

# LAUNCH VEHICLES

GENERAL DATA		PROPULSION		STAGE CONTRACTOR	STAGE OR MOTOR DESIGNATION	PROPELLANTS (OXIDIZER/FUEL)	THRUST (LB.)	DIMENSIONS & WEIGHTS			PERFORMANCE (PAYLOAD IN LB.)		STATUS/OUTLOOK
VEHICLE NAME	STAGE	NO. OF ENGINES						MAX DIA. (FT.)	LENGTH (FT.)	LAUNCH WEIGHT (LB.)	HEAVY LIFT	MEDIUM LIFT	
<b>MANNED SYSTEMS</b>													
<i>THE BOEING CO., Integrated Defense Systems, Huntington Beach, CA, USA</i>													
Space Shuttle	1	2 x Thiokol RSRM, solid		ATK Thiokol	RSRM	PBAN	2,650,000 each (SL)	12.4	149.2	4,500,000	56,000	—	Active. First launch occurred on 4/12/81. Launch cost: \$550 million. Shuttle fleet to remain in service at least through 2020.
	2	3 x Rocketdyne SSME, liquid		Lockheed Martin Boeing	External Tank Orbiter	LOX/LH <sub>2</sub>	418,000 (SL)	27.5	154.2	(overall)	(160 nm., 28.5 deg.)		
<i>CHINA GREAT WALL INDUSTRY CORP., Beijing, People's Republic of China</i>													
Long March 2M-2F	0	4 x CALT YF-20, liquid		CALT	LB40	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	7.4	163.1	1,012,000	7,430	—	Active. First launch on 10/15/03.
	1	4 x CALT YF-20, liquid		CALT	L180	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	11.0	(overall)	(overall)			
	2	4 x CALT YF-22/23, liquid		CALT	L80	N <sub>2</sub> O <sub>4</sub> /UDMH	177,130 total (vac.)	11.0					
<i>RSC ENERGIA, Moscow, Russian Federation</i>													
Soyuz TM/TMA	1	ODU unified liquid propulsion system		Energia	ODU	N <sub>2</sub> O <sub>4</sub> /UDMH	—	8.9	22.9	15,400	—	—	Active. First manned launch occurred on 4/23/67.
<b>UNMANNED SYSTEMS</b>													
<i>ARIANESPACE SA, Evry, France</i>													
Ariane 5	0	2 x MPS, solid		EADS	EAP	HTPB	1,103,000 (SL)	10.0	102.2	1,650,000	15,000	—	Operational.
	1	1 x Vulcain HM60, liquid		Snecma	EPC	LOX/LH <sub>2</sub>	224,720 (SL)	17.9	100.1	(overall)	(geotransfer,		
	2	1 x Aestus, liquid		EADS	EPS	N <sub>2</sub> O <sub>4</sub> /MMH	5,720 (vac.)	17.9	11.0		7 deg.)		
<i>THE BOEING CO., Integrated Defense Systems, Huntington Beach, CA, USA</i>													
Delta 2 (7326)	0	3 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-40	HTPB	100,270 each (SL)	3.3	42.5	333,000	2,040	1,385	Active. First launch on 10/24/98. Two-stage 7320 used for low energy missions. The Star 48B is also available as a third stage.
	1	1 x Rocketdyne RS-27A, liquid		Boeing Rocketdyne	RS-27A	LOX/RP1	200,000 (SL)	8.0	85.6	(overall)	(geotransfer,		
	2	1 x Aerojet AJ10-118K, liquid		Boeing	AJ10-118K	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	9,815 (vac.)	8.0	19.6		28.7 deg.)		
	3	1 x Thiokol Star 37FM, solid		Alliant Techsystems	Star 37FM	HTPB	10,000 (vac.)	4.1	6.7				
Delta 2 (7425)	0	4 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-40	HTPB	100,270 each (SL)	3.3	42.5	364,000	2,510	1,790	Active. First 7420 launch on 2/14/98. First 7425 launch on 12/11/98. Two-stage 7420 used for low energy missions. The Star 37FM is available as a third stage.
	1	1 x Rocketdyne RS-27A, liquid		Boeing Rocketdyne	RS-27A	LOX/RP1	200,000 (SL)	8.0	85.6	(overall)	(geotransfer,		
	2	1 x Aerojet AJ10-118K, liquid		Boeing	AJ10-118K	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	9,815 (vac.)	8.0	19.6		28.7 deg.)		
	3	1 x Thiokol Star 48B, solid		Boeing	Star 48B	HTPB	14,920 (vac.)	4.1	6.7				
Delta 2 (7925)	0	9 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-40	HTPB	100,270 each (SL)	3.3	42.5	511,000	4,060	2,850	Active. First launch occurred on 2/14/89. Two-stage 7920 is used for low energy missions. The Star 37FM is available as a third stage.
	1	1 x Rocketdyne RS-27A, liquid		Boeing Rocketdyne	RS-27A	LOX/RP1	200,000 (SL)	8.0	85.6	(overall)	(geotransfer,		
	2	1 x Aerojet AJ10-118K, liquid		Boeing	AJ10-118K	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	9,815 (vac.)	8.0	19.6		28.7 deg.)		
	3	1 x Thiokol Star 48B, solid		Alliant Techsystems	Star 48B	HTPB	14,920 (vac.)	4.1	6.7				
Delta 2 (7925H)	0	9 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-46	HTPB	120,800 each (SL)	3.8	48.1	665,000	4,815	3,365	Two-stage 7920H is used for low energy missions. The Star 37FM is available as a third stage. First launch 7/7/03.
