(Please Note!) RSDO CATALOG ADVISORY NOTICE

THIS RSDO CATALOG SPREADSHEET SUMMARIZES THE CONTRACT BASELINE CHARACTERISTICS OF EACH CORE SPACECRAFT "BUS" AVAILABLE VIA OUR RAPID III CONTRACTS. EACH SPACECRAFT IS CAPABLE OF BEING MODIFIED TO HAVE OTHER MISSION SPECIFIC CAPABILITIES.

THE CONTRACT BASELINE SHOULD BE CONSIDERED MERELY A STARTING POINT FOR A DESIGN THAT CAN MEET YOUR MISSION SPECIFIC REQUIREMENTS.

ABOUT THIS FILE - ALSO NOTE THE FOLLOWING!

1) THIS FILE IS INTENDED TO BE PRINTED ON FOUR 11 X 17 INCH PAGES CONSISTING OF THIS COVER PAGE OF NOTES, PLUS THREE PAGES FOR THE SPACECRAFT DATA TABLES. PLEASE ADJUST YOUR PRINTER SETTINGS AND PAGE BREAKS AS NEEDED.

2) SOME SPREADSHEET CELLS IN THE TABLES HAVE IMBEDDED POPUP COMMENTS INDICATED BY RED CORNER MARKS WHEN DISPLAYED ON-SCREEN. HOWEVER THESE CORNER MARKS AND COMMENTS WILL NOT BE SEEN IN PRINTOUTS NOR IN PDF VERSION OF THE FILE. TO READ THE ASSOCIATE POP-UP COMMENTS PLACE THE CURSOR ON THE CELL OF INTEREST.

"CONTACT US"

3) TO LEARN MORE ABOUT THE FULL CAPABILITY OF EACH RSDO SPACECRAFT, PLEASE SEND US AN EMAIL VIA "CONTACT US" (above), OR CONTACT US BY PHONE: <u>301-286-1289</u>, OR BY FAX: <u>301-286-0530</u>

VISIT OUR WEBSITE http://RSDO.GSFC.NASA.GOV

PLEASE ADVANCE TO PAGES 2 THROUGH 4 TO REVIEW THE CHARACTERISTICS OF RSDO RAPID III CATALOG SPACECRAFT.

