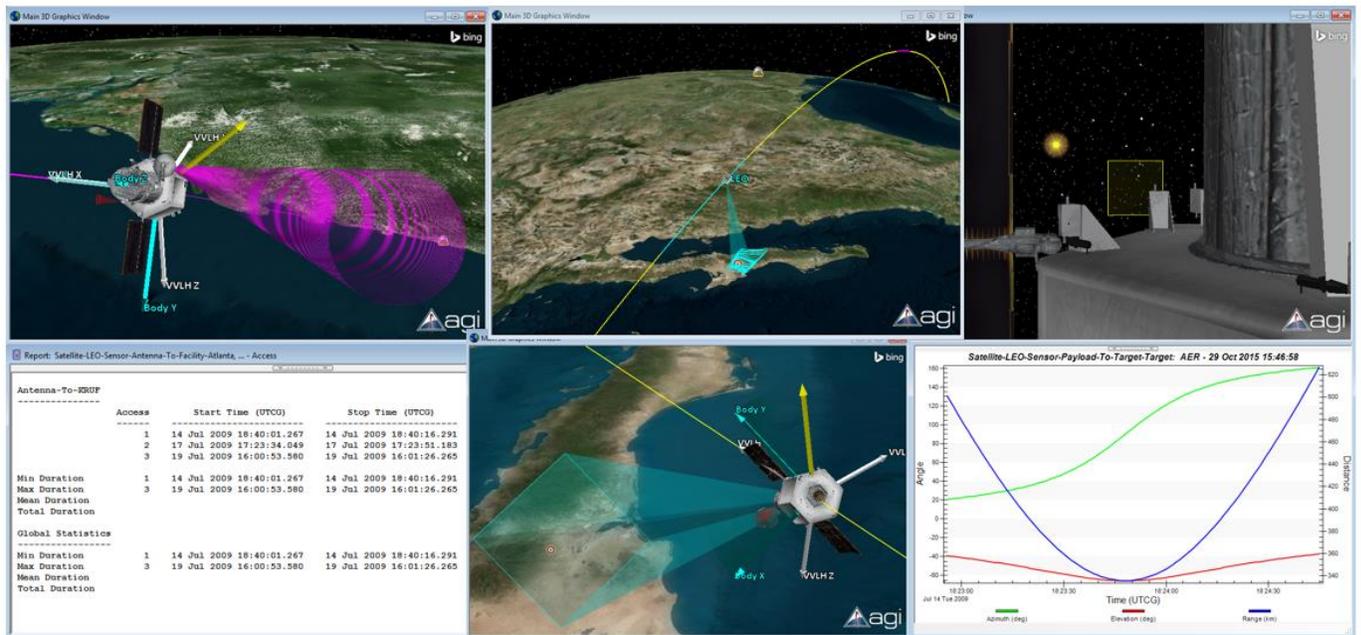


Introduction to STK – Space Systems

Introduction:

This scenario depicts a representative space mission using the free version of STK. The mission in this example is a Low Earth Orbiting (LEO) scenario, which collects imagery for a ground target, then downlinks the data to multiple ground stations while maximizing power to the satellite's solar panels. The satellite's orbit line is colored based on the intervals for payload imaging, antenna downlink, sunlight, penumbra, and umbra.



