



Sharing Space Situational Awareness (SSA)

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A New National Space Policy

Principle: “It is in the shared interest of all nations to act responsibly in space to help prevent mishaps, misperceptions, and mistrust. The US considers the sustainability, stability and free access to, and use of, space vital to its national interests”

Goal: “Strengthen stability in space through ... improved information collection and sharing for space object collision avoidance”

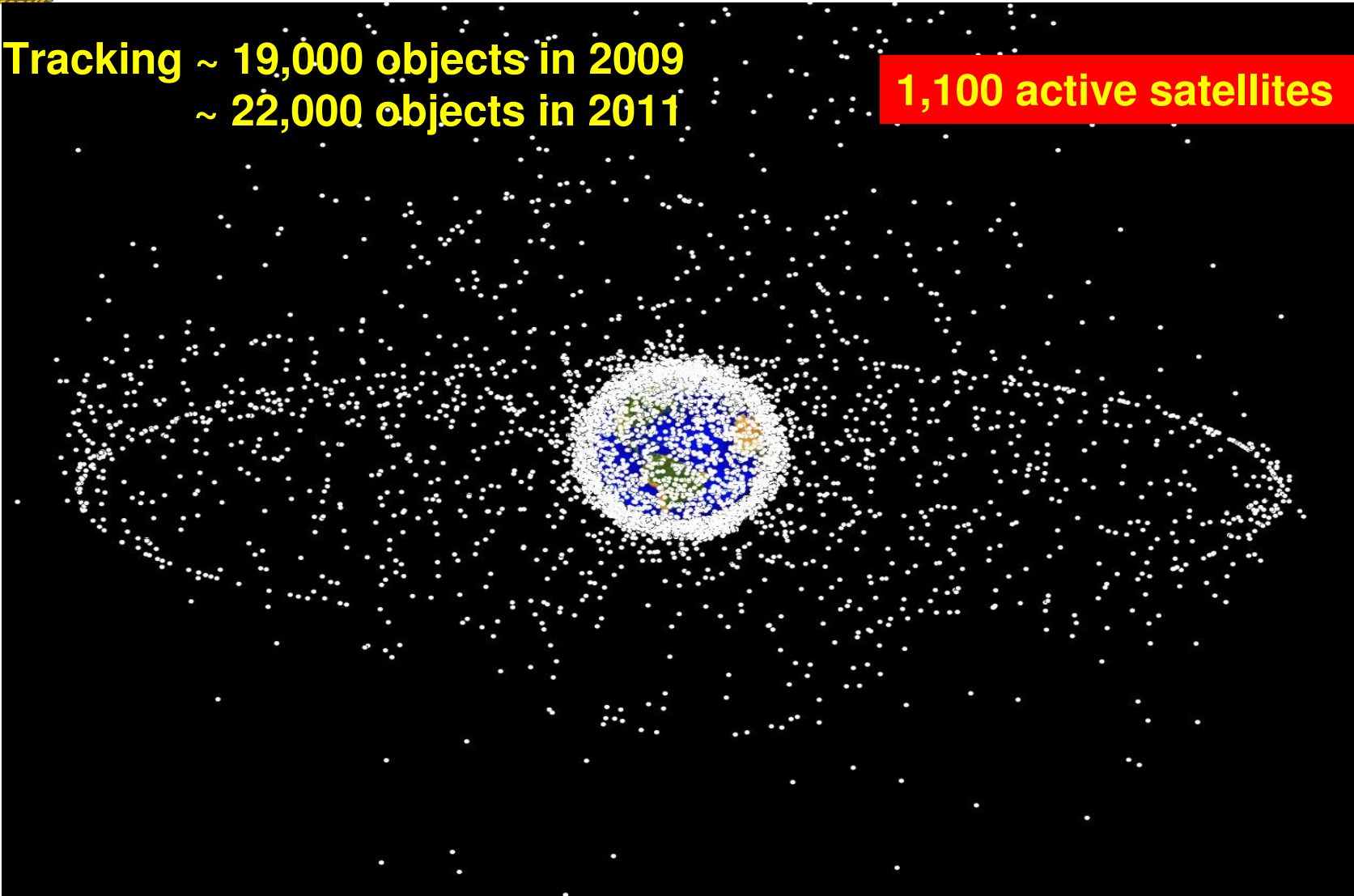
- “Identify potential areas for international cooperation that may include ... space surveillance for debris monitoring and awareness”
- “Collaborate with industry and foreign nations to: maintain and improve space object databases; pursue common international data standards and data integrity measures; and provide services and disseminate orbital tracking information to commercial and international entities, including predictions of space object conjunction”



