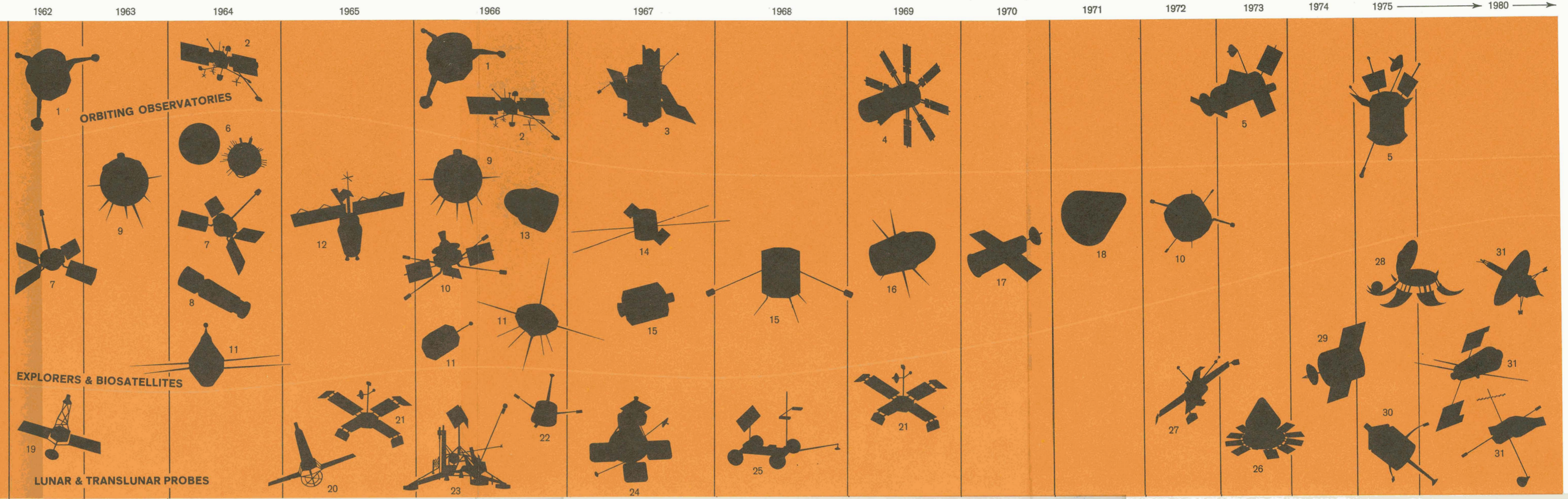


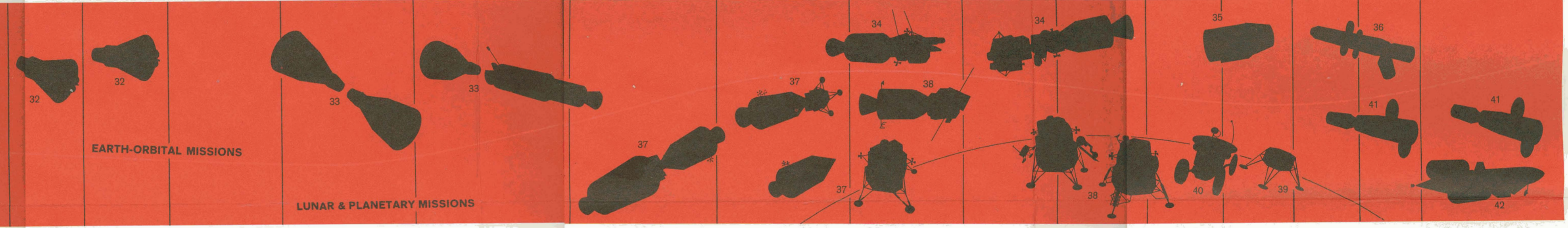
INVESTIGATION

ORBITING OBSERVATORIES 1 OSO (Orbiting Solar Observatory)—Measure emission from sun, other celestial bodies; supply data leading to solar flare prediction system. Six funded, three more planned through '70. OSO-1 launched Mar. '65. OSO-2, Feb. '65. OSO-3 launch due mid-'66. OSO-4, late '65. OSO Drilling Geophysical Observatory—Study of particles and fields in earth's atmosphere, magnetosphere and ionosphere. Includes eccentric and polar orbiters (EOO and POGO). Seven funded, four more planned through '70. OSO-5 (over 6 months) satellite for optical observations and mapping. Four funded through '69, follow-ons likely. First launch (eccentric) due early '66. OSO-6 (polar, late '66). OSO-7 (AOO (Orbiting Astronomical Observatory)—Large, long-life (over 6 months) satellite for optical observations and mapping. Four funded through '69, follow-ons likely. First launch (AOO-A) due early '66. OSO-8, late '66. OSO-9, '67. OSO-10 (Advanced OSO)—Intended to continue OSO studies. Cancelled Dec. '65. 2 Lunar and Solar Orbiting Observatories—Large multi-experiment satellites to study space environment from lunar and solar orbits. Planned for '70s; no formal study in progress. 3 Explorer 11 (AE-E Explorer)—Air Density/Inert Explorer—Spherical and polyhedral satellites flown separately or together to measure density of upper atmosphere, latitudinal variations in atmospheric density and temperature, first sources of atmospheric heating. First AD (Explorer 9) launched Feb. '61; first AD/I (Explorers 24 and 25), Nov. '64. Second AD/I (AD/I-C) under study. Follow-on Injuns under University Explorer program. 7 Energetic Particles Explorer—Measure natural and manmade radiation belts. Four orbiters since Aug. '61. Explorer 12 revealed solar wind. 8 Micrometeoroid Explorers—Determine micrometeoroid hazard to spacecraft, flight-test new micrometeoroid sensors. Two orbiters since Dec. '62. 