>>> PLEASE REFER TO CATALOG ADVISORY NOTICE ON PAGE 1

>>> PLEASE REFER TO CATALOG ADVISORY NOTICE ON PAGE 1 Table of Catalog Spacecraft - Continued on next page								d on next page
		Contractor >> Spacecraft Name \\	Ball Aerospace	Ball Aerospace	Boeing	Lockheed Martin	Lockheed Martin	Lockheed Martin
	Parameter	Units	BCP 300	BCP2000	702SP	LM100	LM400	LMx
Compatibility	Orbit Average Payload Power (EOL)	W (EOL)	200	400	8000	155	409	427
	Maximum Payload Mass	kg	250	500	565	152	75	460
	Bus Dry mass (w/o Payload)	kg	139	450	1191	95	186	426
	Science Data Downlink	kbps	2,000	80,000	4 (see comment)	mission specific	mission specific	mission specific
	Science Data Storage (Capacity)	Mbit	8,000	56,000	200 (see comment)	mission specific	mission specific	mission specific
	Pointing Knowledge	arcsec	< 300	10.5	36 arcsec in Roll/Pitch/Yaw	40 (35)	413 (35)	60 (3s)
	Pointing Control	arcsec	< 300	10.5	360 arcsec Roll/Pitch/Yaw	200 (35)	462 (3s)	130 (3s)
	Pointing Stability (Jitter)	arcsec/sec	0.5	0.5	~0	5 (3s)	5 (3s)	20 (3s)
	Slew rate	deg / min	18	18	6 deg/min (Maximum Maneuver Rate)	15	44	23
	Mission Design Life	years	1	5	15 years	1-3	3-Jan	3
	Compatible LVs	(names)	Pegasus, Taurus XL, Atlas V secondary, Delta II secondary	Delta II, EELV, Taurus XL, Taurus 2, Falcon 9, Minotaur IV	Falcon 9, Proton Breeze M, Ariane 5, Soyuz 5, and Sea Launch	Pegasus XL, Minotaur I & IV, Taurus XL, Taurus 2, Athena IIc, Delta II, Falcon 9, EELV	Pegasus XL, Minitaur I & IV, Taurus XL & II, Delta II, Athena Iic, Falcon 9, EELV	Taurus 2, Delta II, Falcon 9, Minotaur IV, EELV
	Nominal Orbit	Altitude, Inclination, Type, Other	500 km, 46 deg	600 km, 94 deg all-Beta	60,000km (Apogee) , 400km (Perigee), 15 deg (Inclination)	LEO 400-1000 km, 0° to Sun Synch	LEO 400-1000 km, 0 deg to Sun-Sync, Lunar	681 km, 98 deg, Sun Synch
	Types of Orbits Available	as needed	400-500 km, all inclinations	LEO 400 - 900 km 0 to 108 deg	Geosynchronous (see comment)	LEO 400-1000 km, 0° to Sun Synch	LEO 400-1000 km, 0 deg to Sun-Sync, Lunar	LEO 400-1,000 km 0° to Sun Synch
	External Payload Volume	meters	0.7 x 0.8 x 1.4	1.5-m hex (tip-to-tip) x 2.2-m height (3.5 m3)	136 cm by 136 cm by 150 cm (see comment)	1m dia x 1.4m h	0.6 x 0.66 x 0.3 h 0.338 x 0.7 x 0.4 h	1.9 m dia x 1.8m h (ATLAS V 4m LPF)
	Internal Payload Volume	meters	negotiable	negotiable	8.5	0.09 m ³	0.07 m3	1 bay, 0.3 m3
Description	ACS	type	stellar inertial zero net momentum	stellar inertial zero net momentum	3-axis Control	zero momentum, 3-axis, stabilized	Zero momentum, 3-axis stabilized	Zero momentum, 3-axis stabilized
	Star Trackers	# of STs	1	2	2	2	1	2
	GPS	# recievers	0	2	N/A for Geosynchronous Configuration.	mission specific	mission specific	mission-specific
	Batteries	cell type/capacity (Ah)	Li-ion / 24 Ah	Li-ion / 66 Ah	Lithium Ion/200	Li-ion, 30 Ah	L-ion, 30 Ah	Li-ion, 60 Ah
	Solar Arrays	cell type/Area (m2)	UTJ / 2.7 m2	Triple junction GalnP ₂ , 7.3 m2	Ultra Triple Junction Gallium Arsenide/51.6	Triple junction GaAs, 1.7m ²	Triple Junction GaAs, 3.87m2	Triple Junction GaAs
	Main Bus Voltage Range	volts	28-34	24 - 35	30, 100	24-34	23-33 (28V nominal)	28-33
	C&DH Bus Architecture	description	Rad 750 single board computer based	Rad750 single board computer based	1553	Centralized processor control, Discrete I/O, 1553B, RS-422, and SpaceWire connections	Centralized processor control, Discrete I/O, 1553B & RS-422 connections	Centralized processor control, 1553B & RS-422 connections
	Downlink Formats	CCSDS, STDN, etc	STDN, USB	CCSDS, STDN	STDN, DSN, TDRSS, SGLS, others	CCSDS, STDN, TDRSS	CCSDS or JPL type, STDN, DSN, SGLS, TDRSS	CCSDS, STDN
	Comm Up\Downlink Band	S, X, UHF, Ka, Ku, etc.	S-Band	X- and S-Band	C-bands (see comment)	Cmd/Tim: S-Band Data: Mission-specific	Cmd/TIm: S-Band Data: Mission-specific	Cmd/TIm: S-Band Data: Mission-specific
	Structure	description	Al honeycomb hexagon	Al honeycomb hexagon	graphite/epoxy composites structure, aluminum honeycomb panels	Al Octagonal Box Structure	6 panel rect. Box, CFRP facesheets w/Al Honeycomb core	Al Honeycomb Hexagon
	Propulsion	type, fuel	Not Applicable (N/A)	Mono-prop (N ₂ H ₄)	Electric, Xe	mission specific	Blowdown, Mono-prop (N2H4)	Mono-prop (N2H4)
	Propellant Capacity	kg	N/A	95	320	mission specific	106 (LM400 baseline load of 49)	38
	Max delta V	m/s	N/A	200	4000	mission specific	350	90
Programmatic	heritage mission(s)	name(s)	OE/NextSat, WISE	QuikSCAT, QuickBird, ICESat, CloudSat	2 ABS, 2 Eutelsat	IRIS	GRAIL, XSS-11	MRO, IKONOS
	nominal schedule	months (ATP to ready for payload I&T)	22	23	25	15	18	27
	nominal schedule	months (ATP to launch)	30	35	32	24	31	38
Contract Options	Contract Option #1	description						
1	Contract Option #2	description						
	Contract Option #3	description						
	Contract Option #4	description						
1	Contract Option #5	description						
	Contract Option #6	description						

