## **History of Rendevous & Proximity Operations in Space**

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We'd like your feedback! Please direct any questions, comments, or corrections to <a href="mailto:bweeden@swfound.org">bweeden@swfound.org</a>

## Overview

The goal of this spreadsheet is to document all rendevous and proxmity operations in space and any orbital debris created by those activities. Criteria for inclusion in this sheet are:

1) Known RPO conducted via commerical, civil, or military entities for non-aggressive purposes 2) Autonomous & robotic interaction between two or more satellites with low relative velocity

RPO activities involving human spaceflight, such as docking to the International Space Station, were not included in this database. A separate spreadsheet with the history of RPO associated with co-orbital anti-satellite testing can be found <a href="https://example.com/here">https://example.com/here</a>.

Information about RPO tests is compiled from a wide variety of public and open sources. Information about cataloged debris objects is primarily derived from the public <u>Space Track</u> website maintained by the U.S. millitary.

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Ì		Category
	Servicing	Satellite servicing, repair and refueling, life extension, debris removal
	Intelligence	Surveillance and intelligence collection
Ī	Military	Military-funded R&D of dual-use capabilities

"Getting in Your Space: Learning from Past Rendezvous and Proximity Operations" - REBECCA REESMAN, ANDREW ROGERS

1	Date of Activity	Client Satellite	Servicer Satellite	Mission Type	Onk	Launch Site	Debris Released	Total Pieces of Cataloged Debris* Created	Total Pieces Cataloged Debris Re-entered	Amount of Debris Still on Orbit	Date of Final Piece Re-entry	Lifespan of Debris (years on orbit or to date)	Notes	Sources	
USA	Apr 14, 2005	MURLCOM	DART	Servicing		Vanderberg AFB	-	0	0	0	-	-	NASA DART bumped into military satelite but did not cause damage or release tracked debris.	http://www.nass.poubdf/98072main_DART_mishap_overview.pdf_	Debris cataloged by the U.S. military, generally pieces to cm in size and larger. Steakups from after 2002 are
USA	Jan 20%	BEVO-2	ApplesSat4	Servicing	LEO	Cape Canaveral	-	0	0	0	-	-	Lonestar mission setting in space navigation capabilities, Gevo-2 deployed from AggleSat4; Pair of satellites deployed from 65 to practice communication and data exchange as well as stationkeeping and navigation.	https://spacefightnow.com/2015/9/20/etias-Scygnus-oa-4-launch-timeline/	likely to have higher number of pieces detected and tracked by the SSN due to the full-power status of Cobra Dane radar.
USA	Jan 25, 2020	Intellus 901	MEV-1	Servicing	660	Rakorur	-	0	0	0	-		MEV-1 successfully docked to provide mission extension services for Intelest 901	table (Troug northeopolyments com hear believes) cochool comments su coest also completes historic first dockling of mission-autemiter which with these self-first selfes 1855 News pace comments statistic servicing spacecraft stanch success had proportional properties.	Note also that these numbers are based on the last updated time as debris may have fragmented again or deborbited
USA	Jun 15-29 2020	Aerocube 10-9	Aerocube 10-A	Servicing	LEO	Wallops	-	0	0	0	-		AC-108 emerced a presimity orbit resound AC-10A with a radius of 30 x 60 meters and used its orbit board camers to take resolved images of AC-10A while orbiting from maximum to minimum range During another close approach, AC-108 was able to take photos from a merce 22 meters away.	Mass literates and angle ficient absents part does consintly operation interesting insolations	
USA	Apr 10, 2021	Inteliant 10-02	MDV-2	Servicing	660	Guiana Space Center	-	0	0	0	-		Launched on August 15, 2020; On April 12, 2021, MEV-2 docked successfully and is conducting close proximity operations on intelests 16-02 spacecraft for servicing. The service will provide another 5 years of life for the 18 year old satellite.	https://spacenews.com/mer-2-envicer-closing-in-on-inteless-15-02-docking-attempt/ mass (Veryal Inteless Commence Commenc	no arramana second-mission-entension-vehicle/
USA	April 2022	LINUSSI	LINUSS2	Servicing	660	Kennedy Space Center	-	0	0	0	-		Cubesats inauched on November for 2022 by Lockheed Martin as part of the Linus experience. They were deployed in the GEO in April 2022, one cubesate performed the role of a servicing vehicle to the other. The mission was used to test various algorithms, SSA cameras and the new		gi.) https://perception.org/sciols/self-64-apace-force-aucrosofishy-completes-first-
Sweden	Aug 2010 - July 2011	PRISMA Target	PRISMA Main	Servicing	LEO	Dombarovskiy Air Rase	-	0	0	0	-	-	Two issunched as a pair and separated; Autonomous guidance and navigation experiements; GPS	https://paper/liphone/Grindson.com/news.html///Sorisma.  Obstallund Source Missions for Entitle System Maniforing Place 6851  Statistical and Source Selections for Entitle System Maniforing Place 6851  Statistical and Selection Selection (1988)	
Japan	Nov 1997	ORHME	нковоян	Servicing	LEO	Raikonur Cosmodrome	-	0	0	0	-		Demonstrated autonmous docking and satellite servicing with onboard mounted robot system	https://hexis.gefc.nass.gov/workshop.2012/0ds_fnal_presentation.2012_workshop.pdf https://dichai.linus.jo/brojects/workshop.ddf	
Japan	March 2021 - May 2022	ELSA-D Client	SLSA-D Servicer	Servicing	LEO	Raikonur Cosmodrome	-	۰		۰			The ELSA-d servicer is designed specifically for debris removal capabilities by Astroscale; Launched on March 22, 2021, ELSA-d magerifically docks with client satellite and demonstrates debris removal capabilities with multiple PPO; On August 26, 2021, ELSA-d successfully conducted a capture test of a client's spacecraft using the server's magerisic capture system.	tatas ibra secula combetenes ino also di mission auces stilly-completes complex condex	ecation!
taly	Sept 3-Oct 28 2020	Multiple	D-Orbit ION	Servicing	LEO	Guiana Space Center	-	0	0		-		Similar to rideshare where ION will rendevous with a satellite and bring it to it's designated orbit faster than normal drifting	https://spacenews.com/d-orbit-demonstrates-ion/ https://spacenews.com/d-orbit-depos-for-in-orbit-transportation-business-with-upcoming-ariansep	co-and-spaces (number)
China	April 27, 2021 (Inunch)	subsatelite	NEO-1	Servicing	LEO	Talyuan Sateliite Launch Center	-	۰	0	۰			NEO-1 will release a small, square, spiral-patterned target and subsequently attempt capture using a net system. The spacecraft will shell leave its costs using onboard electric propulsion. There is no known evidence of whether or not it completed this mission.	State of the control of the con	
China	Dec 2021 - Jan 2022	Beldou-2 G2	ShiJian-21 (SJ-21)	Servicing	660	Xichang Satellite Launch Center	-	۰	۰	0	-	-	Launched on October 24, 2021, classified as a space debris mitigation satellite by Chinese government; On January 27, 2022, it docked with the defunct Chinese statilite Beldou-2 G2 navigation satellite, towed it above the crowded G6D belt, and undocked the satellite in disposal orbit. These capabilities previously have only been demonstrated by the U.S.	Stan / Suprement com/stance/stance 25 seasons of declared with and leaved a stand schools.  Stan / Suprement schools at help for the Port AS of Stance ments (Stance 2011 1) 1993 (St. 2112 Sent) 200 Stant).	NASOCIAMISC Condition of

