)	FRG, [a]Fr, [a]Neth, [a]UK[C1]	S	Solar wind composition, behavior and mapping; comet flyby
1978	Pioneer Venus-2	FRG, [a]Fr[a]	S	Atmospheric and cloud studies of Venus
1978	Cosmos 1129	USSR[b]	S	Fourteen U.S. biological experiments
1978	TIROS-N	Fr[a]	A	Demonstrate Satellite Data Collection System (ARGOS)
1978	Nimbus-7	UK[a]	A	Stratospheric and mesospheric sounding

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1979	High Energy Astronomical Observatory-3 (HEAO-3)	Fr,[a] D k[d]	S	Study galactic CR composition
1979	Hakucho	Japan[h]	S	Optical and radio observations of x-ray stars
1980	Solar Maximum Mission (SMM)	US-Neth-UK[a]	S	Solar hard x-ray imaging spectrometry
1983	Spacelab-l	Jap[a],It[b]	S	
1983	San Marco-D/L		S	Effects of solar activity on meteorological processes
1983	Cosmos-1514	USSR[b]	S	U.S. providing medical research devices for primate mission; U.S. biological experiments
1983	San Marcus-D/ L	It[b]	A	Atmosphere/ ionosphere electrodynamics
1983	SARSAT	Can,[a] Fr[a]	A	Demonstrate emergency signal receiver
1984	Blood Rheology Experiment	Aus[a]	S	Shuttle mid-deck study of hemoagglutination under microgravity
1984	Spacelab-2	UK[a]	S	Galactic x-ray imaging and determination of He abundance in solar corona
1984	Long-Duration-Exposure Facility (LDEF)	FRG,[a] US-Ire-ESA;[a] Switz, [a] UK; Fr[a]	S	Investigations of space environment and effects
1985	Giotto	ESA[a]	S	Multi-parameter characterization of cometary environment
1985	Spacelab-3	India'	S	Study solar/galactic CR ionization states
1985	Spacelab-D-l	US/Can[b]	S	"Space Sled" to conduct neurophysiology research
1986	Int'1 Solar Polar Mission (ISPM)	ESA[b]	S	Observations of sun and interplanetary medium out of the ecliptic plane
1987	Roentgen-Satellite (ROSAT)	FRG-US-UK~	S	X-ray sky survey and sources study
1988	Gamma Ray Observatory (GRO)	FRG[a]	S	Wide-range gamma ray detection
1988	Venus Radar Mapper (VRM)	Fr[a]	S	Venus gravity and atmospheric tides
1989	Starlab	US-Aus-Can[a]	S	I-m optical /UV telescope for deployment on Shuttle or free flying platform
Part 3: Collaborative data collection analysis				
1961	TIROS	US/(42 others)	A	Compare weather photographs and ground observations
1962	Echo-2	US / USSR	A	Experiments using US passive communications satellite, antennas at Soviet facility
1964	Int'1. Satellite Geodesy Experiment (ISAGEX)	US/COSPAR	A	Laser and optical observation of US and French satellites
1966	GEOS/PAGEOS	US/Fr	A	Analyze data obtained by laser tracking of US and French satellites
1969	Lunar sample studies	US (21 others)	S	Analyze lunar materials returned by Apollo missions
1972	Bering Sea Experiment	US/USSR	A	Coordinate sea, air, and space collection of microwave measurement data
1974	Position Location and Communication Experiment (PLACE)	US /Can/ ESA	A	Determine feasibility of aircraft and satellite operation in L-band
1974	Large Area Crop Inventory Experiment (LACIE)	US Can USSR	A	Collect 'compare agricultural remote sensing and ground truth data
1974	ARGOS	US Fr	A	Collect environmental data from surface platforms via satellites equipped with French detectors
1975	Search and Rescue	US/Can/FRG/ESA	A	Stage search and rescue incident using ATS-*6* satellite