Table of Catalog Spacecraft - Continued from previous page

>>> PLEASE R	EFER TO CATALOG ADVIS	ORY NOTICE ON PAG	E 1				Table of Catalog Spacecraft - Continued	d on next page
		Contractor >> Spacecraft Name \\	Northrop Grumman	Orbital ATK	Orbital ATK	Orbital ATK	QinetiQ Space	Space Systems Loral
	Parameter	Units	Eagle 0	3005	300HP	LEOStar 2	P200	1300
Compatibility	Orbit Average Payload Power (EOL)	W (EOL)	100 (see comment)	125	775	850	70	2857
	Maximum Payload Mass	kg	Panel: 86 ; Axially: 3000 (see comment)	65	3,000	500	70	500
	Bus Dry mass (w/o Payload)	kg	471 (see comment)	272	1,169	938	150	1447
	Science Data Downlink	kbps	1000 (see comment)	40,000	40,000	300,000	200,000	350,000
	Science Data Storage (Capacity)	Mbit	0 (see comment)	160,000	160,000	500,000	512,000	5,600,000
	Pointing Knowledge	arcsec	1,550 (3s) (see comment)	5 (1s)	6 radial (1s)	42	2 (15)	< 60 (3s)
	Pointing Control	arcsec	1,550 (3s) (see comment)	120 (15)	120 (1s)	48	6 (15)	< 200 (3s)
	Pointing Stability (Jitter)	arcsec/sec	12 (see comment)	1.5	1	1	1.5	<5 (3s)
	Slew rate	deg / min	90 (ree comment)	3 deg/sec	0.125 deg/sec	60	60	15
	Mission Design Life	years	1 (see comment)	2	5	5 with expendables for 7	5	15 GEO / 10 LEO
	Compatible LVs	(names)	EELV, Falcon 9, ,Taurus II	Minotaur I, Taurus, EELV	EELV, Delta, Taurus II	Delta II	Falcon-9, VEGA, Soyuz, PSLV, Ariane 5, DNEPR, Rockot, Athena,	Atlas V, Falcon 9, Delta IV
	Nominal Orbit	Altitude, Inclination, Type, Other	(see comment)	425, 97.128, Sun Synch, Asc node at the terminator	565, 25.6, all	600 km 97.8 deg Sun Synch	650 km, 98 deg SSO	GEO standard
	Types of Orbits Available	as needed	LEO (28 - 90° incl & altitudes from 425 km to 1,000 km), GEO, and interplanetary. <i>(see comment)</i>	As needed with impacts to other parameters.	As needed with impacts to other parameters.	400 km to 1,000 km at any inclination	All LEO orbits between 450 km and 900 km	MEO, LEO
	External Payload Volume	meters	0.42 m x 0.76 m x 0.31 m (X x Y x Z) (see comment)	0.762 dia x 1.143	1.828 x 1.828 x 1.4	1.54 m x 1.24 m x 1.66 m	650 mm x 770 mm x 490 - 1872 mm, depending on launcher	2.3 x 2.0 x 3.0
	Internal Payload Volume	meters	N/A (see comment)	32 x 22 x 23 cm, 6 6U cPCI PL I/F slots	35.6 x 71.1 x 30.48 cm to external panel	Limited	180 mm x 290 mm x 160 mm	>1 m3 distributed
Description	ACS	type	3-axis stellar inertial w/ thruster-based control (see comment)	3 axis ZMB, megnetic desat	3 axis ZMB, megnetic desat	3-axis stabilized	3-axis stabilised	3-axis momentum bias systems with continuous 3-axis sensing
	Star Trackers	# of STs	1 (see comment)	1	3	3 for 2 redundant	1 redundant	2
