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Virtual Constellation

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Agenda

Demonstration Vignette

- Demonstration of “Space Based Radar - SBR Video
- Terrorist Geolocation” video
- Overview of Virtual Constellation
- New Classes Satellite Launch Detection
 - Mission Planner DSP cross-cue to a Aegis Cruiser
 - Analysis Center
 - Comm/Processing Nodes
- Extended Features Terrorist Geolocation
 - Fixed Rectangular Sensor Projection
 - New Sensor Type attributes
 - Text Messages within Transmitter Class
 - New Object Attributes
- Summary
- Questions



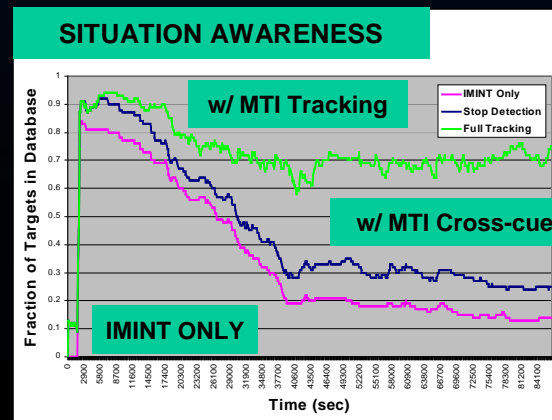
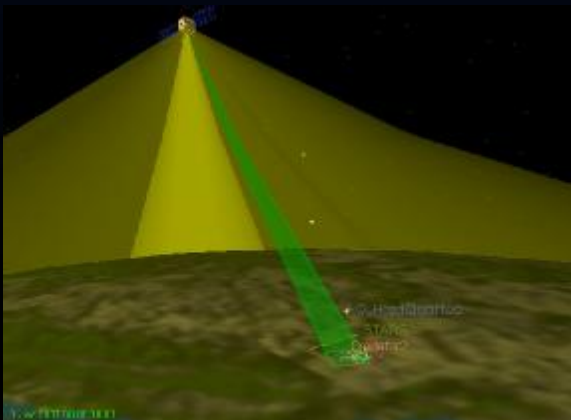
Overview

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Virtual Constellation is a discrete-event ISR simulation tool designed to evaluate the performance of multi-intelligence system architectures. The tool provides analysts a means of generating timely first order metrics on:

- Sensor systems collection capability
- Improved situational awareness derived from cross-cueing
- Effects of processing delays



System of Systems Architecture Analysis

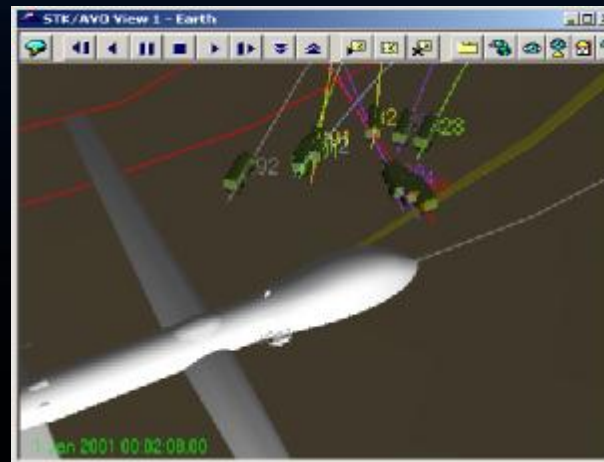
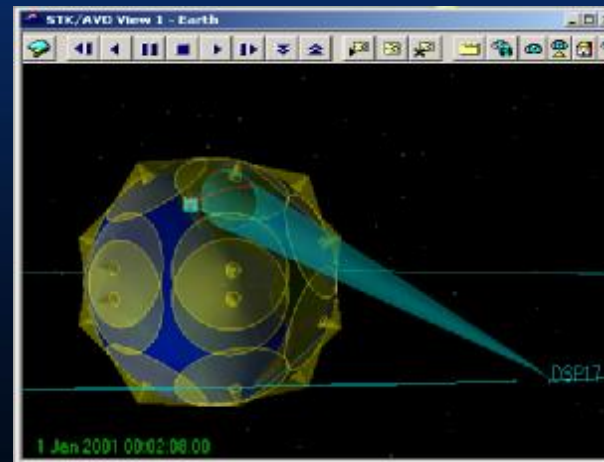
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Leveraging the analytical strengths of Satellite Tool Kit (STK), Virtual Constellation allows operators to model a variety of ISR collection platforms including:

