

AN INTRODUCTION TO LAUNCH BROKERAGE

Presentation to:

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Est. 1983

Management & Trading

- Facilitate trade of components from Western companies to Russia
- Management of satellite development projects between Russia and the West (e.g. Kanopus)



Consultancy

- CST began as a general space consultancy
- All fields of technical consultancy (except communications)
- International expertise
- Extensive report library
- Broad client base:
 - Insurance
 - Space agencies
 - Government departments
 - Private industry



Launcher Brokerage

- Representative Moscow office
- Native Russian team
- Specialising in Russian and Ukrainian launch vehicle procurement
- Services include:
 - Launcher selection and price negotiations
 - Contract support (drafting and implementation of MOU, LSA, ICD)
 - Customs and logistics support
 - Fit check support
 - Pre and post launch campaign support

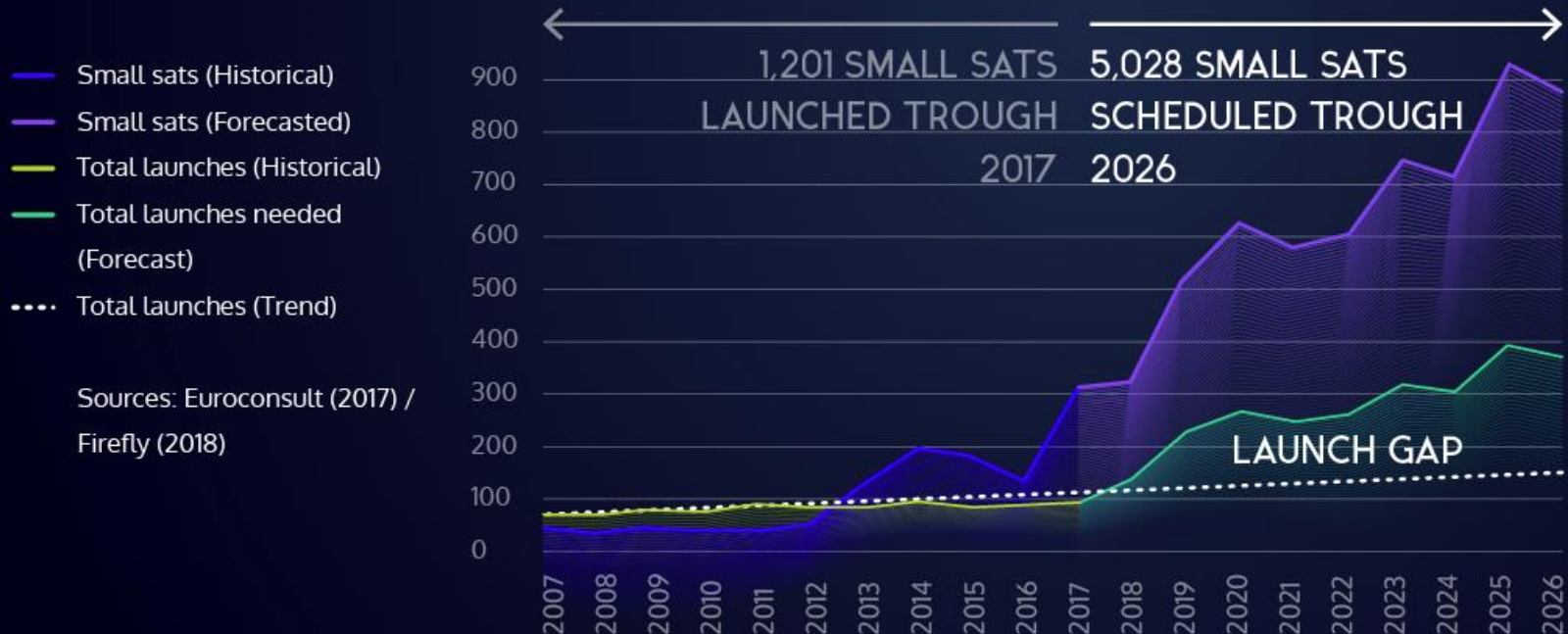




LAUNCH BROKERAGE HISTORY

YEAR	DATE	LAUNCHER (MODE)	SATELLITE(S)
1995	August 31	Tsyklon (1 piggy-back)	Fasat Alpha
1998	July 10	Zenit (2 piggy-back)	Fasat Bravo + TM Sat
1999	April 21	Dnepr (1 dedicated)	Uo Sat 12 (first commercial use of SS-18)
2000	June 28	Cosmos (2 piggy-back)	Tsinghua 1 +Snap (first SSO flight of Cosmos)
2000	September 26	Dnepr (1 piggy-back)	Tiung Sat
2002	November 28	Cosmos (main in cluster)	Alsat-first Disaster Monitoring Constellation (DMC)
2003	September 27	Cosmos (3 in cluster)	NigeriaSat-1, BiSat-1 and UK-DMC (all DMC)
2004	June 29	Dnepr (main in cluster)	Demeter (CNES, first SSO flight of Dnepr)
2005	October 27	Cosmos (3 in cluster)	TopSat, ChinaSat (DMC), SSETI Express+cubesats
2008	August 29	Dnepr (5 in cluster)	RapidEye constellation
2009	July 29	Dnepr (2 in cluster)	UK-DMC2 + DEIMOS-1 (both DMC)
2009	September 17	Soyuz/Fregat (1 piggy-back)	SumbandilaSat (South Africa, first piggy-back from this launcher combination)
2010	June 15	Dnepr (1 of a pair)	Picard (CNES, paired with Prisma)
2011	August 17	Dnepr (2 in cluster)	NigeriaSat-2 and NigeriaSat-X
2012	July 22	Soyuz/Fregat (1 piggy back)	ADS-1B
2014	June 19	Dnepr (1 in cluster)	KazEOSat-2
2014	July 8	Soyuz/ Fregat (2 piggy back)	TechDemoSat-1 (TDS-1), UKube-1
2017	July 14	Soyuz/ Fregat (48 CubeSats)	Flock 2K

LAUNCH DEMAND VS SMALL SATELLITE DEMAND



New Demand

- Cubesats - commercial and educational
- Megaconstellations – OneWeb, SpaceX, IoT, etc.

Focus on value over low-cost

Rideshare

- Comparatively low-cost:
 - Underwritten development (defence, ex-govs, national progs)
 - Comparatively low labour rates
 - Shared management costs
 - Otherwise wasted capacity
- Restrictions on schedule and orbit

