

**UNITED STATES LAUNCH VEHICLE CAPABILITIES**

VEHICLE	# TO LEO	# TO GEO	GEO/CIRCULAR	FIRST FLIGHT
ATLAS	200,000	15,000	20,000 (C/STARS)	1958
SHUTTLE	55,000	5,500 (US)		1981
TITAN 3	40,000	12,500	10,000 (C/STARS)	1959
TITAN 340	33,000	8,600	4,300 (US)	1963
ATLAS 2	14,000	5,200	3,500	1970
ATLAS 3	13,300			1979
DELTA 2	7,800	3,100	1,500 (PAM-D)	1968
TITAN 2	5,500			1965
SCOUT	475			1961

**LAUNCH VEHICLES OF EUROPE AND JAPAN**

VEHICLE	# TO LEO	# TO GEO	COUNTRY	FIRST FLIGHT
ARIANE 3	5,600		EUROPE	1984
ARIANE 4	9,500		EUROPE	1983
ARIANE 5	46,000	14,960	EUROPE	1996
HL-1	2,500		JAPAN	1986
HL-2	2,500		JAPAN	1992

**ABUNDANT NEAR-EARTH EXTRATERRESTRIAL RESOURCES**

RESOURCE	MOON	PHOBOS/DEIMOS	ASTEROIDS	COMETS	ELEMENT
Al	X	X	X	X	ALUMINUM
Ca	X	X	X	X	CALCIUM
Fe	X	X	X	X	IRON
Si	X	X	X	X	SILICON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON
Fe	X	X	X	X	IRON
Mg	X	X	X	X	MAGNESIUM
Ni	X	X	X	X	NICKEL
Co	X	X	X	X	COPPER
Cr	X	X	X	X	CHROMIUM
Zn	X	X	X	X	ZINC
U	X	X	X	X	URANIUM
Th	X	X	X	X	THORIUM
W	X	X	X	X	TUNGSTEN
Pb	X	X	X	X	LEAD
Ag	X	X	X	X	SILVER
Au	X	X	X	X	GOLD
Os	X	X	X	X	OSMIUM
Ir	X	X	X	X	IRIDIUM
Rh	X	X	X	X	RHODIUM
Pt	X	X	X	X	PLATINUM
Bi	X	X	X	X	BISMUTH
As	X	X	X	X	ARSENIC
Sb	X	X	X	X	ANTIMONY
Te	X	X	X	X	TELLURUM
Cd	X	X	X	X	CADMIUM
Hg	X	X	X	X	MERCURY
Cu	X	X	X	X	COPPER
Zn	X	X	X	X	ZINC
Al	X	X	X	X	ALUMINUM
Si	X	X	X	X	SILICON