- IMINT
- SIGINT (COMINT / ELINT)
- SAR / MTI
- IR
- MASINT

Virtual Constellation enhances each of these phenomenologies by providing the capability to cross-cue from one sensor or platform to another.

Example- the views to the right illustrate a Predator UAV responding to cross-cues originating from data collected by space-based DSP (IR) and SBR (MTI) constellations.



3D animation views of DSand Predator UAV over battlefield

New Classes

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One way Virtual Constellation enhances the capabilities of STK is by implementing new classes that can be embedded directly into the STK Object Manager through Programmer's Library (PL). This provides the new classes with the same access to reporting and graphics features of native STK classes. These include:

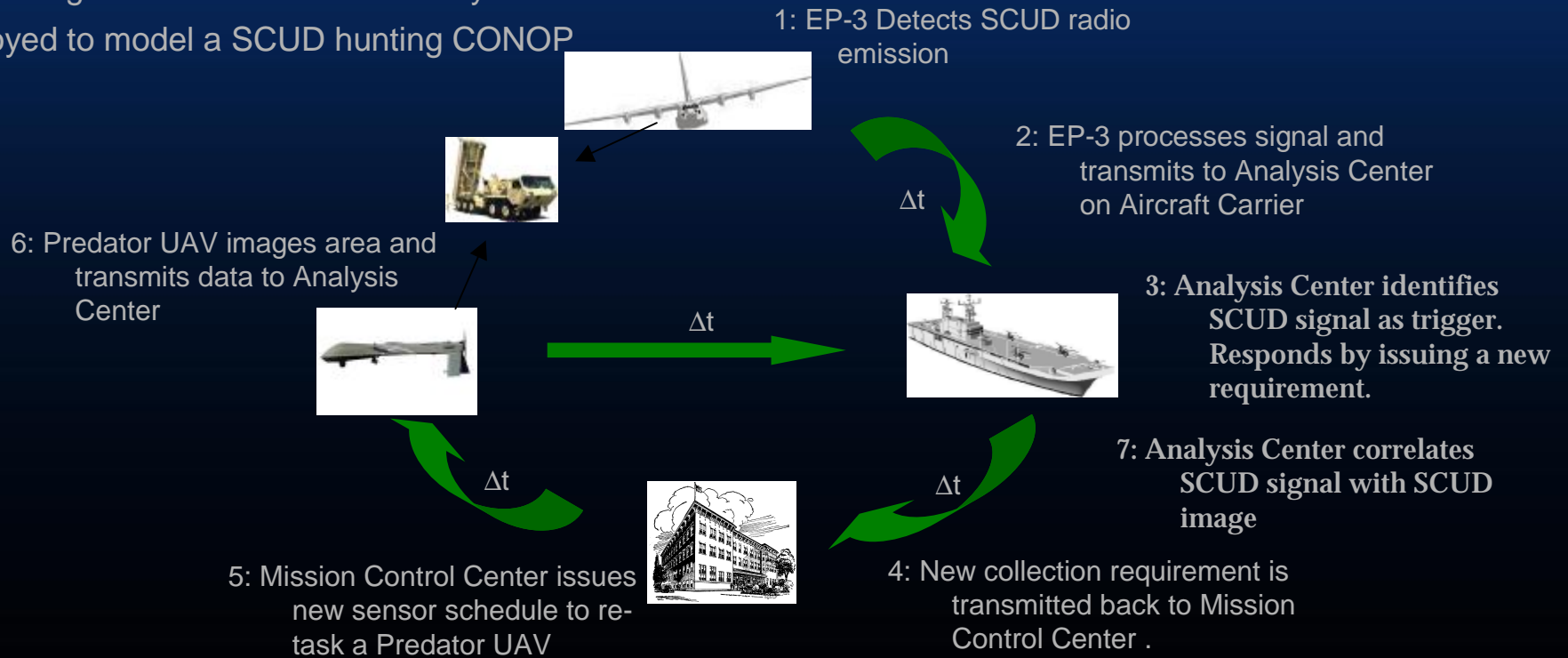
- Mission Planner- Dynamically tasks resources to satisfy a given set of user-defined requirements. Requirements may be dynamically added during the simulation by cross-cues issued from an Analysis Center.
- Analysis Center- Processes information collected by sensors and attempts to construct an independent view of the battle field. Identifies user-defined patterns and issues new requirements to the Mission Planner when detected.
- Communications Node- Models process delays at specified nodes in the simulation. Accounts for delays in analysis time for each phenomenology.
(ex. COMINT- language translation)
- Time Manager- Processes event-based queuing to allow true discrete-event simulation to occur within the STK environment.



