

Rapid and accurate simulated space events for Test, Training, and Exercise (TTX) support.

SEG allows non-expert operators to quickly develop accurate, physics-based scenarios of common space events, from single object maneuvers to complex, linked, multi-object interactions, using simple, GUI-based operator workflows.

Use cases supported

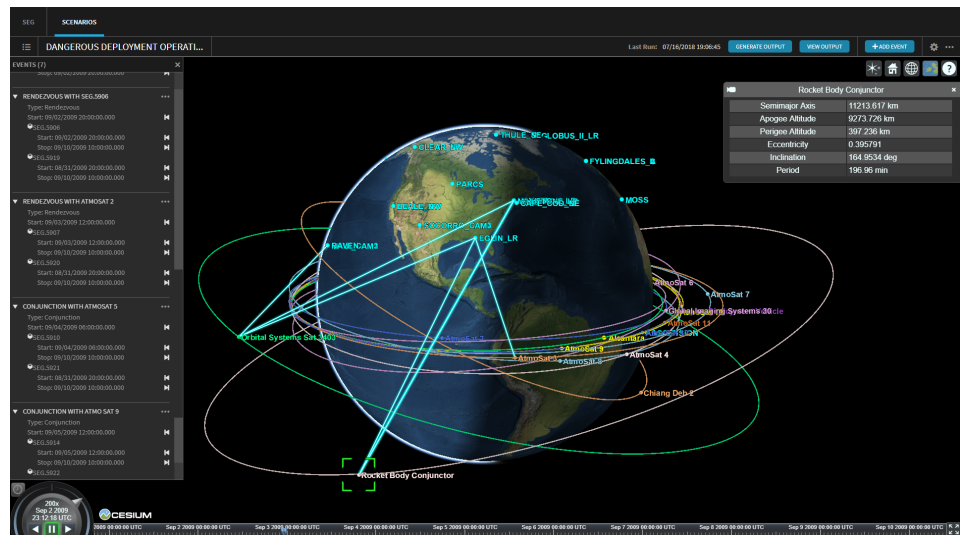
- Repeatable, tailorable operator procedure training
- "Day in the life" training
- System performance tests
- Exercise support
- Simulated over live
- Proof of concept studies (e.g. adding sensors)
- Mission planning
- Tactics development

Key value points

- Doesn't require operators with extensive astrodynamics expertise to create accurate, realistic space events
- Enables rapid generation of simulated tracking observations and "truth" ephemeris
- Easier to use and more accurate than morphed historical data

Enterprise Workflow

- Copy state data from SSA database for exercise/training
- Build scenario(s) in SEG:
 - Define events
 - Define sensor cadence
- Run scenario(s) in SEG to create obs
- Use obs in SSS/other for exercise or training (can layover real data if desired)



Core capabilities

Time independent. Events and observations can be synchronized to run in current time, or in past or future epochs, and can be combined together on a user-defined timeline to generate a complete exercise scenario.

Robust 3D visualization. A 3D visual interface provides an easy way to visualize the scenario events.

Accuracy. SEG accounts for force and debris models, space weather effects, and sensor performance models, including terrain and elevation constraints, to create accurate and realistic SSA events.

SOA Architecture. SEG's Service Oriented Architecture with clearly documented API's enables the use of web services for direct integration with customer architectures or AGI's SSA Software Suite.

User workflows. SEG includes a variety of pre-defined event types out of the box and easy to use, operator workflows, enabling rapid scenario creation.

Supported space events

- Reentry
- Proximity Operations
- Deorbit
- Conjunctions
- Deployment
- Maneuvers
- Orbital Intercept
- Breakup
- Rendezvous
- Docking & Separation
- Launch
- ASAT

Technical Details

Enterprise architecture

- Multi-user: share scenarios and results across the enterprise via a single, common database
- Security: integrates with enterprise authentication services
- Scalable: supports large scale simulations; scales calculations across compute nodes
- Browser-based UI

Desktop architecture

- New in SEG 3.0
- Simpler installation and configuration
- Workspace is unique per user, and can be shared between users
- UI has same look and feel as Enterprise version

Sensors

- Sensor access calculated and visualized in Scenario Preview
- Supported sensors types: optical, RADAR, space-based
- User-defined sensor cadences: tracks/day, observations/track, trackers, timestep, and revisit time

