



18th Space Control Squadron



This Briefing is UNCLASSIFIED



Small Satellite Support

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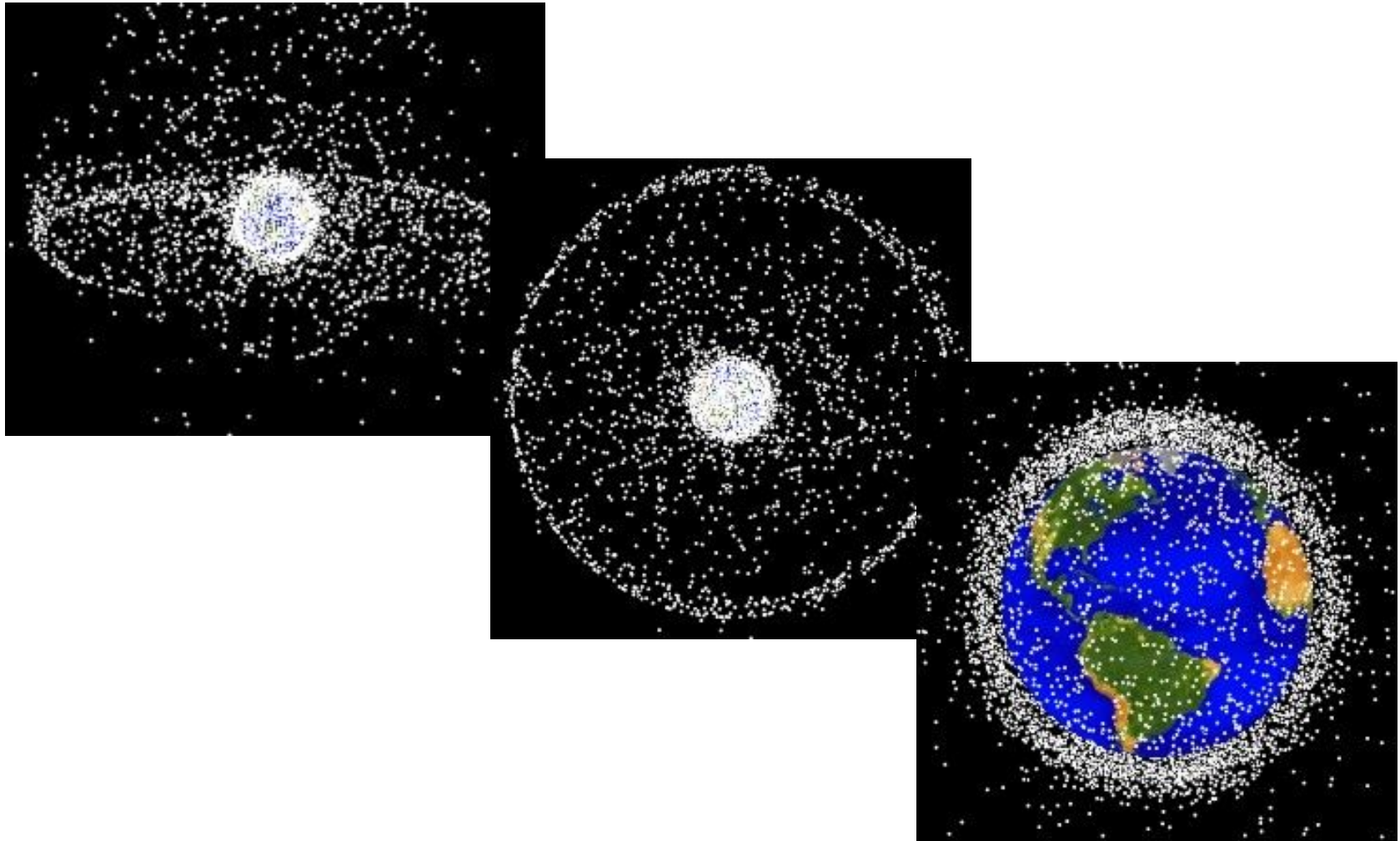
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- Who We Are, What We Do, What We Share
- CubeSat Coordination
 - Finding you
 - Identifying your satellite
 - www.Space-Track.org
- How YOU Can Help

www.Space-Track.org
18SPCS.doo.customerservice@us.af.mil

Space Junk





18th Space Control Squadron Mission

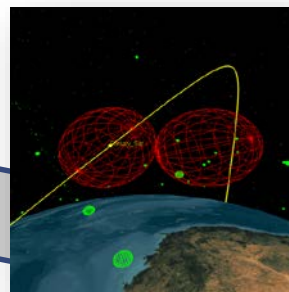
TRACK

- Space Surveillance Network (300,000+ observations/day)
- Sensors deployed across the globe & in space
- Satellite Catalog maintenance