	GPS	# recievers	0 (see comment)	1	2	1 internally redundant	1	2
	Batteries	cell type/capacity (Ah)	Li-Ion / 24 Ah (4 batteries * 96 Ah) <i>(see comment)</i>	NiH2/16	NiH2/125	Li-Ion / 320 A-hr	Li-ion 18,4 AH	18 cell Li-Ion / 102 A-hr
	Solar Arrays	cell type/Area (m2)	ATJ triple junction solar cell with monolithic diode, 3.2 m2 (see comment)	Triple Junction GaAs, 2.7	ATI GaAs, 16	4-panels, triple junction cells, 14.4 m ² total area	Triple Junction GaAs, 2,1m ²	29% efficient GaAs ZTJ cells, 18 m2
	Main Bus Voltage Range	volts	22-34 (28V nominal)	25-34	25-34	24 - 34	22,4 - 33,6	100V regulated, 31V LV bus
	C&DH Bus Architecture	description	Central processor with RAD750, modular with cPCI and serial 1553 backplane (see comment)	cPCI, 1553, LVDS	cPCI, 1553, LVDS	Distributed C&DH and ACS processors, 1553 bus and serial interfaces	Leon-3 (SPARC), cold-redundant	Rad-750 Central Processor
	Downlink Formats	CCSDS, STDN, etc	CCSDS, STDN (see comment)	SGLS	TDRSS, NASA GN	CCSDS	BPSK	CCSDS, STDN
	Comm Up\Downlink Band	S, X, UHF, Ka, Ku, etc.	S-band (see comment)	L-band/S-band	S-band/S-band	S-Band Command and Telemetry, X-band Science Data Downlink	S-band	CMD/TIm: S-Band, Ku, Ka, C Mission: X-band
	Structure	description	Al (ESPA Ring) (see comment)	Al Honeycomb Octagon	Al Honeycomb Octagon	Cuboid with twin articulated solar array wings	Al Honeycomb panels	Al honeycomb, Carbon fiber. Optical bench option
	Propulsion	type, fuel	Mono-prop (N2H4)	Mono-prop (N2H4)	Mono-prop (N2H4)	Monopropellant (N ₂ H ₄) blowdown system	Mono-prop (green propellant - HPGP)	Bi-Prop pressure-fed hypergolic liquid system, monomethyl
	Propellant Capacity	kg	305 kg hydrazine 4 kg pressurant (see comment)	39.4 nominal, 114 tank capacity	353.5	282	15	2,216
	Max delta V	m/s	800 (see comment)	191 nominal	149	371	120	1610
Programmatic	heritage mission(s)	name(s)	LCROSS	NFIRE, C/NOFS, RHESSI, MightySat II	Fermi, GeoEye-1, Swift, Coriolis	Dawn	Proba missions (Proba-1, Proba-2 and Proba-V) built for the European Space Agency (ESA)	MTSAT-1R, Intelsat 34, SES-5, over 70 others
	nominal schedule	months (ATP to ready for payload I&T)	20	26	28	30.5	21	16
	nominal schedule	months (ATP to launch)	28 (see comment)	39	45	42	29	30
Contract Options	Contract Option #1	description	Eagle-1 (single-string LEO optimized configuration) (see comments obove)	Mission Operations Center	Mission Operations Center			
	Contract Option #2	description	Eagle-2 (dual-string LEO optimized configuration) (see comments above)					
	Contract Option #3	description						
	Contract Option #4	description						
1	Contract Option #5	description						