Notional Information Flow

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The diagram illustrates how VC may be employed to model a SCUD hunting CONOP



This analysis accounts for the following:

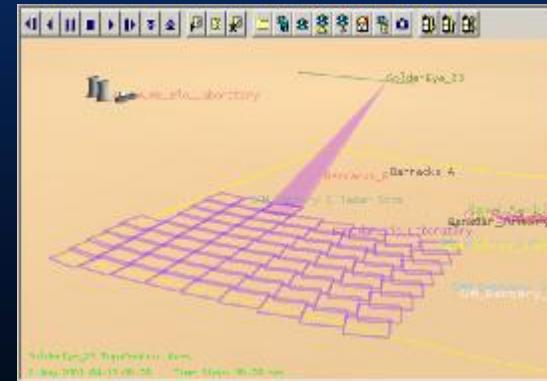
- Processing delay at each stage ($\Sigma \Delta t$)
- Predator UAV collection capability
- EP-3 collection capability
- Effectiveness of cross-cue strategy

Extended Features

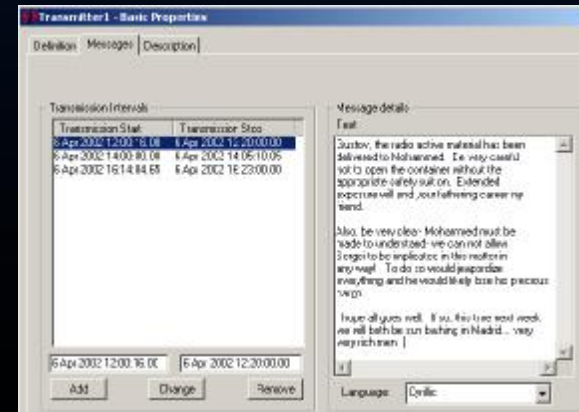
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Virtual Constellation also extends the features of native STK classes. A subset of these include:

- Fixed Rectangular Sensor Projection- A new rectangular sensor class which continuously modulates a sensor's aperture such that the projection on the ground is always a fixed length and width.
- Sensor Type- New panel added to the basic sensor such that 'type' specific traits may be defined. Example- allows a user to define a sensor as an IR sensor and set the minimum detectable temperature level.
- Message Text in Transmitter Class- New panel added to the Transmitter class which allows analyst to add message text and transmission times. Users may also select the language of the message.