DETECT

- Launch Screening (Conjunction Assessment & Collision Avoidance)
- Early Orbit Determination



IDENTIFY

- On-orbit Conjunction Assessment & Collision Avoidance
- Deorbit & Reentry Assessment
- Spacecraft End of Life/Disposal
- Breakup Processing
- Advanced/Specialized Analysis



ENGAGEMENT & SUPPORT

- Human Spaceflight Safety: including the International Space Station
- U.S. Interagency & Allies
- SSA Sharing Agreement Holders
- Small Satellite Owners
- *Space-Track.org* Users



Satellite Lifetime Support

Early Engagement



Launch COLA



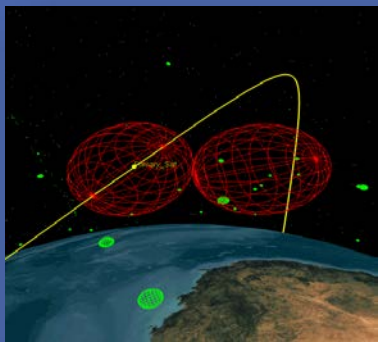
Launch Support



Early Orbit CA



On-Orbit CA & COLA



End-of-Life /Disposal



Deorbit



Reentry





Satellite Catalog on www.space-track.org

NORAD CAT ID	SATNAME	INTLDES	TYPE	COUNTRY	LAUNCH	SITE	DECAY	PERIOD	INCL	APOGEE	PERIGEE	RCS	TLE
1	SL-1 R/B	1957-001A	ROCKET BODY	CIS	1957-10-04	TTMTR	1957-12-01	96.19	65.10	938	214	LARGE	TLE OMM
2	SPUTNIK 1	1957-001B	PAYLOAD	CIS	1957-10-04	TTMTR	1958-01-03	96.10	65.00	945	227		TLE OMM
3	SPUTNIK 2	1957-002A	PAYLOAD	CIS	1957-11-03	TTMTR	1958-04-14	103.74	65.33	1659	211	SMALL	TLE OMM
4	EXPLORER 1	1958-001A	PAYLOAD	US	1958-02-01	AFETR	1970-03-31	88.48	33.15	215	183		TLE OMM
5	VANGUARD 1	1958-002B	PAYLOAD	US	1958-03-17	AFETR		132.75	34.24	3829	655	MEDIUM	TLE OMM
6	EXPLORER 3	1958-003A	PAYLOAD	US	1958-03-26	AFETR	1958-06-28	103.60	33.50	1739	117		TLE OMM
7	SL-1 R/B	1958-004A	ROCKET BODY	CIS	1958-05-15	TTMTR	1958-12-03	102.74	65.14	1571	206		TLE OMM
8	SPUTNIK 3	1958-004B	PAYLOAD	CIS	1958-05-15	TTMTR	1960-04-06	88.43	65.06	255	139	LARGE	TLE OMM

NORAD CAT ID	SATNAME	INTLDES	TYPE	COUNTRY	LAUNCH	SITE	DECAY	PERIOD	INCL	APOGEE	PERIGEE	RCS	TLE
43783	KAZSTSAT	2018-099AB	PAYLOAD	KAZ	2018-12-03	AFWTR		96.41	97.76	594	580	MEDIUM	TLE OMM
43784	SNUGLITE	2018-099AC	PAYLOAD	SKOR	2018-12-03	AFWTR		96.31	97.74	593	570	SMALL	TLE OMM
43785	ORBWEAVER 2	2018-099AD	PAYLOAD	US	2018-12-03	AFWTR		96.30	97.74	592	571	MEDIUM	TLE OMM
43786	OBJECT AE	2018-099AE	TBA	TBD	2018-12-03	AFWTR		96.31	97.74	593	570	MEDIUM	TLE OMM
43787	KAZSCISAT-1	2018-099AF	PAYLOAD	KAZ	2018-12-03	AFWTR		96.30	97.73	592	571	SMALL	TLE OMM
43788	FLOCK 3S 3	2018-099AG	PAYLOAD	US	2018-12-03	AFWTR		96.31	97.74	593	570	MEDIUM	TLE OMM
43789	OBJECT AH	2018-099AH	TBA	TBD	2018-12-03	AFWTR		96.28	97.74	593	568	SMALL	TLE OMM
43790	EAGLET 1	2018-099AJ	PAYLOAD	IT	2018-12-03	AFWTR		96.29	97.74	591	570	SMALL	TLE OMM
43791	CAPELLA-1	2018-099AK	PAYLOAD	US	2018-12-03	AFWTR		96.24	97.75	588	568	LARGE	TLE OMM
43792	ESEO	2018-099AL	PAYLOAD	ESA	2018-12-03	AFWTR		96.29	97.74	591	571	MEDIUM	TLE OMM