Country	Date of Test	Target Satellite	Chaser Satellite	Mission Type	Osit	Launch Site	Debris Released	Total Pieces of Cataloged Debric Created	Total Pieces Cataloged Debris Re-extered	Amount of Debris	Date of Final	Lifespan of Debris freezy on orbit or to date	Notes	Sources	Tutal Debris Remaining	Average Lifespan
Lessa.	Jun 2014 - Mar 2016	ROWER	Cosmos 2499	Intelligence	LEO	Plesetsk	Nec, likely due to precurated tank explosion	60	0	60	SSII On Orbit	great an orbit or to date	Cosmos 2899 did series of naneuvers to being it close to, and then away from the Birth Whyper daige, Cosmos 2499 sociobly part of Newtr program used for intelligence & space stuational awareness.	Mana Para Anni Maria Manada Ma	Tro	439
dustia.	Oct 2014 - Feb 2023	Multiple	Luch (Olymp)	Intelligence	660	Rakonur		0		0	-	- 1.55	Luch parked near several satellites over nearly five years including the Russian Sugress AM-6, American Intelsat 7, Intelsat 401, Intelsat 17, Intelsat 20, and Intelsat 50, and French-Italian Attensa Folias satellites	Samuel Minist Franchiston States Complexation Completion France 2020.  Many American Advantación de La Adribido de Note	*Debits cataloged by the I	U.S. military, generally pieces 10 cm in are likely to have higher number of pr
Name of the lead	Apr 2015 - Apr 2017	812-134 R/R	Cosmos 2504	Intelligence	LEO	Plesettik	Nes, source unknown	2	0	7	SSE ON ORDE		Cosmos 25d4 maneuvers to approach the BirD-KM upper stage and may have had a slight impact before separating again; Possibly part of Newtronousian used for immissence & space stautopal awareness.	him hadron and market and a	and tracked by the SSN du	ue to the full-power status of Cobra Di
Russia	Mor - Apr 2017	FYIC Debris	Cosmos 2604	Intelligence	LEO	Piesetsk	-	0			-	-		Migra-Transformi my transformated Migra-Transformi my transformated Migra-Transformi Migra-Transformi Migra-Transformi Migra-Transformi Migra-Transformi Migra-Transformi Migra-Transformi Migra-Transformi Migra-Transformi	Note also that these numb have fragmented again or	ers are based on the last updated to deborbted
Russia	Aug - Oct. 2017	Multiple	Cosmos 2521	Intelligence	LEO	Piesetsk	-			0	-	-	Cosmor, 25/21 separated from Cosmor 25/26 and performed a series of small maneuvers to do inspections before leaduring with Cosmor 25/26 Cosmor 25/26 separated from Cosmor 25/21 but did not maneuver on to own.	ter/monte for channel STATE		
Russia	Mar - Apr 2018	Cosnos 25/9	Comos 2521	Intelligence	LEO	Plesetsk	-	0	0	0	-	_	Cosmos 25/21 conducted close approaches of Cosmos 25/19.	bins inhered Million bens in health our 70 int.		
Russia	Dec 23, 2019	Unknown	Cosmos 2491	Intelligence	LEO	Plesetsk	Nec, likely due to pressurated tank explosion	62	0	52	SSE On Ordet	4.83	Obbit change and Signerstation event was caused by the explosive release of the residual fuel	Man Marie manufacturi anni delektri 1904 Man Marie manifacturi (1904) Marie 192 Million Marie 1934		
Russia	Dec 2019 - Mar 2020	USA 245	Cosmos 2943	Intelligence	LEO	Plesetsk	-	0				-	Cosmo: 2942 deployed an impector outcaseder, Cosmos 2943 mined as onat to come water 30 am or Crait 246 pRO 6941 statelline and established repeated close approaches within 150 km, lively for the purpose of ourveillance, Cosmo 29452 also stade close approaches to USD 246. Possibly part of Newlir program used for intelligence & space situational awareness.	helms in the first three properties of the control		
Russia	AH - Oct 2020	Courses 2535	Cosnos 2543	Intelligence	LEO	Plesettik	-	0	0	0	-	-	Cosmox 2542 rendezvoused with Cosmox 2535 and released a small object at high relative velocity in Sept, Cosmox 2535 paned in the RPO with the other two and may have docked with Cosmox 2535.	Name of the state		
Russia	November 22, 2022	Resurs P2	Cosmos 2662	Intelligence	LEO	Piesetsk	-	0	۰	0	-	-	Recurd P2 was precurined stactive after falled salar panel deployment, but maneuevered to raise its orbit and was their approached by Cosmos 2562 for an RPO.	Miss Transments combinates data shows on odd memoryms by continues addition;	l	
Russia	Mar 2023 - current	Multiple	Luch (Olymp) 2	Intelligence	LEO	Statement		0	0	0	-	-	Euch 2 paixed near several satelities including American WSS F2 and multiple European commercial communications satelities.	https://www.trateschitenee.com/constitution/artisteschischeschieser.in-orbit substitle or san Mass Group Bestatemples, com/orbit MASS		
													Secrets launched from a Space Shuffe misson in 1992. Maneuvered close to multiple Bussian percoundrymous print samilter			
USA	1990-1998	Unknown Russian communications saterilities	Powler	kreeligence	660	Cape Canaveral	-	0	۰	0	-	-	Secrety launched from a space shuttle risision in 1990, Maneuvived close to multiple Musician geocynchronous orbit caretter to collect intelligence but utilized creatiff technologies to retrain undetected.	http://www.electors.com/s0007050/miles.com/som/s/fight amplies for any of any common V 6-50%, 600000 adults mathematic self-75, 3555 despect 000 Olders 2000 6555 - 80000 Microbial as Produced?		
USA	Jan 29, 2003	Deta Uppentage	X85-10	Intelligence	LEO	Cape Canaversi	-	0		0	-	-	Series of RPO maneuvers near the Delta upper stage,	ages influenced of the Parties AD - Sea assembly AD - THE SEA AND		
USA	Apr 2005 - Oct 2006	Minotaur Upperstage	XSS-TI	Intelligence		Vandenberg AFB	-	0	0	0	-	-	Close appoint manuevers and inspection of other satellites; Sponsored by LEMF, possible co-orbital ASAT test/investigation	Management and mentioners of the relation of the control of the Co		
USA	Apr 2006	MURLCOM	DART	Intelligence	LEO	Vandenberg AFR	-	0	0	0	-		DBAT did a series of autonomous maneuvers to bring it close to the MUBILCOM satellite and ended up bumping into it.	bissilven reasonist 1800 bein 1847 miles variound  his illustrationi polyment		