A Global Focus

Tracking ~ 19,000 objects in 2009
~ 22,000 objects in 2011

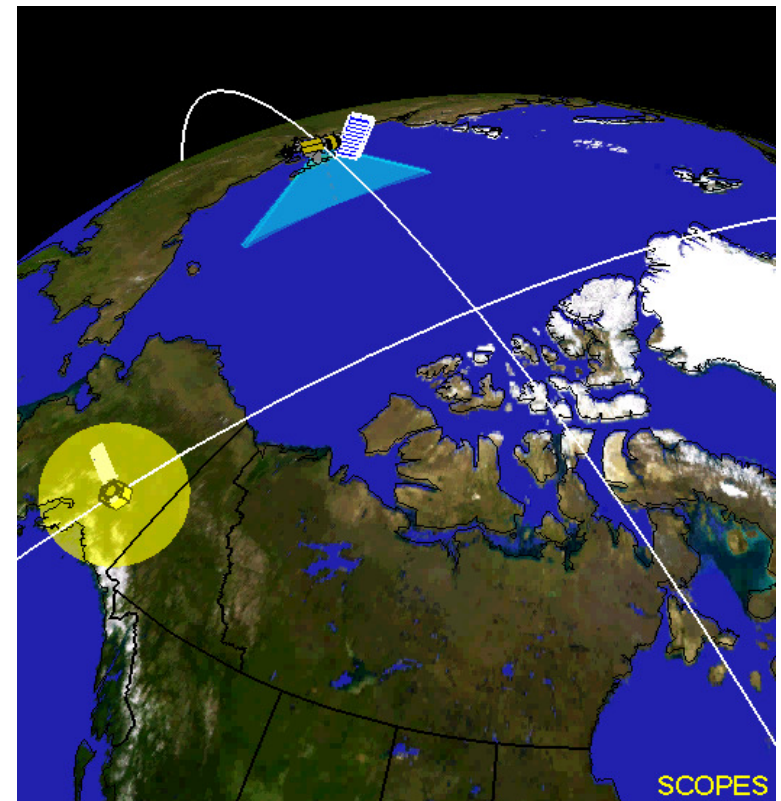
1,100 active satellites





SSA Sharing

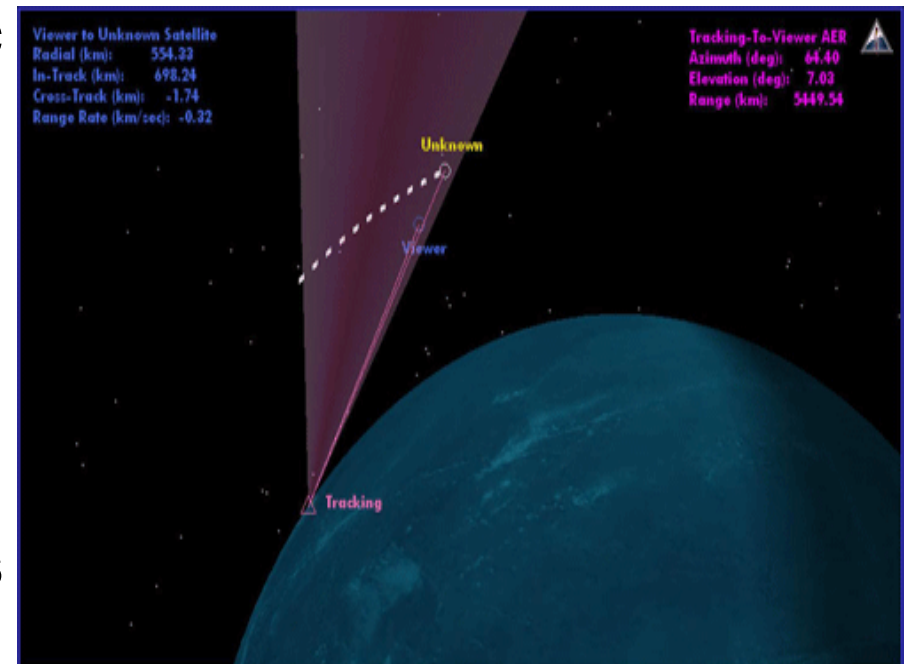
- **Goals**
 - Create transparency of satellite information
 - Promote space flight cooperation and safety
- **SSA Services provides:**
 - Basic Services Website
 - Advanced Services
 - Emergency Notifications





Basic Services - Website

- www.space-track.org
- Maintained by U.S. Strategic Command
- Historical and current satellite data
- Decay and re-entry data
- Support request procedures
- Free of charge





Advanced Services

- **U.S. law requires SSA agreement in place**
- **Two-way information exchange**
- **Mutual terminology, data formats, and units**
- **Mitigate collision risks**





Emergency Notifications

- **Joint Space Operations Center analyzes catalog for close approaches**
- **20 – 30 close approach notifications per day**
- **E-mails direct to satellite operator**





E-mail Alert (Sample)

The Joint Space Operations Center (JSpOC) identified a predicted conjunction between SATELLITE A (SCC# 12345) and SATELLITE B (SCC# 12346).

Primary Object: SATELLITE A (SCC# 12345)

Secondary Object: SATELLITE B (SCC# 12345)

Time of Closest Approach: 12 JUL 2020 11:33 UTC

Overall miss distance: 522 meters

Radial (dU) miss distance: 121 meters