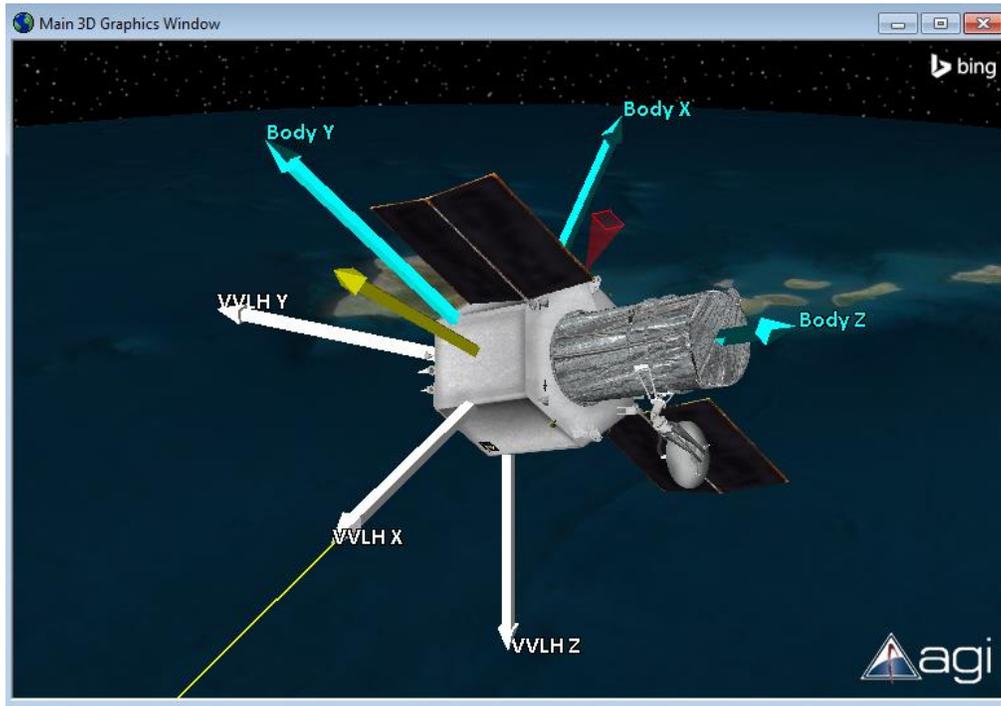
Exploring this demo

- Use the Animation toolbar to put the scenario into motion:
- Use Stored Views to visualize each section
- Use Quick Reports to evaluate each section

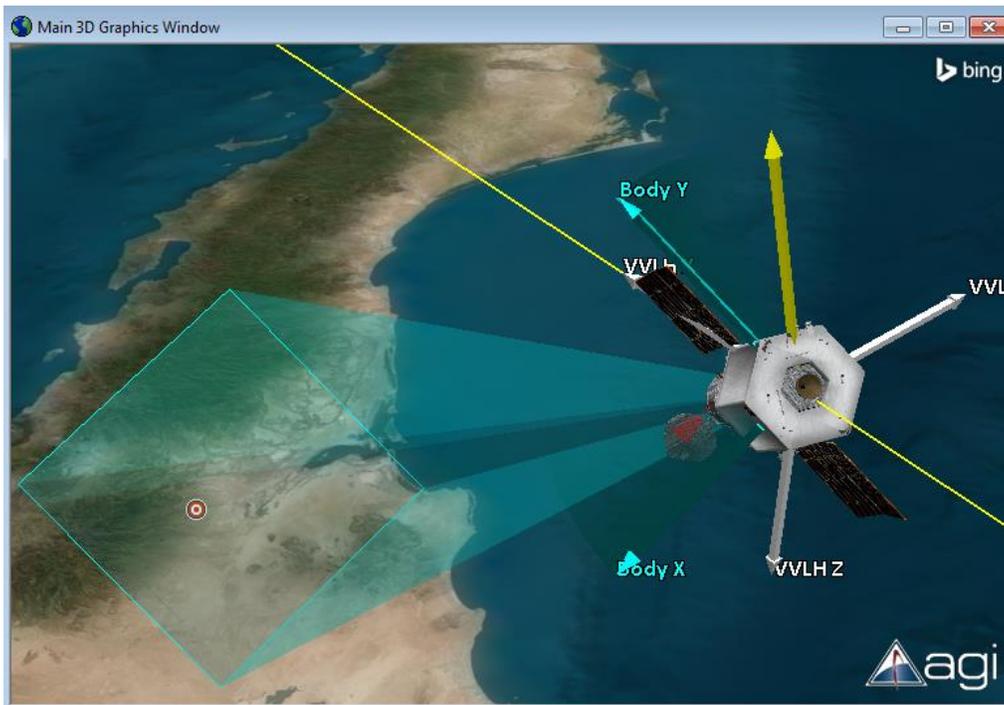
Section 1: LEO Image Collection

This section shows the collection of a ground target from the satellite. The attitude is defined using the "Precomputed" type, which allows users to specify the orientation of their platform from a data file containing time history of yaw, pitch, roll, euler angles, or quaternions. In this case, the attitude was generated using [STK / SOLIS](#), which provides a complete spacecraft simulation environment in STK, including full rotation dynamics; attitude determination and control; sensor and actuator models; and power and payload modeling. Alternatively, STK SatPro allows users to define constant slew times to other STK objects.