	1	1 x Rocketdyne RS-27A, liquid		Boeing Rocketdyne	RS-27A	LOX/RP1	200,000 (SL)	8.0	85.6	(overall)	(geotransfer,		
	2	1 x Aerojet AJ10-118K, liquid		Boeing	AJ10-118K	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	9,815 (vac.)	8.0	19.6		28.7 deg.)		
	3	1 x Thiokol Star 48B, solid		Alliant Techsystems	Star 48B	HTPB	14,920 (vac.)	4.1	6.7				
Delta 3	0	9 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-46	HTPB	120,800 each (SL)	3.8	48.1	660,000	8,400	6,000	Active. Initial flight on 8/26/98 and second on 5/4/99 failed. Third flight on 8/23/00 was a partial success. Launch cost: \$85 million.
	1	1 x Rocketdyne RS-27A, liquid		Boeing Rocketdyne	RS-27A	LOX/RP1	200,000 (SL)	8/13.1	65.7	(overall)			
	2	1 x Pratt & Whitney RL10B-2, liquid		Boeing	RL10B-2	LOX/LH <sub>2</sub>	24,750 (vac.)	13.1	28.8				
Delta 4 Medium	1	1 x Rocketdyne RS-68, liquid		Boeing Rocketdyne	RS-68	LOX/LH <sub>2</sub>	656,000 (SL)	16.7	156.1	565,000	9,285	6,030	Active. Initial flight on 3/10/03.
	2	1 x Pratt & Whitney RL10B-2, liquid		Boeing	RL10B-2	LOX/LH <sub>2</sub>	24,750 (vac.)	16.7/13.1	(overall)	(overall)	(geotransfer,		
Delta 4 Medium + (4, 2)	0	2 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-60	HTPB	165,000 each (SL)	5.0	161.0	723,000	12,890	8,980	Active. Initial flight on 11/20/02.
	1	1 x Rocketdyne RS-68, liquid		Boeing Rocketdyne	RS-68	LOX/LH <sub>2</sub>	656,000 (SL)	16.7	(overall)	(overall)	(geotransfer,		
	2	1 x Pratt & Whitney RL10B-2, liquid		Boeing	RL10B-2	LOX/LH <sub>2</sub>	24,750 (vac.)	16.7/13.1			27 deg.)		
Delta 4 Medium + (5, 2)	0	2 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-60	HTPB	165,000 each (SL)	5.0	53.0	736,000	10,230	—	Initial operating capability planned for 2003.
	1	1 x Rocketdyne RS-68, liquid		Boeing Rocketdyne	RS-68	LOX/LH <sub>2</sub>	656,000 (SL)	16.7	133.9	(overall)	(geotransfer,		
	2	1 x Pratt & Whitney RL10B-2, liquid		Boeing	RL10B-2	LOX/LH <sub>2</sub>	24,750 (vac.)	16.7	42.7		27 deg.)		
Delta 4 Medium + (5, 4)	0	4 x Alliant Techsystems GEM, solid		Alliant Techsystems	GEM-60	HTPB	165,000 each (SL)	5.0	53.0	892,000	14,475	10,100	Initial operating capability planned for 2003.
	1	1 x Rocketdyne RS-68, liquid		Boeing Rocketdyne	RS-68	LOX/LH <sub>2</sub>	656,000 (SL)	16.7	133.9	(overall)	(geotransfer,		
	2	1 x Pratt & Whitney RL10B-2, liquid		Boeing	RL10B-2	LOX/LH <sub>2</sub>	24,750 (vac.)	16.7	42.7		27 deg.)		
Delta 4 Heavy	0	2 x Rocketdyne RS-68, liquid		Boeing Rocketdyne	RS-68	LOX/LH <sub>2</sub>	656,000 each (SL)	16.7	153.8	1,617,000	28,950	20,510	Initial operating capability planned for 2003.
	1	1 x Rocketdyne RS-68, liquid		Boeing Rocketdyne	RS-68	LOX/LH <sub>2</sub>	656,000 (SL)	16.7	153.8	(overall)	(geotransfer,		
	2	1 x Pratt & Whitney RL10B-2, liquid		Boeing	RL10B-2	LOX/LH <sub>2</sub>	24,750 (vac.)	16.7	42.7		27 deg.)		
<i>CENTRAL SPECIALIZED DESIGN BUREAU, Samara, Russian Federation</i>													
Molniya M	0	4 x Energomash RD-107, liquid		TsSKB-Progress	RD-107	LOX/RP1	182,800 each (SL)	8.8	64.3	672,000	4,400	—	Active. First launch occurred on 2/19/64. Launch cost \$20 million.
	1	1 x Energomash RD-108, liquid		TsSKB-Progress	RD-108	LOX/RP1	175,000 (SL)	9.7	91.2	(overall)	(21,600 nm.		
	2	1 x Khimavtomatiki RD-0110, liquid		TsSKB-Progress	RD-0110	LOX/RP1	67,000 (vac.)	8.7	22.1		elliptical, 63 deg.)		
	3	1 x Energia 11D33M, liquid		TsSKB-Progress	11D33M	LOX/RP1	15,000 (vac.)	7.9	8.7				

# LAUNCH VEHICLES

GENERAL DATA		PROPULSION		STAGE CONTRACTOR	STAGE OR MOTOR DESIGNATION	PROPELLANTS (OXIDIZER/FUEL)	THRUST (LB.)	DIMENSIONS & WEIGHTS			PERFORMANCE (PAYLOAD IN LB.)		STATUS/OUTLOOK
VEHICLE NAME	STAGE	NO. OF ENGINES						MAX DIA. (FT.)	LENGTH (FT.)	LAUNCH WEIGHT (LB.)	HEAVY LIFT	MEDIUM LIFT	
<b>UNMANNED SYSTEMS</b>													
<i>CENTRAL SPECIALIZED DESIGN BUREAU, Samara, Russian Federation</i>													
Soyuz U	0	4 x Energomash RD-107, liquid		TsSKB-Progress	RD-107	LOX/RP1	182,800 each (SL)	8.8	64.3	683,000	16,100	—	Active. First launch occurred on 11/16/63. Launch cost: \$20 million. First Soyuz commercial mission launched 2/9/99. Commercially marketed by Starsem joint venture, Paris, France.