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1975	Satellite Instructional Television Experiment (SITE)	US/India	A	Broadcast of programs to remote Indian villages via ATS-6 satellite
1975	Advanced Satellite for Interdisciplinary Communications (SACI)	US/Bra	A	Broadcast of educational programs to Brazilian students via ATS-6
1976	Int'1 Applications Demonstration (AIDSAT)	US/(27 others)	A	Broadcast programs to 27 developing countries
1977	ISEE	US/ESA	S	Coordinated spacecraft studied magnetosphere, interplanetary space, and their interaction
1978	Applications Explorer Mission-A	US/ESA	A	Study earth surface/subsurface phenomena
1979	Ocean Dynamics Study Project	US/Jap	A	Relate Seasat data regarding ocean surface features to measured subsurface features
1979	Cloud Height Study Project	US/Jap	A	Stereographic measurements of cloud height by US and Japanese satellites
1980	Winds and Waves Study Project	US/Jap	A	Correlation of Seasat data with sea surface truth data
1980	Snow Properties Study Project	US/Jap	A	Using satellite and surface truth data, explore use of satellites in determining snow characteristics
1980	Evaporation Study Project	US/Jap	A	Using satellite and surface truth data, explore use of satellites in estimating evaporation
1980	SMM/Astro-A Collaborative Observations Program	US/Jap	A	Coordinated observation/data analysis of solar flares from 2 spacecraft
1981	Agronomic Radiometry Research Project	US/Mex	A	Study electromagnetic radiation characteristics of grains via satellite and ground truth data
1981	Shuttle multispectral infrared radiometer (SMIRR)	US/ Mex/Sp/Egy	A	Verify SMIRR data with ground truth data
1982	Agronomic Remote Sensing Activities	US/Aus	A	Estimate crop production via satellite and ground truth data
1982	Satellite laser tracking data project	US/Jap	A	Joint laser tracking
1982	Crustal Dynamics Study	US/ Fr/It/FRG/Neth/Isr	A	Satellite laser ranging (US and French satellites) to determine plate tectonics, polar motion, and earth rotation
1982	COSPAS/SARSAT	US/ Can/Fr/USSR/UK/ Nor/ Swe/Bul/Fin	A	Demonstrate global search and rescue system
1983	Int'1. Satellite Cloud Climatology Project (ISCCP)	US/Jap/ India	A	Collect cloud climatology data via global satellite coverage
1983	Spacelab-1	ESA/US	S	Multinational experiments include biology, medicine, botany, astronomy, and solar physics
1985	Halley Missions	ESA/USSR/Japan/US	S	Spacecraft and mission design are being coordinated for ESA's Giotto, USSR's Vega (2), and Japan's Planet-A. US providing tracking and coordinating ground-based and near-Earth observations
1985	VEGA	US/Fr	S	Track French balloons in Venus' atmosphere and determine position/velocity using very long baseline interferometry

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1985	Int'1 Halley Watch	US/ (8 others)	**S**	Coordinate ground-based observations of Halley's Comet
1988	Mobile Satellite (MSAT)	US/Can	A	Two-way voice data communication with mobile users
1989	Int'1. Solar-Terrestrial Physics (ISTP) Program	USA/ESA/Jap	**S**	Coordinated solar-terrestrial physics measurement using 9 spacecraft

[a]Foreign experiment [foreignP'1) onU S m ission
[b]U s experiment on foreign spacecraft

NOTES (1) Table includes only projects involving spacecraft It does not include cooperative sounding rocket, balloon, and groundbased projects; also excluded are incidents [)1 data exchange of launch services only
(2) Table includes, n th, case of future missions only those officially approved.
(3) Multilateral joint ventures among ESA member countries are cons] dered as ESA missions However, nat ional project activities involving ESA members with non ESA countries are considered as national cooperative ventures
(4) Fr = France; L'K = United Kingdom; It = Italy; Switz = Switzerland, FRG = Federal Republic of German), Neth = Netherlands Aus = Australia Dk = Denmark Ire = Ireland, Bel = Belgium Mex = Mexico; Spa = Spain; Egy = Egypt Bra = Brazil Nor = Norway Swe = Sweden Bul = Bulgaria; Fin = Finland Isr = Israel, COSPAR = Committee on Space Researc h