9 Atmosphere Explorers (formerly Atmospheric Structures Satellites)—Study composition, density, pressure and temperature of upper atmosphere and chemistry of ionosphere. Explorer 17 launched Apr. '63. AS-11 (Explorer 18) launched Apr. '64. Explorer 18 (formerly Interplanetary Monitoring Platforms, hence "IMPs")—Measure interplanetary radiation and magnetic fields from deep earth or moon orbits; assess Apollo radiation hazards; measure interaction between earth's and sun's magnetic fields. Lunar-anchored satellites will provide data on lunar gravitational field and any lunar ionosphere. Eleven planned, including four advanced IMPs, nine approved. Explorer 18 launched Nov. '63; Explorer 21, Oct. '64 (failed to achieve deep orbit); Explorer 28, May '65. First lunar orbiter (IMP-D) due late '66; first AMP in '67. Additional AMPs planned throughout 11-year solar cycle. 10 International Satellites for Ionospheric Studies—Cooperative series of Canadian Alouettes and U.S. Direct Mission and Ionosphere Explorers to study ionosphere. Alouette 1 launched Sep. '62. Explorer 19, X (DM-E) and Alouette III, Dec. '65. Isis-A launch due '67; Isis-B, '68; Isis-C, '69. 12 Pegasus (Saturn-Launched Meteoroid Explorer)—Modified Apollo booster/motor to provide large meteoroid impact detection surface for collection of engineering data on materials in space. Three satellites planned and launched since Feb. '65. 13 Biosatellites (Bio)—Instrumented, recoverable capsules for three 30-day biological tests in earth orbit. Study effects of space on normal or abnormal diurnal cycle on plants and animals (up to 15-h primates). Six approved (three primary and three backup). First launch due late '66. 14 Radio Astronomy Explorers—Determine direction and intensity of celestial radio emission blocked by ionosphere. Two approved, three more planned. Follow-on likely. Two launches due in '67. 15 University Explorers—Small satellites carrying 1-3 experiments in research by university teams. Program initiation ap-