	1	1 x Energomash RD-108, liquid		TsSKB-Progress	RD-108	LOX/RP1	175,000 (SL)	9.7	91.2	(overall)	(108 nm. circular, 51.6 deg.)		
	2	1 x Khimavtomatiki RD-0110, liquid		TsSKB-Progress	RD-0110	LOX/RP1	67,000 (vac.)	8.7	22.1				
<i>CHINA GREAT WALL INDUSTRY CORP., Beijing, People's Republic of China</i>													
Long March LM-2C	1	4 x CALT YF-20, liquid		CALT	L140	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	11.0	119.9	422,400	2,200 (108 nm., circular, 28.5 deg.)	—	Active. First launch occurred on 11/26/75. Launch cost: \$30 million.
	2	1 x CALT YF-22/23, liquid		CALT	L35	N <sub>2</sub> O <sub>4</sub> /UDMH	177,130 total (vac.)	11.0	(overall)	(overall)			
Long March LM-2E	0	4 x CALT YF-20, liquid		CALT	LB40	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	7.4	163.1	1,012,000	7,430 (geotransfer, 28.5 deg.)	—	Active. First launch occurred on 7/16/90. Launch cost: \$40 million.
	1	4 x CALT YF-20, liquid		CALT	L180	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	11.0	(overall)	(overall)			
	2	1 x CALT YF-22/23, liquid		CALT	L80	N <sub>2</sub> O <sub>4</sub> /UDMH	177,130 total (vac.)	11.0					
Long March LM-3A	1	4 x CALT YF-20, liquid		CALT	L180	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	11.0	172.3	708,400	5,720 (geotransfer, 31.1 deg.)	—	Active. First launch occurred on 2/8/94. Launch cost: \$40 million.
	2	1 x CALT YF-22/23, liquid		CALT	L35	N <sub>2</sub> O <sub>4</sub> /UDMH	177,130 total (SL)	11.0	(overall)	(overall)			
	3	2 x CALT YF-75, liquid		CALT	H18	LOX/LH <sub>2</sub>	17,624 each (vac.)	9.8					
Long March LM-3B	1	4 x CALT YF-20, liquid		CALT	LB180	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	11.0	180	936,760	9,900 (geotransfer, 28.5 deg.)	—	Active. First flight on 2/5/96 failed; subsequent launches successful. Launch cost: \$50 million.
	2	1 x CALT YF-22/23, liquid		CALT	LB35	N <sub>2</sub> O <sub>4</sub> /UDMH	177,130 total (vac.)	11.0	(overall)	(overall)			
	3	2 x CALT YF-75, liquid		CALT	H18	LOX/LH <sub>2</sub>	17,624 each (vac.)	9.8					
Long March LM-4	1	4 x CALT YF-20, liquid		SAST	L180	N <sub>2</sub> O <sub>4</sub> /UDMH	16,624 each (SL)	11.0	261.5	712,800	2,430 (geotransfer, 28.5 deg.)	—	First launch occurred on 9/7/88. Launch cost: \$30 million.
	2	1 x CALT YF-22/23, liquid		SAST	L35	N <sub>2</sub> O <sub>4</sub> /UDMH	176,928 total (vac.)	11.0	(overall)	(overall)			
	3	1 x CALT YF-40, liquid		SAST	L15	N <sub>2</sub> O <sub>4</sub> /UDMH	22,641 (vac.)	9.5					
<i>ELV SpA. (Avio, Italian Space Agency), Rome, Italy</i>													
Vega	1	1 x P80, solid		Avio	P80	HTPB	471,960 (vac.)	9.9	32.8	286,650	3,300 (380 nm., polar orbit)	—	In development. Launch cost goal: \$18 million.
	2	1 x Z23, solid		Avio	Z23	HTPB	206,130 (vac.)	6.2	24.6	(overall)			
	3	1 x Z9, solid		Avio	Z9	HTPB	68,720 (vac.)	6.2	11.8				
	4	1 x AVUM, liquid		Avio	AVUM	N <sub>2</sub> O <sub>4</sub> /UDMH	485(vac.)	6.2	5.3				
<i>INDIAN SPACE RESEARCH ORGANIZATION, Launch Vehicle Program Office, Bangalore, India</i>													
GSLV	0	4 x LPSC L40H, liquid		ISRO	L40H	N <sub>2</sub> O <sub>4</sub> /UH25	171,975 each (vac.)	6.9	64.6	912,698	4,409	—	Active. First launch occurred on 4/18/01. Operational payload. 3,960-4,400 lb. (geotransfer, 18 deg.)
	1	1 x VSSC S139, solid		ISRO	S139	HTPB	1,064,677 (vac.)	9.2	66.0	(overall)	(geotransfer, 18 deg.)		
	2	1 x LPSC L39H, liquid		ISRO	L39H	N <sub>2</sub> O <sub>4</sub> /UH25	180,743 (vac.)	9.2	38.1				
	3	1 x C12, cryo.		ISRO	C12	LOX/LH <sub>2</sub>	16,547 (vac.)	9.5	28.5				
PSLV	0	6 x VSSC S9, solid		ISRO	S9	HTPB	152,153 each (vac.)	3.3	37.1	650,352	3,000	—	Active. Has demonstrated multiple satellite launch capability.