USA	Mar - Jul 2007	NEXTES	ASTRO	Servicing	LEO	Cape Canaversi	-	0	۰	0	-	-	CARPA demonstration of autonomous on-orbit techniques with two sarelities including refueling, Servicing mission; yet, run by the Definise Advanced Research Projects Agency – possible military precursion/application			
USA	Dec 23, 2008 & Jan 1, 2009	099-23	MTE: (USA 167, USA 168)	Intelligence	660	Cape Canaveror	-	0		0	-	-	inspection and close rendevous with a fided US satellite; Possibly other demonstrations and tests in geosynchronous orbit	Management and Control of the Contro		
USA	2009 - 2013	Yahus 18, others unknown	FBN (USA-207)	Intelligence	660	Cape Canaveor	-			0	-	-	Part of NROs Nemess satelities (geostationary COMINT) Presumed to have completed SittleT (signals intelligence) with other satelities, Unique for roaming various times to different critics and satelities.	him-less de pure color ambitich 2005		
USA	2014 - Present	Unknown	CUO (USA 257)	Intelligence	660	Cape Canaversi	-	0	0	0	-	-	Part of NROs Nemesis catelities (geocontonary COMINT) Similar to PBN with classified communications surveillance and outsing between different outsits; Worked on "targeting commercial satelities upsinish" of foreign satelities.	Manufacture objects for the administration of the state o		
USA	Jul 2014 - Present	Various Objects	GSSAP	kroeligence	660	Cape Canaveol	-	0			-	-	RPO demonstrations, using electro-optical sensors to gain intelligence on other satelities; Expected & satelities in total as part of the Homes sense by 2020	Man Company and control of the contr		
USA	Jul 2014 - Nov 2017	Delta Upperstage	ANSELS (USA 255)	Intelligence	660	Cape Canaveral	-	0	0	0	-	-	IPO demonstrations in GSO disposal region, satellite inspection	Managarian de la compansión de la compan		
USA	May 2018	ERGLE (USA 284)	MYCROFT	Intelligence		Cape Canaveral	-	0	•	0	-	-	Mycroft payload deployed from Eagle Susmitte, Mycroft RPO of Eagle in GEO region, satellite impection	Manufacture object for the Additional Manufacture of the Additional Additiona		
USA	Out 2019	55	MYCROFT	Intelligence	_	-	-	0		0	-	-	Mycroft manuevered to rendevous with SS after SS caused communications	Mana Patrick adversarial of the substitution has		
USA	August 2020	SJ-20	USA 271	kronligence	660	Cape Canaveral	-	0		0	-	-	On August 2020, USA 271 approached the PRC's SI-30, shadowing the spacecraft. The Chinese spacecraft detected the U.S. shallow and signify moved away.	Mass Treatment from 2007/15/a white resist test measurement tests such busine securious sectors sectors		
USA	January 2022	Shiyan-13(05) and Shiyan-13(02)	USA 270	kroeligence	660	Cape Canaveral	-	0	۰	0	-	-	In annuary 2022, USA 270-defined near China's Sinyan-12(0) and (22)-catelloss put below the GEO set. The USA 270-got close, pulsed a maneuver and within 2 days, the Sinyan-12 satellites had left the vicinity. The closest approach was around 72 (attorneties).	Management and Alexa delice 27 terms dans and the a bid amount of the		
						Jugual Satelite							861 was degloyed from \$2-7 and proceeded to orbit around the spacecraft; 1861 may have been designed to test in orbit	Manufactures and transfer and ATM annual counts.		
China	Sept 2008	12.7	8001	Intelligence	LEO	Launch Certer	-	0					ejection of "companion" satelites, dual-use on-orbit inspection capabilities, and use of attitude control and propulsion systems for formation flying"	http://www.nitomodis.com/v/downland.ide/		
China	Jun - Aug 2010	suosi	S2-12	irteligence	LEO	Juquar Sateline Launch Center	-	0		0	-	-	SU 12 moved to renderous with SU-DBF and may have bumped it	data di adami and madangana. data di pengunya na handi data di pengunya na pen		
China	Jul 2013 - May 2016	8V7, CK-9	1/5	Intelligence	LEO	Talyuan Satelite Launch Center	-	0		0	-	-	SY 7 released an additional object that it performed maneuvers with and may have had a telesobotic arm. CX-3 performed optical surveillance of other in space objects. SX-55 Demonstrand altitude and inclination changes to approach other characteristics, some space delete observations; in the CZ-505, SX-54 section of this CX-54 demonstrating materials.	Harman Andrews Committee C		
China	Nov 2016 - May 2018	Chinasat SA, Chinasat-20	53-17	Irteligence	660	Wenchang Satelite Launch Gerber	-				-	-	Y2-2 upper case fished to burn to the graveyord orbit and clayed near 66/0. \$3-17 demonstrated maneuversistity around the 66/0 set and crossmanigated Crissaut 64.	Charachardused and insulinantal and a second characteristic and a second characteristi		
China	Jan 19, 2020	T29-3	T29-3 AGM	kreeligence	660	Xicharg Satelite Launch Center	-	0			-	-	T26-2 ASM separated from T26-3 is GSC and both manuevered dightly to stay within close orbits.	Mana Career and American Committee C	1	
China	Jan-August 2020	Chinacat 68, 52-20	\$247	Intelligence	660	Wenchang Satelite Launch Center	-	0		0	-	-	\$1-17 made smaller changes to RPO with Chinasat 68 in January 2020 and, \$1-20, a new Chinese high bandwidth communications usette launched in December 2018, in October 2000	200 Continuous Sect (SET)	1	
China	Nov 2023	VENESAT1	\$J-17	kreeligence	660	Wenchang Satelite Launch Center		0	0	0			SJ-17 made a brief RPO with VENESAS 1, a Vinezuelan communications satelitie built and launched by China in 2008		1	
Chita	Nov 2022 - Feb 2023	Object J	PRC Test Spacecraft 2	Unknown	LEO	Juquar Satelite Launch Certer	-	0	0	0	-		PRC Test Spacecraft 2 (Shentong spaceplane) released Object J and made multiple RPOs, including repeated docking, declarates and formation forms.	Management and their security and related and to the angeles of the best file of the security.		