UPCOMING LAUNCHERS

There are over 100 small LVs under development



ARCHER 1
MiG-29UB
Maximum speed: Mach 2.2
Operational ceiling: 20 Km



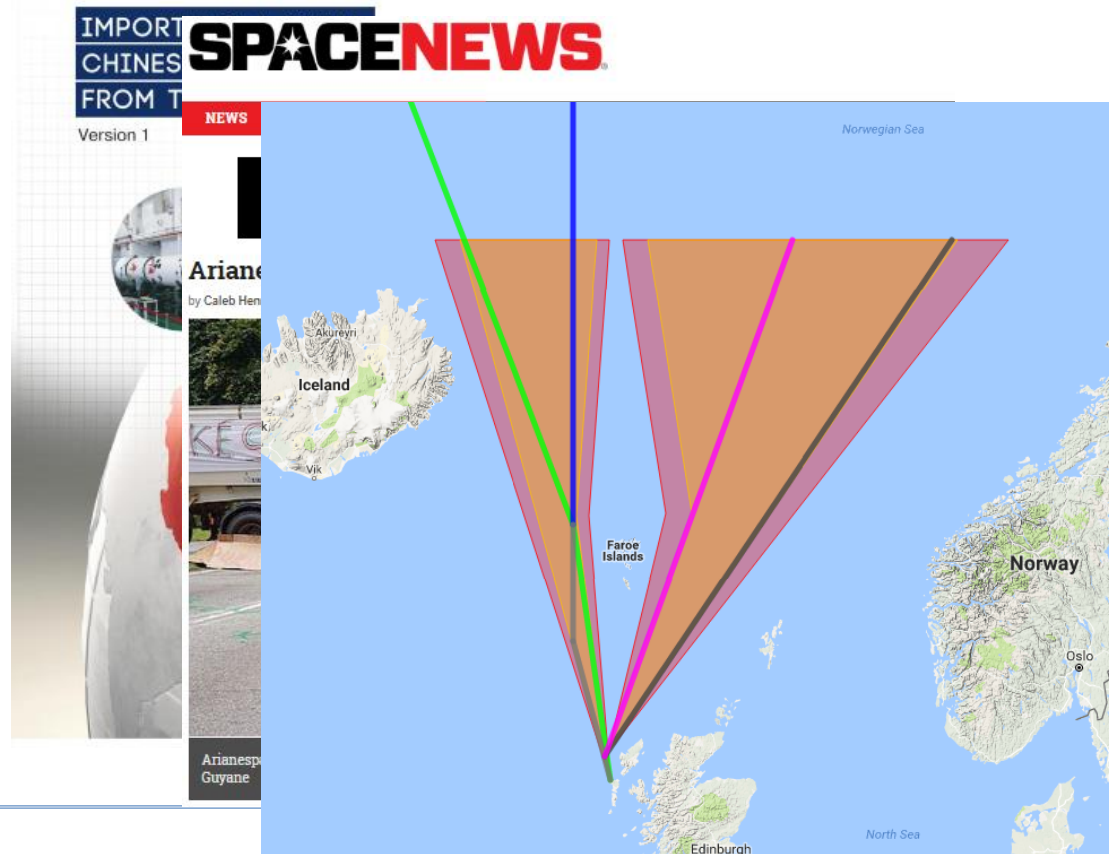
LAUNCH VEHICLE RESTRICTIONS

- Export Restrictions
 - International Traffic in Arms Regulations (ITAR) – China
 - Missile Technology Control Regime (MTCR) – China
- Geopolitics
 - Russia Ukraine conflict – Dnepr, Zenit
 - Israeli Shavit launcher
 - Civil unrest Kourou
- Technical restrictions
 - Restricted inclinations
 - Schedule restrictions – Japanese fishing