	1	1 x VSSC S139, solid		ISRO	S139	HTPB	1,064,677 (vac.)	9.2	66.0	(overall)	(446 nm., Sun synchronous polar orbit)		
	2	1 x VSSC L40H, liquid		ISRO	L40H	N <sub>2</sub> O <sub>4</sub> /UH25	180,743 (vac.)	9.2	41.0				
	3	1 x LPSC S7, solid		ISRO	S7	HTPB	52,604 (vac.)	6.6	11.8				
4	1 x LPSC L2, twin liquid		ISRO	L2	MON/MMH	1,663.6 each (vac.)	9.2	8.9					
<i>INSTITUTO DE AERONAUTICA E ESPACO, São Jose dos Campos, São Paulo, Brazil</i>													
VLS-1	1	4 x S43TM, solid		IAE	S43	HTPB	260,000	3.3	30.0	110,000	275	—	Initial launch on 11/2/97 failed. Second launch on 12/11/99 also failed. Two qualification flights expected 2002/2003. Launch cost goal: \$9 million.
	2	1 x S43TM, solid		IAE	S43	HTPB	71,000	3.3	29.2	(overall)	(low Earth circular, 25 deg.)		
	3	1 x S40TM, solid		IAE	S40	HTPB	46,000	3.3	20.5				
	4	1 x S44, solid		IAE	S44	HTPB	7,300	3.3	5.7				
<i>ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES, IHI Aerospace Co., Ltd., Tokyo, Japan</i>													
J-1	1	1 x IA SRM, solid		IA	SRB-A	HTPB	432,000 (vac.)	8.2	43.5	201,000	2,540 (100 nm. circular, 30 deg.)	—	In development.
	2	1 x IA M-23, solid		IA	M-23	HTPB	118,000 (vac.)	4.6	25.2	(overall)			
	3	1 x IA M-3B, solid		IA	M-3B	HTPB	30,000 (vac.)	4.9	12.1				
M-5	1	1 x IA M-14, solid		IA	M-14	HTPB	867,000 (vac.)	8.2	45.3	302,000	4,000 (100 nm. circular, 31 deg.)	—	Active. First launched on 2/12/97.
	2	1 x IA M-24, solid		IA	M-24	HTPB	280,000 (vac.)	8.2	22.3	(overall)			
	3	1 x IA M-34, solid		IA	M-34	HTPB	74,000 (vac.)	7.2	11.8				
<i>ISRAEL AIRCRAFT INDUSTRIES LTD., Yehud, Israel</i>													
LK-1	1	1 x solid		—	—	Solid	—	—	—	—	560-720	—	—
	2	1 x solid		—	—	Solid	—	—	—	—	(low Earth orbit)		
	3	1 x Thiokol Star 48, solid		Cordant Tech.-Thiokol	—	Solid	—	—	—	—			
Shavit	1	1 x TAAS Israel Industries SRM		IAI	SRM 1	HTPB	—	4.5	21.5	66,000	352 (100 nm. circular, 143 deg.)	—	Active. First launch occurred on 9/19/88. Launch on 1/22/98 failed. Launch cost: \$25 million.
	2	1 x TAAS Israel Industries SRM		IAI	SRM 2	HTPB	—	4.5	17.5	(overall)			
	3	1 x Rafael AUS-51, solid		IAI	AUS-51	HTPB	12,300 (vac.)	4.3	6.9				

# LAUNCH VEHICLES

GENERAL DATA		PROPULSION		STAGE CONTRACTOR	STAGE OR MOTOR DESIGNATION	PROPELLANTS (OXIDIZER/FUEL)	THRUST (LB.)	DIMENSIONS & WEIGHTS			PERFORMANCE (PAYLOAD IN LB.)		STATUS/OUTLOOK
VEHICLE NAME	STAGE	NO. OF ENGINES						MAX DIA. (FT.)	LENGTH (FT.)	LAUNCH WEIGHT (LB.)	HEAVY LIFT	MEDIUM LIFT	
<b>UNMANNED SYSTEMS</b>													
<i>KB POLYOT, Omsk, Russian Federation</i>													
Cosmos 3M	1	1 x Energomash RD-216, liquid		KB Polyot	RD-216	Nitric acid, N <sub>2</sub> O <sub>4</sub> /UDMH	334,000 (vac.)	7.9	73.0	240,000	3,100 (216 nm. circular)	—	Active. First launch occurred on 10/21/61. Launch cost: \$10 million. Marketed commercially by PO Polyot and Rosvoorouzhenie.
	2	1 x Khimmach 11D49, liquid		KB Polyot	11D49	N <sub>2</sub> O <sub>4</sub> /UDMH	35,200 (vac.)	7.9	22.0	(overall)			
<i>KHRUNICHEV STATE RESEARCH AND PRODUCTION SPACE CENTER, Moscow, Russian Federation</i>													
Proton K	1	6 x Energomash RD-253, liquid		Khruichev	RD-253	N <sub>2</sub> O <sub>4</sub> /UDMH	394,043 each (SL)	24.3	69.5	1,547,000 (overall)	45,747 (geotransfer, 28.5 deg.)	—	Active. First launch on 7/16/65. Marketed commercially by ILS, San Diego, CA, USA. Three stage configuration.