Country	Date of Test	Date of Test Org Client Servicer Mission Type Launch Site		Notes	Sources						
USA	2022	NASA	CPOD B	CPOD A	Servicing	Cape Canaveral	RPO and inspection mission with pair of cubesats	https://www.nasa.gov/directorates/spacetech/small_spacecraft/cpod_project.html			
USA	Feb 2024	True Anomaly	Jackal-1	Jackal-2	Servicing	tbc	RPO and inspection mission as precursor to commercial service	https://spacenews.com/true-anomaly-to-pursue-military-contracts-for-virtual-live-trainin sech/			
India	2024	ISRO	SPADEX	SPADEX	Servicing	Satish Dhawan Space Centre	Test RPO and robotic arm operations to support future servicing capabilities	https://space.skyrocket.de/doc_sdat/spadex.htm			
UK	2024	Astroscale		ELSA-M	Servicing	tbd	In-orbit demonstration of a removal of a constellation customer satellite	https://astroscale.com/elsa-m/			
Switzerland	2025	ClearSpace SA	Vespa adapter	Clear-Space 1	Servicing	tbd		https://www.esa.int/Space_Safety/ESA_purchases_world- first_dobate_company_microse_from_ctast_up			

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italog Number	Common Name	ernational Designa	Country (Key)	Launch date	Launch site	Decay	Period	Incl.	Apogee	Perigee	RCS
45128	COSMOS 2491 DER *	2013-076A A	crs	41633	PKMTR		100.92	81.21	822	783	SMAL
45129	COSMOS 2491 DEB	2013-076AB	CIS	41633	PKMTR		114.11	82.43	1608	1222	SMAL
45130	COSMOS 2491 DEB	2013-076AC	CIS	41633	PKMTR		113.8	82.46	1540	1262	SMAL
					7.000.710		110.0			1202	
45172	COSMOS 2491 DEB	2013-076AD	CIS	41633	PKMTR		113.99	82.45	1545	1274	SMAI
45173	COSMOS 2491 DEB	2013-076AE	CIS	41633	PKMTR		114.76	82.44	1648	1240	SMAI
47110	COSMOS 2491 DEB	2013-076AF	CIS	41633	PKMTR		114.8	82.46	1539	1354	SMAI
47111	COSMOS 2491 DEB	2013-076AG	CIS	41633	PKMTR		115.27	82.45	1589	1347	SMAI
57546	COSMOS 2491 DEB	2013-076AH	CIS	41633	PKMTR		112.65	82.63	1397	1300	SMA
57547	COSMOS 2491 DEB	2013-076AJ	CIS	41633	PKMTR		115.59	82.46	1555	1409	SMA
57548	COSMOS 2491 DEB	2013-076AK	CIS	41633	PKMTR		117.24	82.82	1595	1518	SMAI
57549	COSMOS 2491 DEB	2013-076AL	CIS	41633	PKMTR		113.54	82.46	1531	1246	SMA
57550	COSMOS 2491 DEB	2013-076AM	CIS	41633	PKMTR		113.59	82.45	1563	1219	SMA
57551	COSMOS 2491 DEB	2013-076AN	CIS	41633	PKMTR		115.71	82.44	1587	1388	SMA
57552	COSMOS 2491 DEB	2013-076AP	CIS	41633	PKMTR		113.76	82.44	1562	1236	SMA
57553	COSMOS 2491 DEB	2013-076AQ	CIS	41633	PKMTR		115.19	82.48	1502	1426	SMA
57554	COSMOS 2491 DEB	2013-076AR	CIS	41633	PKMTR		115.45	82.48	1526	1426	SMA
57555	COSMOS 2491 DEB	2013-076AS	CIS	41633	PKMTR		115.96	82.47	1543	1456	SMA
57556	COSMOS 2491 DEB	2013-076AT	CIS	41633	PKMTR		115.56	82.48	1527	1435	SMA