Conjunction Assessment Services (No Cost)

- Conjunction Assessment
 - We screen all active payloads (about 2,000) against everything out there (satellites, rocket bodies, debris – roughly 25,000 pieces)
 - If we have contact information for a satellite owner/operator, we provide conjunction assessment information to them automatically
 - If your satellite's involved, we'll tell you!
- We create more than 20,000 “Conjunction Data Messages” daily
- If it's really close, we'll call you – wherever you are (rare)
- Space Situational Awareness Sharing (SSA Sharing): why is the U.S. military doing this? Because when you're safer, we're safer!

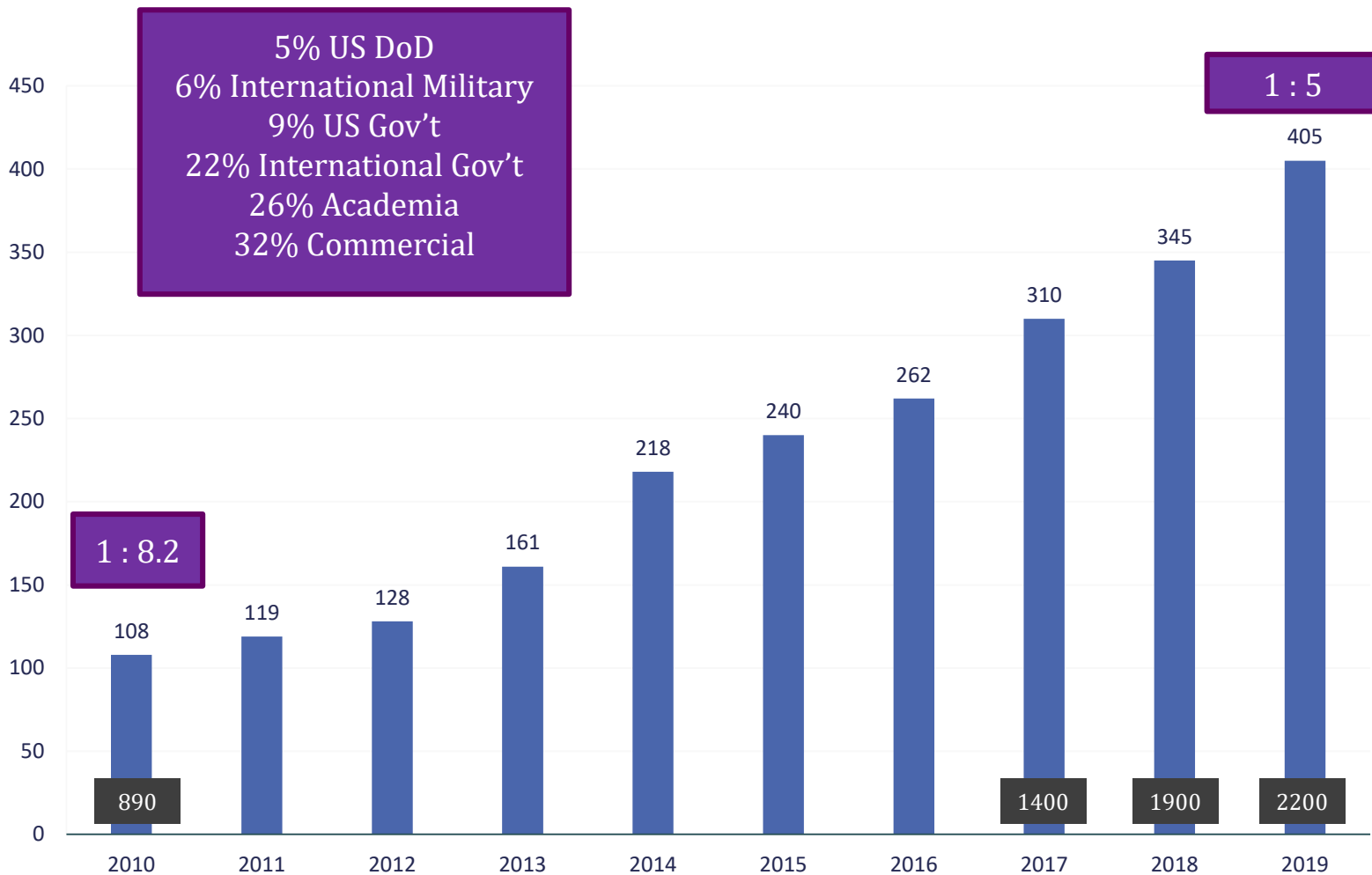


Space Situational Awareness Sharing

- Basic services are available to any person or organization with an account on www.space-track.org
- What we can do:
 - Provide high accuracy data and support at no cost
 - Facilitate communication and cooperation
- What we can't do:
 - Recommend courses of action
 - Tell an operator what to do
- Having “public” contact info in Space-Track allows easy coordination with other satellites owner/operators
- It's all at no cost



Satellites & Organizations We Support



■ Unique Organizations Receiving Spaceflight Safety Support



Advanced Services

- Beyond the basic TLEs and conjunction assessment, more advanced services can be requested. For example, historic data pulls, or increased screening volumes
- If it's a one-time request, you can submit an "Orbital Data Request" (available on Space-Track.org)
- If you're interested in long-term advanced support, consider getting an "SSA Sharing Agreement" with the U.S. Space Command (we can introduce you to the right people)
- It's still all at no cost





Working with SmallSat Owners

- Register on www.Space-Track.org
 - Fill out the (easy, one page) small satellite registration form
 - Available on the Space-Track HELP/SSA SHARING page (<https://www.space-track.org/documentation#/odr>)
- Contact us at 18SPCS.doo.customerservice@us.af.mil
 - Let us know about your launch and your satellite
 - Provide contact information for your operators
 - We'll set up an organization account and link the appropriate people to it
 - We'll work with you to identify your satellite after launch
 - Once your satellite is identified, it will also be linked to your account
- Once on orbit, we'll track your satellite (if we can) and provide orbital info (TLEs) daily
- We'll alert you if any other object gets close to your satellite (Conjunction Assessment)