	2	3 x Khimavtomatiki RD-0210, liquid		Khruichev	RD-0210	N <sub>2</sub> O <sub>4</sub> /UDMH	524,654 total (vac.)	13.5	55.9				
	3	1 x Khimavtomatiki RD-0211, liquid 1 x Khimavtomatiki RD-0210, liquid		Khruichev	RD-0211 RD-0210	N <sub>2</sub> O <sub>4</sub> /UDMH N <sub>2</sub> O <sub>4</sub> /UDMH	6,962 (vac.)	13.5	13.5				
Proton K/Block DM	1	6 x Energomash RD-253, liquid		Khruichev	RD-253	N <sub>2</sub> O <sub>4</sub> /UDMH	394,043 each (SL)	24.3	69.5	1,547,000 (overall)	46,189 (geotransfer, 28.5 deg.)	—	Active. Modernized fourth stage. Marketed commercially by ILS, San Diego, CA, USA.
	2	3 x Khimavtomatiki RD-0210, liquid		Khruichev	RD-0210	N <sub>2</sub> O <sub>4</sub> /UDMH	524,654 total (vac.)	13.5	55.9				
	3	1 x Khimavtomatiki RD-0211, liquid		Khruichev	RD-0211	N <sub>2</sub> O <sub>4</sub> /UDMH	6,962 (vac.)	13.5	13.5				
	4	1 x Khimavtomatiki RD-0210, liquid		RSC Energia	RD-0210	N <sub>2</sub> O <sub>4</sub> /UDMH	18,883 (vac.)	12.1	20.6				
Proton M/Breeze M	1	6 x Energomash RD-253, liquid		Khruichev	RD-253	N <sub>2</sub> O <sub>4</sub> /UDMH	394,043 each (SL)	24.3	69.5	1,595,996 (overall)	7,072 (geotransfer, 28.5 deg.)	—	Active. Modernized upper stage. First launch on 4/7/01.
	2	3 x Khimavtomatiki RD-0210, liquid		Khruichev	RD-0210	N <sub>2</sub> O <sub>4</sub> /UDMH	524,654 total (vac.)	13.5	55.9				
	3	1 x Khimavtomatiki RD-0211, liquid		Khruichev	RD-0211	N <sub>2</sub> O <sub>4</sub> /UDMH	6,962 (vac.)	13.5	13.5				
	4	1 x Khimavtomatiki RD-0210, liquid 1 x Khimmach Breeze M core, liquid		Khruichev	RD-0210 Breeze M	N <sub>2</sub> O <sub>4</sub> /UDMH N <sub>2</sub> O <sub>4</sub> /UDMH	4,410 (vac.)	13.1	8.7				
Rockot	1	3 x Khimavtomatiki 15D95, liquid		Khruichev	15D95	N <sub>2</sub> O <sub>4</sub> /UDMH	470,067 total (vac.)	8.2	93.5	237,575 (overall)	4,044 (low Earth orbit)	—	Active. First launch on 12/26/94. Marketed commercially by the Khruichev/Astrum joint venture, Eurockot.
	2	1 x Khimavtomatiki 15D96, liquid		Khruichev	15D96	N <sub>2</sub> O <sub>4</sub> /UDMH	56,488 (vac.)						
	3	1 x Khimavtomatiki 15D113, liquid		Khruichev	15D113	N <sub>2</sub> O <sub>4</sub> /UDMH	4,420 (vac.)						
<i>LOCKHEED MARTIN ASTRONAUTICS, Denver, CO, USA</i>													
Athena 1	1	1 x Thiokol Castor 120, solid		Cordant Tech.-Thiokol	Castor 120	HTPB	360,000 (vac.)	7.7	29.6	146,000 (overall)	1,750 (100 nm. circular, 28.5 deg.)	—	Active. First flight on 8/15/95 failed. Later launches successful. Launch cost: \$20 million.
	2	1 x UTC Orbus 21D, solid		UTC	Orbus 21D	HTPB	42,400 (vac.)	7.7	10.4				
	3	4 x Primex MR-107, liquid		Aerojet	Orbit Adjust Module	Hydrazine	200	7.7	3.3				
Athena 2	1	1 x Thiokol Castor 120, solid		Cordant Tech.-Thiokol	Castor 120	HTPB	360,000	7.7	29.6	266,000 (overall)	4,520 (100 nm. circular, 28.5 deg.)	770	Active. First launch on 1/6/98. Launch cost: \$25 million.
	2	1 x Thiokol Castor 120, solid		Cordant Tech.-Thiokol	Castor 120	HTPB	360,000	7.7	29.6				
	3	1 x UTC Orbus 21D, solid		UTC	Orbus 21D	HTPB	42,400	7.7	10.4				
	4	4 x Primex MR-107, liquid		Aerojet	Orbit Adjust Module	Hydrazine	200	7.7	3.3				
Atlas 2AS	0	4 x Thiokol Castor 4A, solid		Cordant Tech.-Thiokol	Strap-ons	HTPB	96,000 each (SL)	3.3	44.0	522,000 (overall)	8,202 (geotransfer, 28 deg.)	6,200	Active. First launch on 12/15/93.
	1	1 x Rocketdyne MA-5A, liquid		Lockheed Martin	Core	LOX/RP1	490,000 (SL)	10.0	82.0				
	2	2 x Pratt & Whitney RL10A-4-1, liquid		Lockheed Martin	Centaur	LOX/LH <sub>2</sub>	20,800 each (vac.)	10.0	33.0				
Atlas 3	1	1 x Energomash RD-180, liquid		Lockheed Martin	Core	LOX/RP1	860,000 (SL)	10.0	94.8	496,900 (overall)	9,920 (geotransfer)	6,600	Active. First launch on 5/24/00.
	2	1-2 x Pratt & Whitney RL10A-4-1B, liquid		Lockheed Martin	Centaur	LOX/LH <sub>2</sub>	22,300 each (vac.)	10.0	41.6				
Atlas 5 (400 series)	0	0-3 strap-ons, solid		Aerojet	Strap-ons	HTPB	270,400 (avg.)	5.2	67	734,800 (overall)	16,843 (geotransfer)	7,600 to 12,400	Active. First launch on 8/21/02.