57557	COSMOS 2491 DEB	2013-076AU	CIS	41633	PKMTR		115.78	82.48	1546	1435	SMA
57558	COSMOS 2491 DEB	2013-076AV	CIS	41633	PKMTR		115.54	82.47	1519	1441	SMA
57559	COSMOS 2491 DEB	2013-076AW	CIS	41633	PKMTR		115.77	82.48	1512	1470	SMA
57560	COSMOS 2491 DEB	2013-076AX	CIS	41633	PKMTR		115.3	82.48	1549	1390	SMA
57561	COSMOS 2491 DEB	2013-076AY	CIS	41633	PKMTR		113.53	82.75	1485	1292	SMA
57562	COSMOS 2491 DEB	2013-076AZ	CIS	41633	PKMTR		112.46	82.6	1344	1334	SMA
57563	COSMOS 2491 DEB	2013-076BA	CIS	41633	PKMTR		114.78	82.48	1542	1349	SMA
57564	COSMOS 2491 DEB	2013-076BB	CIS	41633	PKMTR		115.93	82.48	1513	1483	SMA
57565	COSMOS 2491 DEB	2013-076BC	CIS	41633	PKMTR		116.03	82.49	1517	1487	SMA
57566	COSMOS 2491 DEB	2013-076BD	CIS	41633	PKMTR		113.8	82.47	1558	1244	SMA
57567	COSMOS 2491 DEB	2013-076BE	CIS	41633	PKMTR		114.98	82.47	1555	1354	SMA
57568	COSMOS 2491 DEB	2013-076BF	CIS	41633	PKMTR		114.13	82.47	1497	1335	
57569	COSMOS 2491 DEB	2013-076BG	CIS	41633	PKMTR		115.16	82.47	1549	1376	SMA
57570	COSMOS 2491 DEB	2013-076BH	CIS	41633	PKMTR		115.26	82.46	1569	1365	SMA
39497 44912	COSMOS 2491 COSMOS 2491 DEB	2013-076E 2013-076F	CIS	41633 41633	PKMTR PKMTR		115.8	82.49 82.43	1502 1569	1481	MEDI
44912	COSMOS 2491 DEB	2013-076G	CIS	41633	PKMTR PKMTR		115.78	82.43 82.47	1504	1415	SMA
44913	COSMOS 2491 DEB	2013-076G 2013-076H	CIS	41633	PKMTR PKMTR		113.73	82.42	1504	1244	SMA
44988	COSMOS 2491 DEB	2013-0761	CIS	41633	PKMTR		115.73	82.46	1489	1439	SMA
44988	COSMOS 2491 DEB	2013-076K	CIS	41633	PKMTR PKMTR		115.2	82.46 82.48	1489	1378	MEDI
44989	COSMOS 2491 DEB	2013-076K 2013-076L	CIS	41633	PKMTR PKMTR		114.61	82.48 82.48	1498	13/8	sucDi
44990	COSMOS 2491 DEB	2013-076M	CIS	41633	PKMTR		114.48	82.4	1487	1377	SMA
44992	COSMOS 2491 DEB	2013-076N	CIS	41633	PKMTR	l	115.14	82.47	1555	1368	SMA
44993	COSMOS 2491 DEB	2013-076P	CIS	41633	PKMTR		118.13	82.44	1705	1489	SMA
44994	COSMOS 2491 DEB	2013-0760	CIS	41633	PKMTR		114.15	82.48	1501	1332	SMA
44996	COSMOS 2491 DEB	2013-076R	CIS	41633	PKMTR		115.84	82.48	1502	1485	SMA
44998	COSMOS 2491 DEB	2013-076S	CIS	41633	PKMTR		113.98	82.46	1498	1320	SMA
45030	COSMOS 2491 DEB	2013-076T	CIS	41633	PKMTR		113.96	82.39	1669	1147	SMA
45031	COSMOS 2491 DEB	2013-076U	CIS	41633	PKMTR		114.43	82.44	1531	1328	SMA
45032	COSMOS 2491 DEB	2013-076V	CIS	41633	PKMTR		114.44	82.49	1506	1354	
45033	COSMOS 2491 DEB	2013-076W	CIS	41633	PKMTR		118.14	82.45	1633	1562	SMA
45108	COSMOS 2491 DEB	2013-076X	CIS	41633	PKMTR		117.35	82.49	1611	1513	SMA
45109	COSMOS 2491 DEB	2013-076Y	CIS	41633	PKMTR		117.84	82.43	1694	1474	SMA
45127	COSMOS 2491 DEB	2013-076Z	CIS	41633	PKMTR		114.47	82.45	1531	1332	SMAI