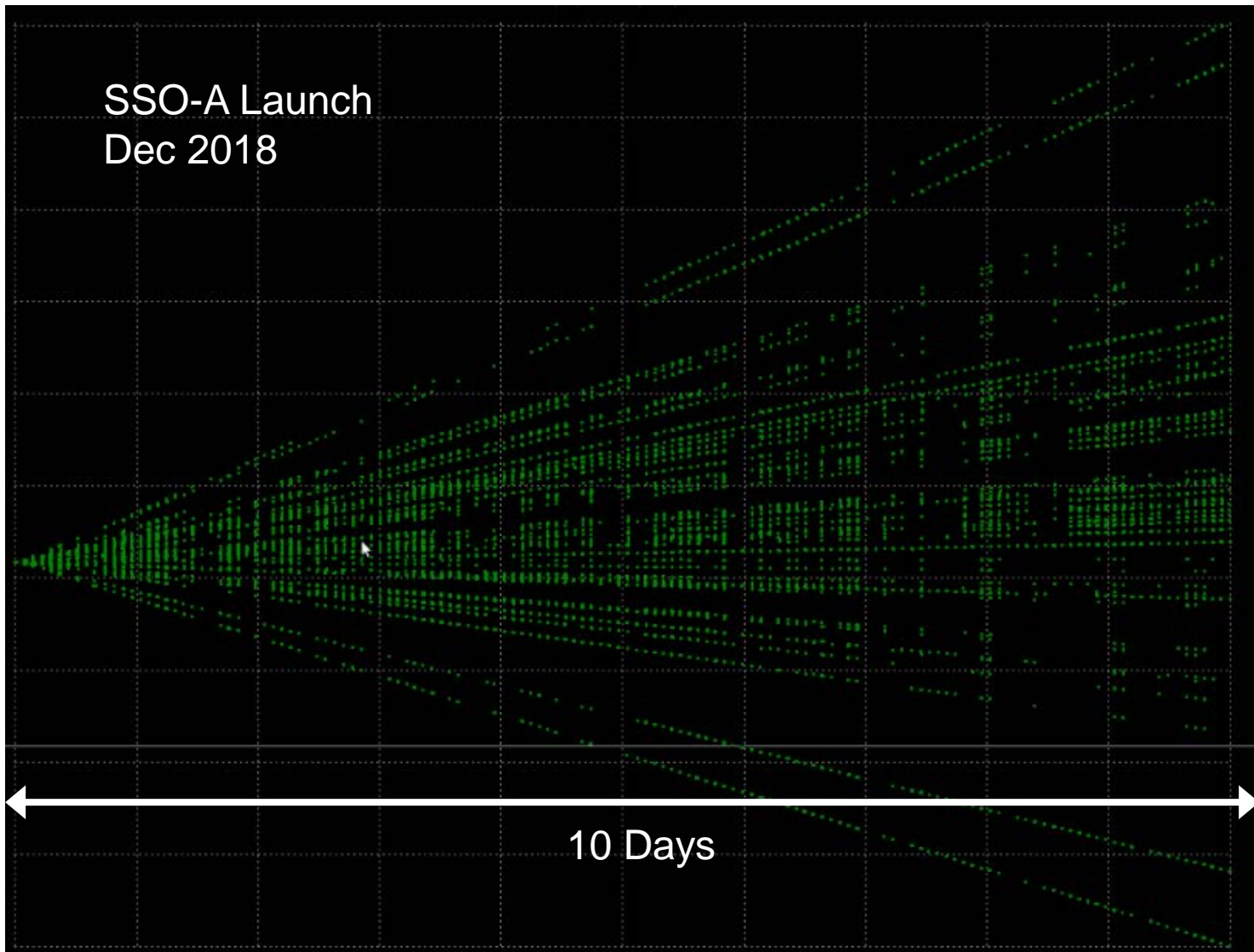


Multi-Payload Launch Coordination

- TLEs are published in the public catalog when we have enough tracking data and the TLEs are judged to be good enough quality
 - At first, they'll be named OBJECT A, OBJECT B, etc.
- We rely on you, the small satellite owner, to tell us which object is your satellite
 - Better signal equals more likely match
 - We can only accept identifications from the owners
- Be patient! For single satellite launches, we'll have it catalogued within a day or two, but multi-payload launches can take days



Identifying Your Satellite After Launch

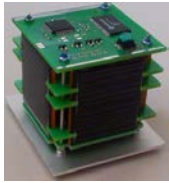




How Can You Help?

- Register on www.space-track.org, find the satellite registration form, and contact us: 18SPCS.doo.customerservice@us.af.mil
- Mission Design
 - Consider human life: below the ISS is safer
 - Have an independent means of identification (beacon, GPS, ...)
 - Higher inclination orbits are better tracked
 - Is it big enough to be seen for tracking? (>1U in LEO is optimal; check with us if you're not sure)
 - Remove from orbit as soon as possible after its mission is complete
- On Orbit
 - Help us identify your satellite after launch
 - If you've got propulsion, let us know
 - Let us know when your satellite has reached the end of its mission

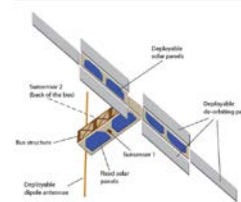
What About PocketQubes?



1p (5 cm³)

WREN:

Launched in 2013, not tracked since 2014



2.5 p (5 x 5 x 12.5 cm)

QUBESCOUT-S1:

Launched in 2013, still being tracked

- Larger PocketQubes with large solar panels should be fine (as long as the big side faces Earth often – and the panels are well attached and don't go flying off)
- What may not be helpful
 - Reflective surface: would have to be tuned to a specific radar's frequency. Data from only one tracking site does not make good orbits
 - Space Fence: coming on line (probably) spring 2020. Open sources report detection down to 2 cm (we'll see), but again only one source of data points



If you're launching in the next few months, or if you have any questions, we'd be happy to talk with you!

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And don't forget www.Space-Track.org