 **Stored View: LEO Image Collection**



 **Stored View: LEO First Image**



 **Quick Report:** Target Collection Times

Report: Satellite-LEO-Sensor-Payload-To-Target-Target - AER

29 Oct 2015 15:46:08

Satellite-LEO-Sensor-Payload-To-Target-Target: Inview Azimuth, Elevation, & Range

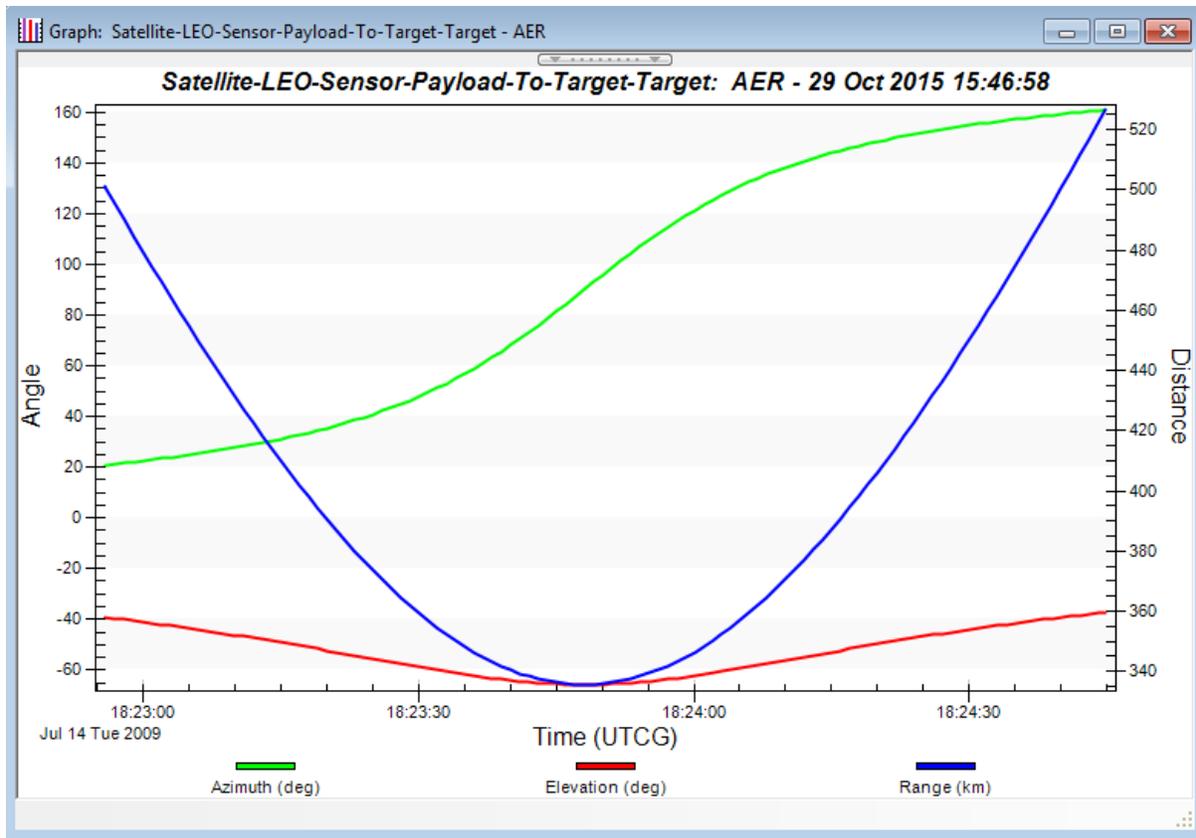
Payload-To-Target - AER reported in the object's default AER frame

Time (UTCG)	Azimuth (deg)	Elevation (deg)	Range (km)
14 Jul 2009 18:22:55.786	20.943	-39.116	501.441
14 Jul 2009 18:23:05.000	24.901	-43.499	454.731
14 Jul 2009 18:23:15.000	31.143	-49.148	409.983
14 Jul 2009 18:23:25.000	40.911	-55.523	373.599
14 Jul 2009 18:23:35.000	56.914	-61.703	348.216
14 Jul 2009 18:23:45.000	81.604	-65.477	336.336
14 Jul 2009 18:23:55.000	109.689	-64.433	339.383
14 Jul 2009 18:24:05.000	130.850	-59.339	356.974
14 Jul 2009 18:24:15.000	143.932	-52.895	387.129
14 Jul 2009 18:24:25.000	152.023	-46.757	427.194
14 Jul 2009 18:24:35.000	157.325	-41.480	474.661
14 Jul 2009 18:24:44.830	160.956	-37.188	526.594

Global Statistics

Min Elevation	14 Jul 2009 18:23:47.980	90.164	-65.716	335.663
Max Elevation	14 Jul 2009 18:24:44.830	160.956	-37.188	526.594
Mean Elevation			-51.380	
Min Range	14 Jul 2009 18:23:47.985	90.178	-65.716	335.663
Max Range	14 Jul 2009 18:24:44.830	160.956	-37.188	526.594
Mean Range				411.354

 **Quick Report:** AER



Section 2: LEO Solar Power Collection

This section shows how to compute the lighting times for the solar power collection. Furthermore, the attitude of the satellite slew so that the spacecraft solar panels are perpendicular to the Sun when not in another operation mode. [STK / SatPro](#) allows users to extend these calculations and compute the angles and power generation of the solar panels.