In-Track (dV) miss distance: 37 meters

Cross-track (dW) miss distance: 537 meters

Primary Radial Error (U): 12 meters

Primary In-track Error (V): 90 meters

Primary Cross-track Error (W): 13 meters

Secondary Radial Error (U): 145 meters

Secondary In-track Error (V): 1021 meters

Secondary Cross-track Error (W): 91 meters



Conjunction Summary Message (sample)

CONJUNCTION SUMMARY MESSAGE FOR: SATELLITE A

MESSAGE CREATION TIME: 2020 171 (12 JUN) 22:31:12.000 CENTER: JSPOC
MESSAGE VERSION: V2.0

RELATIVE DATA:

TIME OF CLOSEST APPROACH (UTC): 2020 172 (13 JUN) 22:37:52.618
MISS DISTANCE (M): 715
RELATIVE SPEED (M/S): 14762
CLOSEST APP. REL. POSITION (M): 27.4 -70.2 711.8
CLOSEST APP. REL. VELOCITY (M/S): -7.2 -14692.0 -1437.2

ASSET: 12345 INT. DES.: 1917-010A

COMMON NAME: SATELLITE A
TIME OF LAST ACCEPTED OB: <24 HOURS FROM MESSAGE CREATION TIME
LUPI/DC SPAN USED (DAYS): 7.88/ 5.50 RESIDUAL ACCPT: 97.8 %
NUM OBS AVAIL/USED: 592/ 418
APOGEE (KM): 779 PERIGEE (KM): 765 INCLINATION (DEG): 86.4
RADAR CROSS SECTION (SCALED): LARGE (>1m sq) WEIGHTED RMS: 0.864
BALLISTIC COEFFICIENT (M2/KG): 0.045663
SOLAR RADIATION PRESSURE COEFFICIENT (M2/KG): 0.000000
ENERGY DISSIPATION RATE (W/KG): 4.54570E-05
GEOPOTENTIAL: EGM-96 36Z,36T DRAG: JACCHIA70DCA LUNAR/SOLAR: ON
SOLAR RAD PRESS: OFF SOLID EARTH TIDES: OFF IN-TRACK THRUST: OFF