Table of Catalog Spacecraft - Continued from previous page >>> PLEASE REFER TO CATALOG ADVISORY NOTICE ON PAGE 1

		Contractor >>	SST-US	SST-US	SST-US	SST-US	Thales Alenia France	Thales Alenia Italy
		Spacecraft Name \\	CCT1 450	6771 470 FCD4	C(7) 000	6771 COD		
Compatibility	Parameter	Units	5512-150	5511-150 ESPA	5511-300	5511-000	Etile 1000	PRIMA
	Orbit Average Payload Power (EOL)	W (EOL)	50	160	140	386	1500	1,100
	Maximum Payload Mass	kg	50	65	150	200	352	1,138
	Bus Dry mass (w/o Payload)	kg	103	115	217.7	429	341.5	1,032
	Science Data Downlink	kbps	80 Mbps (X-Band)	2,000	105 Mbps (X-Band)	105 Mbps (X-Band)	8	up to 310
	Science Data Storage (Capacity)	Mbit	16,000	256,000	16,000	128	8 (EDAC protected) + 4 (non protected)	up to 1,200 (EOL)
	Pointing Knowledge	arcsec	25	2,880	72	360	typical : 74 - best : 22	<18
	Pointing Control	arcsec	36	7,200	360	605	360 (down to 55 if Star Tracker accomodated near PL)	< 36
	Pointing Stability (Jitter)	arcsec/sec	1.5	1.5	2	mission-specific	10	<1
	Slew rate	deg / min	1 deg/sec	60	0.75 deg/sec	1 deg/sec	56 up to 70	up to 1*/sec
	Mission Design Life	years	7	7	7	4	12	7
	Compatible LVs	(names)	Falcon 1e, Atlas, Delta, Athena and other launchers	ESPA rideshare on EELV vehicles and SpaceX vehicles	Falcon 1e, Atlas, Delta, Athena and other launchers	Falcon 1e, Atlas, Delta, Athena and other launchers	Falcon 9, Dnepr, Rockot, Soyuz, Atlas V521, Atlas V531, VEGA, Taurus	Soyuz, Delta II,Zenit, Ariane 5, EuRockot, Dnepr, PSLV, Cosmos, Taurus, Falcon-9
	Nominal Orbit	Altitude, Inclination, Type, Other	630km, 99 deg	630 km, 98 deg, Sun Sync	700km, 98.7 deg	23,590km, 56 deg	780 km, 86.4 deg	620 km, 98°, Sun Synch
	Types of Orbits Available	as needed	LEO from 400km to 1,000km, any inclination	LEO: 400 km to 1000km; any inclination	LEO from 400km to 2,000km, any inclination	LEO, MEO, GEO	Inclination from 0° to 180°, altitude from 400 km to 25,000 km	LEO from 0 deg to SSO inclination, up to 1,500 km
	External Payload Volume	meters	730mm x 455mm x 774mm	0.224 x 0.474 x 0.130	730mm x 455mm x 1,000mm	1900mm x 1400mm x 476mm	Height = 0.43m, Length = 3.075m, Width = 1.8m (~2.38 m3)	1.344 m x 1.344 m x 0.7m h (on top floor) 1.344 m x 0.7 m x 3.3 m h (on two lateral panels)
	Internal Payload Volume	meters	279.5mm x 231.5mm x 252.5mm	0.485 x 0.547 x 0.470	279.5mm x 231.5mm x 252.5mm	901mm x 908mm x 260mm	Height = 0.38m, Length = 2.712m, Width = 1.425m (~1.47 m3)	1 bay, 1.23 m3
Description	ACS	type	3-axis control with Reaction wheels and Magnetorquers	3-axis control with Reaction Wheels and Magnetorquers	3-axis control with Reaction wheels and Magnetorquers	3-axis control with gyros and Reaction wheels	3-axis stabilized	3-axis
	Star Trackers	# of STs	1	None, See Options	1	Not baselined	3	2 (able to manage up to 3)