	1	1 x Energomash RD-180, liquid		Lockheed Martin	RD-180	LOX/RP1	860,000 (SL)	12.5	106.5				
	2	1-2 x Pratt & Whitney RL10-A-4-2, liquid		Lockheed Martin	Centaur	LOX/LH <sub>2</sub>	22,300 each	10.0	41.6				
Atlas 5 (500 series)	0	0-5 strap-ons, solid		Aerojet	Strap-ons	HTPB	270,400 (avg.)	5.2	67	1,191,200 (overall)	19,110 (geotransfer, 28 deg.)	5,900 to 14,000	Active. First launch on 7/17/03.
	1	1 x Energomash RD-180, liquid		Lockheed Martin	RD-180	LOX/RP1	860,000 (SL)	12.5	106.5				
	2	1-2 x Pratt & Whitney RL10-A-4-1, liquid		Lockheed Martin	Centaur	LOX/LH <sub>2</sub>	22,300 each	10.0	41.6				
Atlas 5 (Heavy Lift Vehicle)	0	2 x boosters, liquid		Lockheed Martin	Strap-ons	LOX/RP1	860,000 (SL)	12.5	106.5	1,191,200 (overall)	27,800 (geotransfer, 28 deg.)	19,900	First launch planned for 2006.
	1	1 x Energomash RD-180, liquid		Lockheed Martin	RD-180	LOX/RP1	860,000 (SL)	12.5	106.5				
	2	1-2 x Pratt & Whitney RL10A-4-2, liquid		Lockheed Martin	Centaur	LOX/LH <sub>2</sub>	22,300 each	10.0	41.6				
Titan 2	1	2 x Aerojet LR87-AJ-5, liquid		Lockheed Martin	LR87-AJ-5	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	474,000 each (vac.)	10.0	70.7	340,000 (overall)	4,200 (100 nm. circular, 90 deg.)	9,300	Active. First launch occurred on 4/8/64. Launch cost: \$50 million. Total of 38 Titan 2s have been stockpiled and are available for conversion into space launchers.
	2	1 x Aerojet LR91-AJ-11, liquid		Lockheed Martin	LR91-AJ-11	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	100,000 (vac.)	10.0	40.1				
Titan 4	0	2 x Alliant Techsystems SRMU, solid		Alliant Techsystems	SRMU	HTPB	1,700,000 each (vac.)	10.5	112.5	2,100,000 (overall)	47,000 LEO, equatorial; 39,000 LEO,	—	Active. First launch occurred on 6/14/89. Launch cost: \$250-400 million. The uprated Titan 4B, using the SRMU strap-on boosters, was initially launched on 2/22/97.
	1	2 x Aerojet LR87-AJ-11, liquid		Lockheed Martin	LR87-AJ-11	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	548,000 each (vac.)	10.0	86.5				
	2	1 x Aerojet LR91-AJ-11, liquid		Lockheed Martin	LR91-AJ-11	N <sub>2</sub> O <sub>4</sub> /Aerozine-50	105,000 (vac.)	10.0	32.6				

# LAUNCH VEHICLES

GENERAL DATA		PROPULSION		STAGE CONTRACTOR	STAGE OR MOTOR DESIGNATION	PROPELLANTS (OXIDIZER/FUEL)	THRUST (LB.)	DIMENSIONS & WEIGHTS			PERFORMANCE (PAYLOAD IN LB.)		STATUS/OUTLOOK
VEHICLE NAME	STAGE	NO. OF ENGINES						MAX DIA. (FT.)	LENGTH (FT.)	LAUNCH WEIGHT (LB.)	HEAVY LIFT	MEDIUM LIFT	
<b>UNMANNED SYSTEMS</b>													
<b>LOCKHEED MARTIN ASTRONAUTICS, Denver, CO, USA</b>													
Titan 4 (continued)	3	2 x Boeing SRM, solid (IUS) or		Boeing	IUS	HTPB	63,300 total (vac.)	9.5	17.0		polar; 12,700 geosynchronous		
	3	2 x Pratt & Whitney RL10A-3-3A, liquid (Centaur)		Lockheed Martin	Centaur	LOX/LH <sub>2</sub>	16,500 each (vac.)	14.0	38.5				
<b>ORBITAL SCIENCES CORP., Dulles, VA, USA</b>													
Minotaur (Orbital Suborbital Program; OSP-Space Launch vehicle)	1	1 x Minuteman M55A1, solid		Orbital Sciences	M55A1	TP-H1011, type 2	178,000	5.5	24.6	80,340 (overall)	1,400 (100 nm. circular, 28 deg.)	—	First launch of OSP SLV was 1/21/00. First launch of OSP TLV was 5/28/00. Both were successful.
	2	1 x Minuteman SR-19, solid		Orbital Sciences	MSR-19	ANB-3066	60,312	4.4	13.5				
	3	1 x Alliant Techsystems Orion 38, solid		Alliant Techsystems	Orion 38	HTPB	34,515 (vac.)	3.2	4.4				
	4	1 x Alliant Techsystems Orion 38, solid		Alliant Techsystems	Orion 38	HTPB	7,155 (vac.)	3.2	4.4				
Pegasus XL	1	1 x Alliant Techsystems Orion 50SXL, solid		Alliant Techsystems	Orion 50SXL	HTPB	163,247 (vac.)	4.2	33.7	51,000 (overall)	7,800 (300 nm. circular, 28 deg.)	—	Active. Optional fourth stage (HAPS) is available.