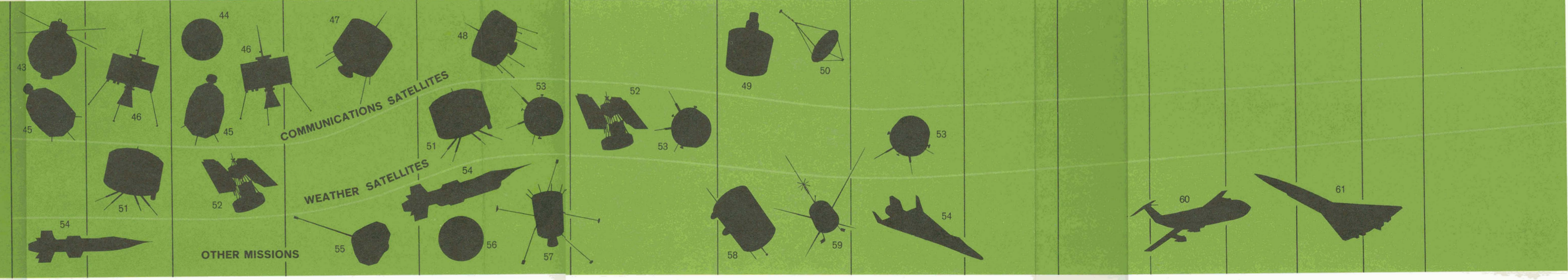
EXPLORATION

EARTH-ORBITAL MISSIONS 22 Mercury—One-man capsule to demonstrate basic orbital and recovery technologies. Two suborbital and four orbital flights since '61; ended with 22-orbit flight May '63. 23 Gemini—Two-man capsule to demonstrate extended orbital flight, rendezvous and docking capabilities for Apollo. First manned flight Mar. '65; first EVA from Gemini 4 in June '65. Gemini 7 in orbit 14 days; rendezvoused with Gemini 6 in Dec. '65. Five more flights, all involving rendezvous and docking with Agena target vehicle, from Mar. through late '66. 24 Apollo Applications (AA, see also 41)—Extension of manned orbital flights to 45 and perhaps 90-135 days; to determine best ways to, and provide technological basis for long-term manned orbital stations. Boosted by Saturn I-Bs and Ss, to start with largely unmodified Apollo spacecraft; later flights will require extended CSM, laboratory version of Lem for astronomical, biological and similar experiments. First launch tentatively planned for '68, depending on Apollo progress; seven 14-day flights through '69, nine flights of 45 days or more in '70-'71. 25 Moon (Manned Research Laboratory)—"Space-station" orbital station with crew of 9-12; nominal life 5 years. Could be launched by Saturn I-B or S. Study only, but NASA definitely planning on larger orbital station as immediate AA flight that would set up for Apollo Applications (AA, see also 41). If built, first launch likely in '73. 26 Operational Orbital Station—Larger, "permanent" manned orbital station for inventory of earth resources, astronomical observations, other scientific studies. May be used for space communications systems, weather observation, could double as planetary assembly and launch base. In early study stage only; could fly in '74-'75.



UTILIZATION

COMMUNICATIONS SATELLITES 43 Telstar—Experimental low-altitude comsat. Launched July '62. 44 Echo—Two large, self-inflating spheres for passive communications. Echo 1 launched '60; Echo 2, Jan. '64 (still performing). 45 Relay—Two active comsats in medium-altitude elliptical orbits. Relay 1 launched Dec. '62; Relay 2, Jan. '64. 46 Syncom—Three active comsats in synchronous orbit. First successful launch (Syncom 2) July '63; Syncom 3, Aug. '64. 47 Early Bird—First commercial comsat, launched Apr. '65 into synchronous orbit. Links Europe and North America. 240, 000-watt transmitter, 180 over Pacific. Launch in late '66. 48 Advanced Global Comsat—Commercial global comsat system using synchronous or phased intermediate-altitude orbits, with 1200 two-way circuits per spacecraft. To be launched in '68; will be followed eventually by comsat system with 8000 two-way circuits per satellite, providing conventional commercial communications and service to aircraft in flight and ships plus TV network distribution. 50 Advanced Passive Comsat—Inflatable double-lens passive comsat for 2000-3000 or synchronous orbit. Study only; scale model may fly in '68.



CONTROL

INTELLIGENCE AND DEFENSE 62 Samos—Military satellite surveillance from 100-300-mile polar orbits. Advanced version carry multi-sensors, TV, at least one to orbit at any time. First launch '60. 63 IRBM Alarm (formerly Alarm) in orbit and detection from satellites of vehicles from at Toulon. First successful detection in '63. 64 Nuclear Detection Satellite (formerly Vela Neutron)—Satellites carrying gas, gamma ray, and neutron sensors for detection of nuclear explosions at sea. Succeeded version may be able to detect atmospheric nuclear explosions. Launched in pairs since late '63 via Pegasus. 65 W-12A—Long-range strategic interceptor capable of Mach 3 at 30,000 feet. Succeeded version may have improved low-altitude capability. First flight in '64. 66 Phosnix—Two-stage, multi-payload, 100-mph tactical anti-air missile. For F-111B can carry nuclear warhead. Operational in '67. 67 Advanced Anti-Ballistic Missile—To destroy satellites in earth orbit, uses anti-missile-sensor but "window" limited inert success mission. Advanced version in '68 to carry terminal homing. 68 SAM-D (Surface-to-air Missiles)—Fully integrated surface-to-aircraft and anti-missile system for deployment in '70. Used systems, Hawk with self-propelled launcher and its version (Thunder). 69 ASMB (Advanced Surface Missile System)—First anti-aircraft and anti-missile in '70 to replace Hawk. Later, surface-to-air. 70 Anti-ICBM Missiles (Zeus, Sprint, Advanced Zeus (ZBran)—Missiles for intercept above atmosphere at 500-mile range (Zeus), at 50,000 ft after atmospheric interception of ICBM or other "target", even lower intercepts for protect launch sites (Sprint). Deployment of these terminal systems may be patched until development feasibility in '70 of Advanced Zeus for 400-mile range and intercept. 71 Advanced Surveillance Satellites—Comprehensive surveillance and military and economic intelligence activities in synchronous orbit by post-1964 satellite carrying multi-sensors, real-time communications and adaptive data processing systems. May fly in '72. 72 VEX—Advanced satellite surveillance aircraft with responsive concept for long stay times (6 hr). To fly in '73. 73 Satellite Intercepter/Interceptor—Originally conceived as orbital satellites (Sat), now in research stages as part of Gemini and Mar. Operations vehicle may fly in late '70s.