 **Stored View:** LEO Sun Sensor



 **Quick Report:** Spacecraft Eclipse Summary

Report: LEO - Eclipse Summary

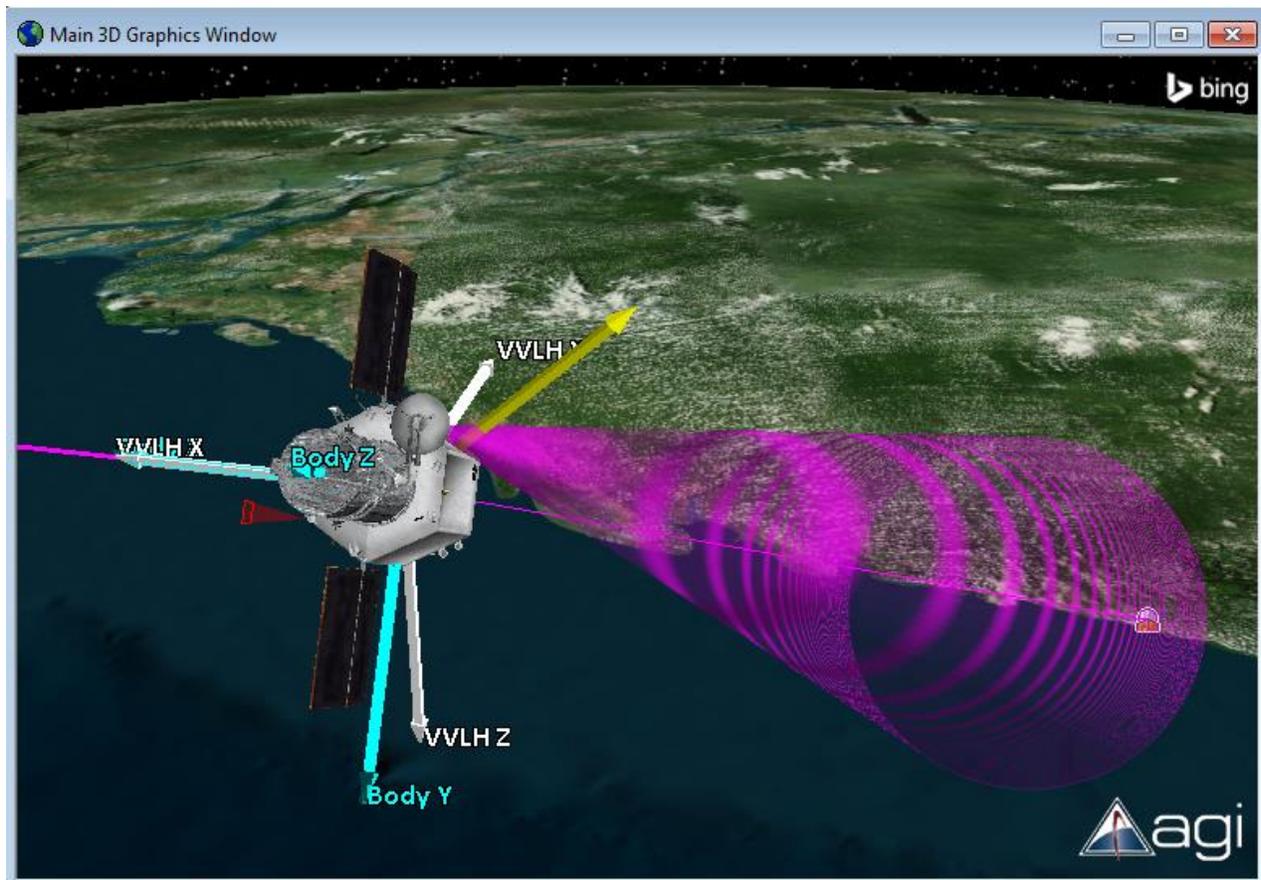
Satellite-LEO

Penumbra Start Time (UTCG)	Umbra Start Time (UTCG)	Umbra Stop Time (UTCG)	Penumbra Stop Time (UTCG)
14 Jul 2009 18:55:04.502	14 Jul 2009 18:55:12.440	14 Jul 2009 19:31:33.801	14 Jul 2009 19:31:41.710
14 Jul 2009 20:25:26.191	14 Jul 2009 20:25:34.128	14 Jul 2009 21:01:55.526	14 Jul 2009 21:02:03.437
14 Jul 2009 21:55:47.867	14 Jul 2009 21:55:55.807	14 Jul 2009 22:32:17.244	14 Jul 2009 22:32:25.151
14 Jul 2009 23:26:09.544	14 Jul 2009 23:26:17.479	15 Jul 2009 00:02:38.960	15 Jul 2009 00:02:46.861
15 Jul 2009 00:56:31.211	15 Jul 2009 00:56:39.143	15 Jul 2009 01:33:00.665	15 Jul 2009 01:33:08.565
15 Jul 2009 02:26:52.870	15 Jul 2009 02:27:00.806	15 Jul 2009 03:03:22.363	15 Jul 2009 03:03:30.266
15 Jul 2009 03:57:14.528	15 Jul 2009 03:57:22.462	15 Jul 2009 04:33:44.052	15 Jul 2009 04:33:51.955
15 Jul 2009 05:27:36.176	15 Jul 2009 05:27:44.109	15 Jul 2009 06:04:05.737	15 Jul 2009 06:04:13.637
15 Jul 2009 06:57:57.820	15 Jul 2009 06:58:05.750	15 Jul 2009 07:34:27.414	15 Jul 2009 07:34:35.313
15 Jul 2009 08:28:19.456	15 Jul 2009 08:28:27.386	15 Jul 2009 09:04:49.087	15 Jul 2009 09:04:56.982
15 Jul 2009 09:58:41.087	15 Jul 2009 09:58:49.016	15 Jul 2009 10:35:10.748	15 Jul 2009 10:35:18.646
15 Jul 2009 11:29:02.711	15 Jul 2009 11:29:10.639	15 Jul 2009 12:05:32.404	15 Jul 2009 12:05:40.303
15 Jul 2009 12:59:24.328	15 Jul 2009 12:59:32.255	15 Jul 2009 13:35:54.057	15 Jul 2009 13:36:01.945
15 Jul 2009 14:29:45.942	15 Jul 2009 14:29:53.868	15 Jul 2009 15:06:15.692	15 Jul 2009 15:06:23.589