	2	1 x Alliant Techsystems Orion 50XL, solid		Alliant Techsystems	Orion 50XL	HTPB	34,515 (vac.)	4.2	10.2				
	3	1 x Alliant Techsystems Orion 38, solid		Alliant Techsystems	Orion 38	HTPB	7,155 (vac.)	3.2	4.4				
Taurus	0	1 x Thiokol Castor 120		Cordant Tech.-Thiokol	Castor 120	HTPB	363,087 (vac.)	7.8	41.9	160,000 (overall)	3,300 (215 nm. circular, 28 deg.)	825	Active. First launch occurred on 3/13/94.
	1	1 x Alliant Techsystems Orion 50S, solid		Alliant Techsystems	Orion 50S	HTPB	130,500 (vac.)	4.2	29.5				
	2	1 x Alliant Techsystems Orion 50, solid		Alliant Techsystems	Orion 50	HTPB	34,515 (vac.)	4.2	10.2				
	3	1 x Alliant Techsystems Orion 38, solid		Alliant Techsystems	Orion 38	HTPB	7,155 (vac.)	3.2	4.4				
<b>ROCKET SYSTEM CORP., Tokyo, Japan</b>													
H-2A (H2A202)	0	2 x IA SRM, solid		IA	SRB-A	HTPB	508,000 each (vac.)	8.2	173.9	628,400 (overall)	9,000 (geotransfer, 28.5 deg.)	—	Active. First test flight 8/29/01. Launch cost goal: \$80-90 million.
	1	1 x MHI LE-7A, liquid		MHI	LE-7A	LOX/LH <sub>2</sub>	247,300 (vac.)	13.1	(overall)				
	2	1 x MHI LE-5B, liquid		MHI	LE-5B	LOX/LH <sub>2</sub>	30,800 (vac.)	13.1					
H-2A (H2A2022)	0	2 x MHI solid strap-ons		MHI	SSB	HTPB	167,500 each (vac.)	—	172.3	708,400 (overall)	9,900 (geotransfer, 28.5 deg.)	—	Active.
	0	2 x IA SRM, solid		IA	SRB-A	HTPB	508,000 each (vac.)	8.2	(overall)				
	1	1 x MHI LE-7A, liquid		MHI	LE-7A	LOX/LH <sub>2</sub>	247,300 (vac.)	6.6					
	2	1 x MHI LE-5B, liquid		MHI	LE-5B	LOX/LH <sub>2</sub>	30,800 (vac.)	5.6					
H-2A (H2A2024)	0	4 x MHI solid strap-ons		MHI	SSB	HTPB	167,500 each (vac.)	—	173.9	765,000 (overall)	11,000 (geotransfer, 28.5 deg.)	—	Active.
	0	2 x IA SRM, solid		IA	SRB-A	HTPB	508,000 each (vac.)	8.2	(overall)				
	1	1 x MHI LE-7A, liquid		MHI	LE-7A	LOX/LH <sub>2</sub>	247,300 (vac.)	13.1					
	2	1 x MHI LE-5B, liquid		MHI	LE-5B	LOX/LH <sub>2</sub>	30,800 (vac.)	13.1					
<b>SEA LAUNCH COMPANY LLC (YUZHNOYE STATE DESIGN OFFICE, Dnepropetrovsk, Ukraine, ENERGIA RSC, Korolev, Russian Federation, THE BOEING CO., Seattle, WA, USA) Long Beach, CA, USA</b>													
Zenit 3SL	1	1 x Energomash RD-171, liquid		Yuzhmash	RD-171	LOX/Kerosene	1,631,460 (SL)	12.8	108.0	1,042,785 (overall)	13,373 (108 nm. perigee GTO, 0.0 deg.)	8,829	Boeing's Sea Launch joint venture with the Ukrainians, Russians and Norwegians uses a Zenit 3SL launched from an ocean platform on the equator. First launch on 3/27/99 successful. Launch cost goal: \$90 million.
	2	1 x Energomash RD-120, liquid & 1 x Yuxhmad RD-8, liquid (vernier)		Yuzhmash	RD-120 RD-8	LOX/Kerosene LOX/Kerosene	223,000 (vac.) 17,860 (vac.)	12.8	34.1				
	3	1 x Energomash 11D58M, liquid		Energia	11D58M (DM-SL)	LOX/Kerosene	18,700 (vac.)	12.1	16.1				
<b>STATE ROCKET CENTER (Makayev Design Bureau), Miass, Russian Federation</b>													
Shtil	1	1 x liquid		—	—	Liquid	—	6.2	48.6	88,000 (overall)	195 (108 nm., circular, 79 deg.)	—	Commercial version of Shtil (SS-N-23) ICBM. First launch was in 1998. Active.
	2	1 x liquid		—	—	Liquid	—	(overall)	(overall)				
	3	1 x liquid		—	—	Liquid	—						
Shtil 2.1	1	1 x liquid		—	—	Liquid	—	6.2	52.5	88,000 (overall)	488 (108 nm., circular, 79 deg.)	—	In development.
	2	1 x liquid		—	—	Liquid	—	(overall)	(overall)				
	3	1 x liquid		—	—	Liquid	—						
Volna	1	1 x liquid		—	—	Liquid	—	5.9	46.6	77,000 (overall)	244 (216 nm., circular, 79 deg.)	—	Commercial version of SS-N-18 ICBM. First launch was in 1995. Active.
	2	1 x liquid		—	—	Liquid	—	(overall)	(overall)				
<b>STC COMPLEX-MIHT, Moscow, Russian Federation</b>													
Start-1	1	SRM, solid		MIHT	—	Solid	—	5.9	74.9	103,400	231.8 (540 nm.)	—	Active. First launch of Start-1 on 3/25/93.