Sensor foot-print remains fixed, independent of sensor elevation angle



Screen shot of Transmitter 'Message' panel

Extended Features (continued)

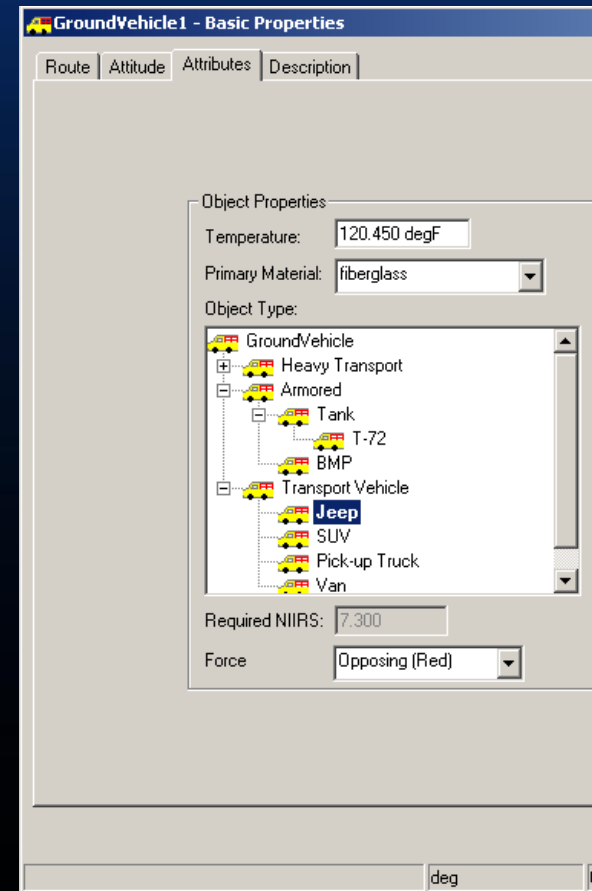
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Object Class Definition- Extension added to all physical object classes in STK which provides the user a means of 'decorating' an object with new attributes such as:

- Temperature
- Primary Material
- Force Affiliation
 - Opposing
 - Friendly
 - Neutral
 - Unknown
- Object Type

Example- A ground vehicle may be defined as either a T-72 or a Jeep. Each selection has a predefined required NIIRS rating associated with it for that level.

<u>Object Type</u>	<u>Req. NIIRS</u>
Ground Vehicle	5.5
- Armored	7.5
- Tank	8.0
- T-72	8.5



Screen shot of 'Attributes' extension panel added to all physical object classes

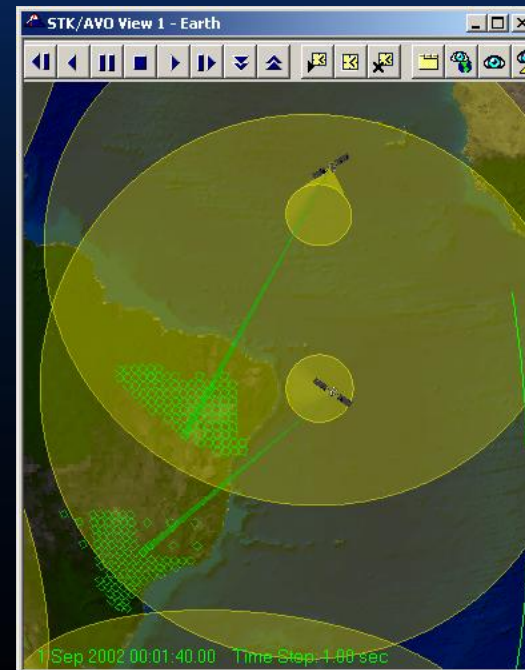
Summary

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Virtual Constellation models ISR architecture performance between terrestrial and space-based systems, supporting a variety of analysis needs, including AoA's and CONOPS.

Principal features include:

- Modeling a wide variety of collection asset phenomenologies
- Leveraging asset strengths through user-defined strategies and cross-cueing
- Accounting for PEDs process delays
- Deriving situational awareness metrics on a theater or global scale



A 24-ball SBR constellation performing global coverage of selected suspect terrorist regions.

Virtual Constellation enhances Satellite Tool Kit by incorporating new classes and extended basic features for higher fidelity ISR analysis.

QUESTIONS ?