15 Jul 2009 16:00:07.547	15 Jul 2009 16:00:15.472	15 Jul 2009 16:36:37.324	15 Jul 2009 16:36:45.215
15 Jul 2009 17:30:29.146	15 Jul 2009 17:30:37.070	15 Jul 2009 18:06:58.949	15 Jul 2009 18:07:06.839

Section 3: Antenna Downlink Times

After the image is collected, the spacecraft needs to downlink the data to a ground station. In this case, the data needs to be downlinked over 2 passes at a Ground Station in Atlanta and KRUF. Again, the spacecraft will need to slew to point the antenna in the direction of the ground stations.

 **Stored View:** Antenna Downlink



 **Quick Report:** Antenna Downlink Access Times

Report: Satellite-LEO-Sensor-Antenna-To-Facility-Atlanta, ... - Access

Antenna-To-KRUF				
Access	Start Time (UTCG)		Stop Time (UTCG)	Duration (sec)
1	14 Jul 2009	18:40:01.267	14 Jul 2009 18:40:16.291	15.023
2	17 Jul 2009	17:23:34.049	17 Jul 2009 17:23:51.183	17.134
3	19 Jul 2009	16:00:53.580	19 Jul 2009 16:01:26.265	32.685
Min Duration	1	14 Jul 2009 18:40:01.267	14 Jul 2009 18:40:16.291	15.023
Max Duration	3	19 Jul 2009 16:00:53.580	19 Jul 2009 16:01:26.265	32.685
Mean Duration				21.614
Total Duration				64.843
Global Statistics				
Min Duration	1	14 Jul 2009 18:40:01.267	14 Jul 2009 18:40:16.291	15.023
Max Duration	3	19 Jul 2009 16:00:53.580	19 Jul 2009 16:01:26.265	32.685
Mean Duration				23.323
Total Duration				93.291

Further capabilities:

STK has a several of add-on modules that extend these capabilities for space systems. For a collection of capability videos for space systems, please go to the following website:

<http://www.agi.com/products/video-samples/>