# LAUNCH VEHICLES

GENERAL DATA		PROPULSION		STAGE CONTRACTOR	STAGE OR MOTOR DESIGNATION	PROPELLANTS (OXIDIZER/FUEL)	THRUST (LB.)	DIMENSIONS & WEIGHTS			PERFORMANCE (PAYLOAD IN LB.)		STATUS/OUTLOOK
VEHICLE NAME	STAGE	NO. OF ENGINES						MAX DIA. (FT.)	LENGTH (FT.)	LAUNCH WEIGHT (LB.)	HEAVY LIFT	MEDIUM LIFT	
<b>UNMANNED SYSTEMS</b>													
<i>STC COMPLEX-MIHT, Moscow, Russian Federation</i>													
Start-1 (continued)	2	SRM, solid		MIHT	—	Solid	—	(overall)	(overall)	(overall)	circular; polar to 1,077 (108 nm. circular; polar)		
	3	SRM, solid		MIHT	—	Solid	—						
	4	SRM, solid		MIHT	—	Solid	—						
<i>YUZHNOYE STATE DESIGN OFFICE, Dnepropetrovsk, Ukraine</i>													
Cyclone 2K	1	3 x Energomash RD-261, liquid & 1 x Yuzhnoye RD-855, liquid		Yuzhmash	RD-261 RD-855	N <sub>2</sub> O <sub>4</sub> /UDMH N <sub>2</sub> O <sub>4</sub> /UDMH	594,600 (vac.) 73,800 (vac.)	9.8	61.8	404,000 (overall)	7,900 (89.1 nm. circular, 51 deg.)	—	Joint Ukrainian-Russian development for commercial use of 7 existing Cyclone 2 vehicles.
	2	1 x Energomash RD-262, liquid & 1 x Yuzhnoye RD-856, liquid		Yuzhmash	RD-262 RD-856	N <sub>2</sub> O <sub>4</sub> /UDMH N <sub>2</sub> O <sub>4</sub> /UDMH	211,000 (vac.) 12,100 (vac.)	9.8	37.6				
	3	1 x liquid		Makeyev	—	N <sub>2</sub> O <sub>4</sub> /UDMH	1,989	8.9	9.5				
Cyclone 3	1	3 x Energomash RD-260, liquid & 1 x Yuzhnoye RD-855, liquid		Yuzhmash	RD-261 RD-855	N <sub>2</sub> O <sub>4</sub> /UDMH N <sub>2</sub> O <sub>4</sub> /UDMH	594,600 (vac.) 73,800 (vac.)	9.8	61.8	417,000 (overall)	7,900 (108 nm. circular, 73.5 deg.)	—	Active. First launch was on 06/24/77. Launch cost: \$20-23 million.
	2	1 x Yuzhnoye RD-856, liquid & 1 x RD-262, Energomash, liquid		Yuzhmash	RD-856 RD-262	N <sub>2</sub> O <sub>4</sub> /UDMH N <sub>2</sub> O <sub>4</sub> /UDMH	12,100 (vac.) 211,000 (vac.)	9.8	37.6				
	3	1 x Yuzhnoye RD-861, liquid		Yuzhmash	RD-861	N <sub>2</sub> O <sub>4</sub> /UDMH	17,600 (vac.)	7.9	10.5				
Dnepr-1	1	4 x Energomash RD-264, liquid		Yuzhmash	RD-264	N <sub>2</sub> O <sub>4</sub> /UDMH	1,016,673 (vac.)	9.8	73.0	464,377 (overall)	8,377 (108 nm. circular, 65 deg.)	—	Active. First launch on 4/21/99. Launch cost: \$10 million.
	2	1 x VMZ RD-0228, liquid		Yuzhmash	RD-0288	N <sub>2</sub> O <sub>4</sub> /UDMH	170,945 (vac.)	9.8	22.0				
	3	1 x dual-mode liquid RD-864		Yuzhmash	RD-864	N <sub>2</sub> O <sub>4</sub> /UDMH	4,268 (vac.) 1,792 (vac.)	9.8	6.0				
Zenit 2	1	1 x Energomash RD-170, liquid		Yuzhmash	RD-170	LOX/Kerosene	1,631,460 (SL)	12.8	108.1	1,012,620 (overall)	29,980 (108 nm. circular, 51.4 deg.)	—	Active. First launch on 4/13/85. Launch cost: \$45 million.
	2	1 x Energomash RD-120, liquid & 1 Yuzhnoye RD-8, liquid		Yuzhmash	RD-120 RD-8	LOX/Kerosene LOX/Kerosene	187,400 (vac.) 17,860 (vac.)	12.8	36.2				

Abbreviations:	
CALT	— China Academy of Launch Vehicle Technology
CTPB	— Carboxyl-terminated polybutadiene
HTPB	— Hydroxyl-terminated polybutadiene
IA	— IHI (Ishikawajima-Harima Heavy Industries) Aerospace Co., Ltd.
IAE	— Instituto de Aeronautica e Espaco
ISRO	— Indian Space Research Org.
LH <sub>2</sub>	— Liquid hydrogen
LOX	— Liquid oxygen
LPSC	— Liquid Propulsion System Center
MHI	— Mitsubishi Heavy Industries
MIT	— Moscow Institute of Thermal Technology
MMH	— Monomethylhydrazine
nm.	— Nautical miles
PBAN	— Polybutadiene acrylonitrile
RP1	— Rocket Propellant 1
SL	— Sea Level
UDMH	— Unsymmetrical dimethylhydrazine
UTC	— United Technologies Corp.
VAC	— Vacuum
VSSC	— Vikram Sarabhai Space Center