Total Pieces of Cataloged
Debris\* Created
52

Last Updated 30 Jan-24
Updated By Seth Walton

52

Total Piccas Cataloged
Debtis Reviewed

Amount of Debtis
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Catalog Number	Common Name	ernational Designa	Country (Key)	Launch Date	Launch Site	Decay Date	Period	Incl.	Apogee	Perigee	RCS
49943	COSMOS 2499 DEB	2014-028AA	CIS	5/23/2014	PKMTR		111.29	82.52	1506	1066	SMALL
49944	COSMOS 2499 DEB	2014-028AB	CIS	5/23/2014	PKMTR		112.49	82.45	1496	1187	SMALL.
50802	COSMOS 2499 DEB	2014-028AC	CIS	5/23/2014	PKMTR		110.5	82.54	1492	1008	SMALL.
55717	COSMOS 2499 DEB	2014-028AD	CIS	5/23/2014	PKMTR		112.24	82.37	1495	1164	SMALL.
55718	COSMOS 2499 DEB	2014-028AE	CIS	5/23/2014	PKMTR		112.24	82.38	1491	1168	SMALL.
55719	COSMOS 2499 DEB	2014-028AF	CIS	2014-05-23	PKMTR		112.13	82.38	1523	1126	SMALL
55720	COSMOS 2499 DEB	2014-028AG	CIS	5/23/2014	PKMTR		113.22	82.51	1533	1216	SMALL
55721	COSMOS 2499 DEB	2014-028AH	CIS	5/23/2014	PKMTR		112.2	82.94	1505	1151	SMALL
55722	COSMOS 2499 DEB	2014-028AJ	CIS	5/23/2014	PKMTR		112.96	82.35	1503	1222	SMALL
55723	COSMOS 2499 DER	2014-028AK	CIS	5/23/2014	PKMTR		113.28	82.58	1546	1209	SMALL
55724	COSMOS 2499 DEB	2014-028AL	CIS	5/23/2014	PKMTR		107.81	81.88	1358	894	SMALL
55725	COSMOS 2499 DEB	2014-028AM	CIS	5/23/2014	PKMTR		110.87	82.29	1509	1024	SMALL.
55726	COSMOS 2499 DEB	2014-028AN	CIS	5/23/2014	PKMTR		112.26	82.32	1489	1172	SMALL.
55727	COSMOS 2499 DEB	2014-028AP	CIS	5/23/2014	PKMTR		112.58	82.24	1492	1198	SMALL
55728	COSMOS 2499 DEB	2014-028AO	CIS	5/23/2014	PKMTR		112.27	82.35	1478	1184	SMALL.
55729	COSMOS 2499 DEB	2014-028AR	CIS	5/23/2014	PKMTR		112.22	82.45	1508	1149	SMALL
55730	COSMOS 2499 DEB	2014-028AS	CIS	5/23/2014	PKMTR		111.28	82.15	1471	1100	SMALL
55731	COSMOS 2499 DEB	2014-028AT	CIS	5/23/2014	PKMTR		109.93	82.44	1323	1124	SMALL
55732	COSMOS 2499 DEB	2014-028AU	CIS	5/23/2014	PKMTR		112.78	82.32	1472	1237	SMALL
55733	COSMOS 2499 DEB	2014-028AV	CIS	5/23/2014	PKMTR		110.5	82.29	1499	1000	SMALL.
55734	COSMOS 2499 DEB	2014-028AW	CIS	5/23/2014	PKMTR		107.76	82.36	1288	958	SMALL
55735	COSMOS 2499 DEB	2014-028AX	CIS	5/23/2014	PKMTR		111.83	82.42	1434	1188	SMALL
55736	COSMOS 2499 DEB	2014-028AY	CIS	5/23/2014	PKMTR		111.08	82.36	1469	1084	LARGE
56566	COSMOS 2499 DEB	2014-028AZ	CIS	5/23/2014	PKMTR		109.9	82.23	1453	992	SMALL
56567	COSMOS 2499 DEB	2014-028BA	CIS	5/23/2014	PKMTR		113.43	82.63	1566	1201	SMALL
56568	COSMOS 2499 DEB	2014-028BB	CIS	5/23/2014	PKMTR		109.65	82.34	1484	938	SMALL.
56569	COSMOS 2499 DEB	2014-028BC	CIS	5/23/2014	PKMTR		111.34	82.32	1476	1101	SMALL.
56570 56571	COSMOS 2499 DEB COSMOS 2499 DEB	2014-028BD 2014-028BE	CIS	5/23/2014 5/23/2014	PKMTR PKMTR		112.66	82.44 81.99	1447	1250 979	SMALL SMALL