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WHY USE A LAUNCH BROKER

What Does This Mean?

Preferable launch rates (greatly improves with satellite size)

- Launch providers save money working through brokers
- Sharing launch costs across multiple customers

Cost saving

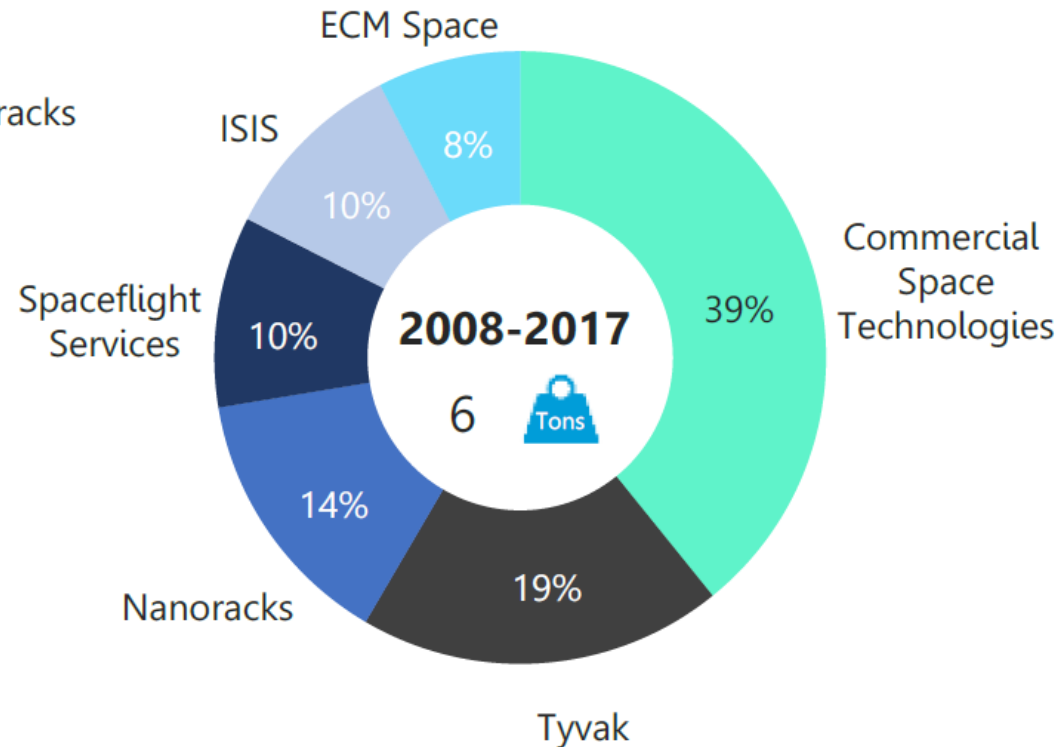
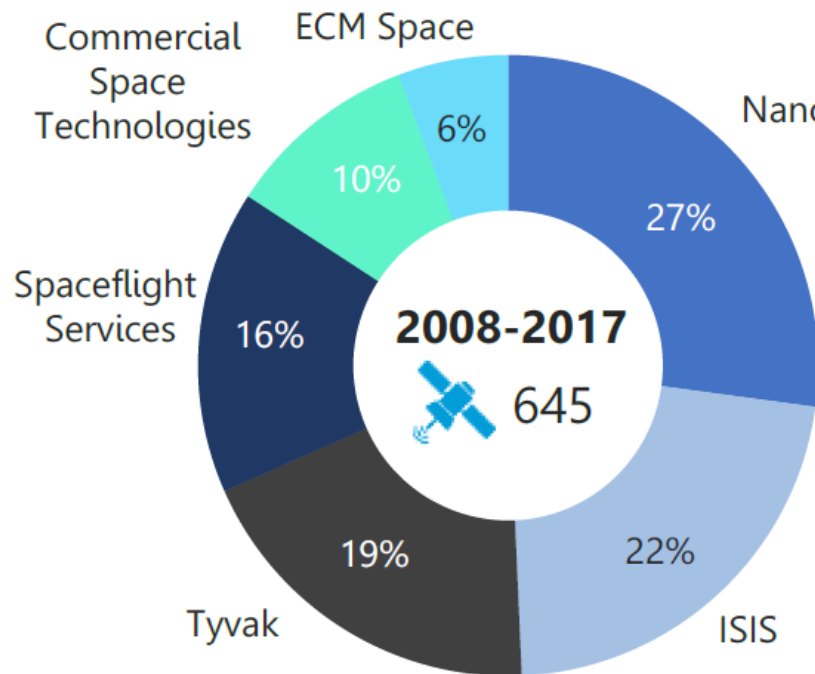
- Time saved researching launch options
- Time saved in negotiations
- Less in-house expertise (licencing, contract construction, integration, etc.)
- Time saved in export and logistics