	GPS	# recievers	1	1	2	Not baselined	0	2
	Batteries	cell type/capacity (Ah)	Li-ion/15Ah	28V, 15Ah Li-Ion battery	Li-ion/15Ah	Li-ion/60Ah	Li-lon VES16 / 126 Ah	Li-Ion/up to 340 Ah
	Solar Arrays	cell type/Area (m2)	Triple Junction GaAS, 1.15m ²	GaAs triple junction, e.g. ZTJ 76mm x 37mm, 748 cells used / 2.05 m^2	Triple Junction GaAS, 2.44m ²	Silicon, 6.8m ²	GaAs triple junction cells - 10.8m2	Triple Junction GaAs/18.3 m2
	Main Bus Voltage Range	volts	28V-33V	28 V - 33 V	28V-33V	26.5V-38V	28-38	23-38
	C&DH Bus Architecture	description	CAN Bus	OBC: IBM PPC750FL, HSDR: Reconfigurable FPGA based Data Recorder with embedded PowerPC	CAN Bus	CAN Bus	1553 + SpaceWire	Mil-Std-1553B
	Downlink Formats	CCSDS, STDN, etc	ssn	BPSK, QPSK, 8PSK	SSTL	ssn	CCSDS	CCSDS
	Comm Up\Downlink Band	S, X, UHF, Ka, Ku, etc.	S-Band	S-Band	S-Band	S-Band	Ka-band (any is possible)	S-Band or X Band
	Structure	description	Aluminum/ Aluminium skinned honeycomb panels	Aluminum 6061 & 7075 cuboid; Aluminum 2014 skinned honeycomb panels	Aluminum/ Aluminium skinned honeycomb panels	Aluminum/ Aluminium skinned honeycomb panels	Al bars and Al honeycomb panels Trapezoidal	Al alloys Honeycomb, with CFRP facesheets (for internal items) and Al facesheets (for external panels), square base prism
	Propulsion	type, fuel	Hot gas Xenon Resistojet	None, See Options	Hot gas Xenon Resistojet	Liquified Butane Gas	Mono-prop (N2H4)	Mono-propellant, N2H4
	Propellant Capacity	kg	12	None, See Options	12	66	164	134
	Max delta V	m/s	36	None, See Options	15	91.4	340	150
Programmatic	heritage mission(s)	name(s)	RapidEye, DMC+4, TopSat	CFESat, OTB (2016)	RapidEye, DMC+4, TopSat, NigeriaSAT-2	GIOVE-A	Iridium Next, O3b, GlobalStar2	COSMO FM1, FM2, and FM3, RADARSAT-2
	nominal schedule	months (ATP to ready for payload I&T)	24	24	31	31	21	26
	nominal schedule	months (ATP to launch)	31	30	37	39	30	39
Contract Options	Contract Option #1	description	Enhanced X-Band Transmitter	X-Band Transmitter	Enhanced X-Band Transmitter	High-Speed Data Recorder		Prima-S (Small)
	Contract Option #2	description	X-Band Antenna Pointing Mechanism	Antenna Pointing Mechanism	X-Band Antenna Pointing Mechanism	Enhanced X-Band Transmitter		Prima with Advanced Data Handling
	Contract Option #3	description	Enhanced Small Satellite Reaction Wheel	Enhanced Small Satellite Reaction Wheels	SmallWheel 200SP Reaction Wheel	X-Band Antenna Pointing Mechanism		Prima High Agility Add-on
	Contract Option #4	description	Ground Station Provision	Surrey Satellite Compatibility Ground Station	Ground Station Provision	Ground Station Provision		
	Contract Option #5	description		Star Tracker		SSTL 600 Fine Pointing		
	Contract Option #6	description		Propulsion				