56571	COSMOS 2499 DEB COSMOS 2499 DEB	2014-028BE 2014-028BE		5/23/2014	PKMTR		109.87	81.99	1462	1158	
56572 56573	COSMOS 2499 DEB	2014-028BF 2014-028BG	CIS	5/23/2014	PKMTR	_	109.35	82.03 82.25	1431	894	SMALL SMALL
56574	COSMOS 2499 DEB	2014-028BU 2014-028BH	CIS	5/23/2014	PKMTR		111.76	82.23	1463	1152	SMALL
56575	COSMOS 2499 DEB	2014-028BJ	CIS	5/23/2014	PKMTR		112.41	82.29	1494	1181	SMALL
56576	COSMOS 2499 DEB	2014-028BK	CIS	5/23/2014	PKMTR		112.34	82.4	1557	1112	SMALL.
56577	COSMOS 2499 DEB	2014-028BL	CIS	5/23/2014	PKMTR		111.9	82.32	1460	1168	SMALL
56578	COSMOS 2499 DEB	2014-028BM	CIS	5/23/2014	PKMTR		109.57	82.23	1383	1031	SMALL.
56579	COSMOS 2499 DEB	2014-028BN	CIS	5/23/2014	PKMTR		112.39	82.27	1452	1222	SMALL.
56580	COSMOS 2499 DEB	2014-028BP	CIS	5/23/2014	PKMTR		109.37	82.34	1445	951	SMALL.
56581	COSMOS 2499 DEB	2014-028BQ	CIS	5/23/2014	PKMTR		109.69	82.25	1465	959	SMALL
57759	COSMOS 2499 DEB	2014-028BR	CIS	5/23/2014	PKMTR		110.52	82.27	1454	1047	LARGE
39765	COSMOS 2499	2014-028E	CIS	5/23/2014	PKMTR		112.25	82.45	1508	1152	MEDIUM
49924	COSMOS 2499 DEB	2014-028F	CIS	5/23/2014	PKMTR		111.46	82.5	1506	1081	SMALL.
49925	COSMOS 2499 DEB	2014-028G	CIS	5/23/2014	PKMTR		110.69	82.51	1493	1024	SMALL
49926	COSMOS 2499 DEB	2014-028H	CIS	5/23/2014	PKMTR		111.82	82.4	1584	1037	SMALL.
49927	COSMOS 2499 DEB	2014-028J	CIS	5/23/2014	PKMTR		111.55	82.48	1527	1068	SMALL.
49928	COSMOS 2499 DEB	2014-028K	CIS	5/23/2014	PKMTR		112.48	82.45	1498	1183	SMALL.
49929	COSMOS 2499 DEB	2014-028L	CIS	5/23/2014	PKMTR		111.76	82.54	1529	1086	SMALL
49930 49931	COSMOS 2499 DEB COSMOS 2499 DEB	2014-028M 2014-028N	CIS	5/23/2014 5/23/2014	PKMTR PKMTR		111.88	82.55 82.54	1499	1127	SMALL SMALL
49932 49933	COSMOS 2499 DEB COSMOS 2499 DEB	2014-028P 2014-028Q	CIS	5/23/2014 5/23/2014	PKMTR PKMTR	-	111.62 111.63	82.52 82.55	1560 1520	1042 1084	SMALL SMALL
49933	COSMOS 2499 DEB COSMOS 2499 DEB	2014-028Q 2014-028R	CIS	5/23/2014	PKMTR		110.98	82.55 82.51	1520	1084	SMALL SMALL
49935	COSMOS 2499 DEB COSMOS 2499 DEB	2014-028K 2014-028S	CIS	5/23/2014	PKMTR PKMTR		110.98	82.51 82.52	1507	1091	SMALL SMALL
49935	COSMOS 2499 DEB	2014-0285 2014-028T	CIS	5/23/2014	PKMTR		111.21	82.52	1568	997	SMALL.
49937	COSMOS 2499 DEB	2014-028U	CIS	5/23/2014	PKMTR		111.57	82.49	1571	1027	SMALL.
49938	COSMOS 2499 DEB	2014-028V	CIS	5/23/2014	PKMTR		110.86	82.56	1501	1031	SMALL.
49939	COSMOS 2499 DEB	2014-028W	CIS	5/23/2014	PKMTR		112.02	82.5	1542	1097	SMALL
49940	COSMOS 2499 DEB	2014-028X	CIS	5/23/2014	PKMTR		110.97	82.49	1512	1030	SMALL.
49941	COSMOS 2499 DEB	2014-028Y	CIS	5/23/2014	PKMTR		111.72	82.55	1519	1093	SMALL
49942	COSMOS 2499 DEB	2014-028Z	CIS	5/23/2014	PKMTR		112.33	82.45	1509	1158	SMALL.