Risk mitigation

- Experience on what can go wrong as well as right



BROKER COMPARISON



Market shares of launch brokers (2008 – 2017) – Euroconsult 2018



THE CST EXAMPLE

Stage 1 – 20% - Location of suitable launch options, preliminary price negotiations, report to customer, signing of CST contract (represents up-front cost)

Stage 2 – 35% - Construction of Launch Services Agreement (LSA), which represents the master contract dictating the conditions of collaboration between the spacecraft customer and launch provider

Stage 3 – 30% - Management of LSA through to Interface Control Documentation (ICD), Fit Check and other meetings

Stage 4 – 15% - Management of launch campaign up to integration of payload with launcher, launch and return of EGSE after the launch campaign

- Daily rate after Stage 4 completion to end of campaign
- Expenses (e.g. travel to customer) agreed and modest
- Historically, Stages 1 & 2 have saved customer more than CST fees

Note: Contract can be abandoned after Stage 1 if no launch is found



BROKERAGE STYLES

Spaceflight

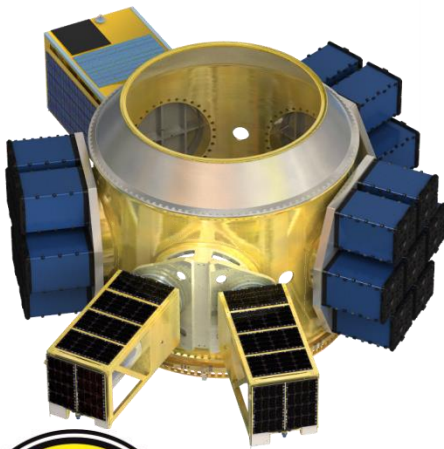
- Research launch options
- Licensing support
- Price negotiations
- Insurance support
- Integration
- Logistics

ISIS

- Research launch options
- Deployer aggregation
- Price negotiation
- Integration

CST

- Research launch options
- Price negotiation
- Insurance support
- Contract construction and execution
- Full Representation
- Export and Logistics



DETAIL	CONTAINERIZED			SATELLITE CLASS							
PAYLOAD TYPE	3U	6U	12U	50kg	100kg	150kg	200kg	300kg	450kg	750kg	1000kg
LENGTH (CM)	34.05	34.05	34.05	80	100	100	100	125	150	200	350
HEIGHT/DIA (CM)	10	10	22.63	40	50	60	80	100	150	200	200
WIDTH (CM)	10	22.63	22.63	40	50	60	80	100			
MASS (KG)	5	10	20	50	100	150	200	300	450	750	1000
PRICE-LEO	\$295	\$595	\$1,195	\$1,750	\$3,950	\$4,950	\$5,950	\$7,950	\$17,500	\$22,000	\$28,000
PRICE-GTO	\$915	\$1,400	\$2,750	\$4,600	\$8,400	\$9,800	\$11,200	\$14,000	CALL	CALL	CALL

Prices are in thousands (USD)

Launch costs don't scale with satellite size!



IN CONCLUSION

- Small Satellite market on the rise
- Launch demand is growing and evolving
- Pressure on launch providers to move with the times
- Launch challenges always evolving
- Demand for brokers also evolving
- Symbiosis between brokers and launch providers strengthening