ASSET TDR POSITION (M): 2570098.594 2244663.456 6281494.300
ASSET TDR VELOCITY (M/S): 4418.768701 4833.542969 -3526.781960

CONJUNCTING SATELLITE: 12345 INT. DES.: 1917-010B
COMMON NAME: SATELLITE B
TIME OF LAST ACCEPTED OB: <24 HOURS FROM MESSAGE CREATION TIME
LUPI/DC SPAN USED (DAYS): 2.63/ 2.63 RESIDUAL ACCPT: 97.8 %
NUM OBS AVAIL/USED: 59/ 58
APOGEE (KM): 786 PERIGEE (KM): 414 INCLINATION (DEG): 98.8
RADAR CROSS SECTION (SCALED): SMALL (<0.1m sq) WEIGHTED RMS: 0.864
BALLISTIC COEFFICIENT (M2/KG): 0.118668
SOLAR RADIATION PRESSURE COEFFICIENT (M2/KG): 0.075204
ENERGY DISSIPATION RATE (W/KG): 5.40900E-03
GEOPOTENTIAL: EGM-96 36Z,36T DRAG: JACCHIA70DCA LUNAR/SOLAR: ON
SOLAR RAD PRESS: ON SOLID EARTH TIDES: OFF IN-TRACK THRUST: OFF

SAT. TDR POSITION (M): 2569542.299 2245102.187 6281596.315
SAT. TDR VELOCITY (M/S): -2888.611701 -6007.242986 3328.778993

ASSET COVARIANCE: (1,1) TO (6,6) (M^2, M^2/S, M^2/S^2)

U	V	W	UD	VD	WD
4.142E+01	-8.579E+00	-2.312E+01	0.000E+00	0.000E+00	0.000E+00
-8.579E+00	2.533E+03	1.336E+01	0.000E+00	0.000E+00	0.000E+00
-2.312E+01	1.336E+01	7.098E+01	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

SAT. COVARIANCE: (1,1) TO (6,6) (M^2, M^2/S, M^2/S^2)

U	V	W	UD	VD	WD
1.337E+03	-4.806E+04	-3.298E+01	0.000E+00	0.000E+00	0.000E+00
-4.806E+04	2.492E+06	-7.588E+02	0.000E+00	0.000E+00	0.000E+00
-3.298E+01	-7.588E+02	7.105E+01	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

ASSET COVARIANCE (7,1) TO (8,8) (M^3/KG, M^3/KG-S, M^4/KG^2)

(7,1)	(7,2)	(7,3)	(7,4)	(7,5)	(7,6)
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
(7,7)	(7,8)				
0.000E+00	0.000E+00				
(8,1)	(8,2)	(8,3)	(8,4)	(8,5)	(8,6)
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
(8,7)	(8,8)				
0.000E+00	0.000E+00				

SAT. COVARIANCE (7,1) TO (8,8) (M^3/KG, M^3/KG-S, M^4/KG^2)

(7,1)	(7,2)	(7,3)	(7,4)	(7,5)	(7,6)
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
(7,7)	(7,8)				
0.000E+00	0.000E+00				
(8,1)	(8,2)	(8,3)	(8,4)	(8,5)	(8,6)
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
(8,7)	(8,8)				
0.000E+00	0.000E+00				



Way Ahead

- **Improved menu of services**
- **Cooperative partnerships with other governments**
- **Improve transparency and confidence-building measures based on sharing of information**
- **Develop best practices for responsible behavior**