Total Pieces of Cataloged Dubris Created Updated By Sin Whaton 60

Total Pieces Cataloged Dubris (Resetted Updated By Sin Whaton 60)

Total Pieces Cataloged Dubris Resetted of Sin Whaton 60 of

Catalog Number	Common Name	International Designator	Country (Key)	Launch Date	Launch Site (Key)	Decay Date	Period	Incl.	Apogee	Perigee	RCS
40556	BREEZE-KM R/B	2015-020E	CIS	2015-03-31	PKMTR		112.45	82.49	1504	1174	LARGE
41718	BREEZE-KM DEB	2015-020F	CIS	3/31/2015	PKMTR		111.52	82.49	1473	1120	SMALL
41719	BREEZE-KM DEB	2015-020G	CIS	3/31/2015	PKMTR		112.93	82.49	1532	1190	SMALL
41720	BREEZE-KM DEB	2015-020H	CIS	3/31/2015	PKMTR		111.55	82.49	1475	1121	SMALL
41721	BREEZE-KM DEB	2015-020J	CIS	3/31/2015	PKMTR		112.97	82.49	1552	1174	SMALL
41722	BREEZE-KM DEB	2015-020K	CIS	3/31/2015	PKMTR		113.34	82.49	1519	1241	SMALL
41723	BREEZE-KM DEB	2015-020L	CIS	3/31/2015	PKMTR		111.42	82.48	1464	1121	SMALL

Date of Final Piece Re-entry Still On Orbit

Lifespan of Debris 6.00

\* Debris cataloged by the U. S. military, generally pleces 10 cm in size and larger. Breakups from after 2003 are likely to have higher number of pleces detected and tracked by the SSN due to the full-power status of Cobra Dane radar.

Note also that these numbers are based on the last updated time as debris may have fragmented again or deborbited