Catalog Event

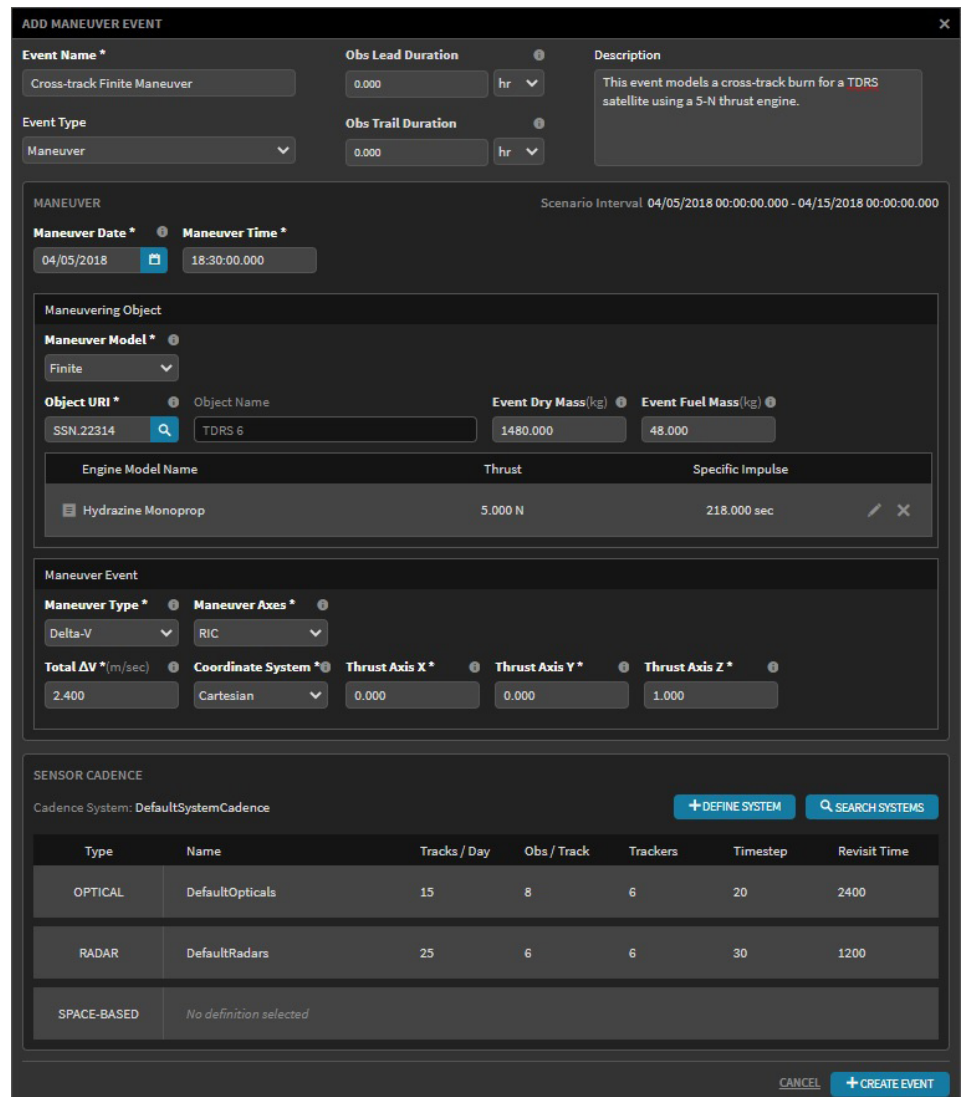
User-defined list of 1 to n (no limit) RSOs propagated throughout the scenario epoch. These background objects provide additional realism and complexity to the simulated scenario.

Maneuvers

- Users can model maneuvers as either impulsive or finite.
- Finite maneuvers are modeled using engines with constant thrust and Isp.
- Users can define their own engine models or select from those provided.

Ephemeris Event

The ephemeris event allows users to directly define a SEG event using externally provided ephemeris. This allows creation of more complex events using external tools such as STK.



The screenshot shows the 'ADD MANEUVER EVENT' form with the following fields and values:

- Event Name ***: Cross-track Finite Maneuver
- Obs Lead Duration**: 0.000 hr
- Event Type**: Maneuver
- Obs Trail Duration**: 0.000 hr
- Description**: This event models a cross-track burn for a TDRS satellite using a 5-N thrust engine.
- Scenario Interval**: 04/05/2018 00:00:00.000 - 04/15/2018 00:00:00.000
- Maneuver Date ***: 04/05/2018
- Maneuver Time ***: 18:30:00.000
- Maneuvering Object**:
 - Maneuver Model ***: Finite
 - Object URI ***: SSN.22314 (Object Name: TDRS 6)
 - Event Dry Mass (kg)**: 1480.000
 - Event Fuel Mass (kg)**: 48.000
- Engine Model Name**: Hydrazine Monoprop
- Thrust**: 5.000 N
- Specific Impulse**: 218.000 sec
- Maneuver Event**:
 - Maneuver Type ***: Delta-V
 - Maneuver Axes ***: RIC
 - Total ΔV *(m/sec)**: 2.400
 - Coordinate System ***: Cartesian
 - Thrust Axis X ***: 0.000
 - Thrust Axis Y ***: 0.000
 - Thrust Axis Z ***: 1.000
- SENSOR CADENCE**:
 - Cadence System: DefaultSystemCadence
 - Buttons: + DEFINE SYSTEM, SEARCH SYSTEMS
 - Table:

Type	Name	Tracks / Day	Obs / Track	Trackers	Timestep	Revisit Time
OPTICAL	DefaultOpticals	15	8	6	20	2400
RADAR	DefaultRadars	25	6	6	30	1200
SPACE-BASED	No definition selected					

Objects

- SEG enables use of real world, SSN catalog objects and simulated, user-defined objects in concert.
- This approach supports simulated over live operations.

Scenarios

- A container for a collection of events over a span of time
- Users can combine and reuse existing events into different scenarios

Linked Events

- Users can link events that have the same object to each other without having to manually solve for the intermediate maneuvers.

- SEG automatically calculates the requisite maneuvers using Lambert's solution to link the events.
- These orbit transfer maneuvers may be modeled as either impulsive or finite.

Outputs

- B3 observations
- Ephemeris
- Can then be fed into a flight dynamics or catalog processing system
- Segment reports
- VDFs for use in STK