Human / Machine partnership in complex situations; perspectives from two DARPA programs

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Decision aids for high uncertainty and high sensitivity

COMPASS: Develop probing actions, designed to reduce the ambiguity (of actors and objectives) in gray zone scenarios

Hallmark: Understand and characterize the threat from a military operation that has escalated into space, and develop courses of action to counter it

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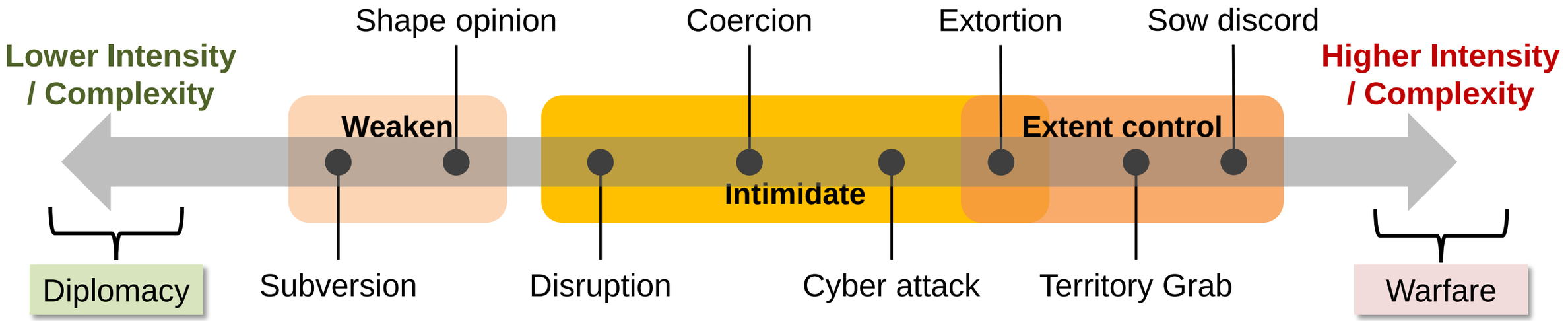
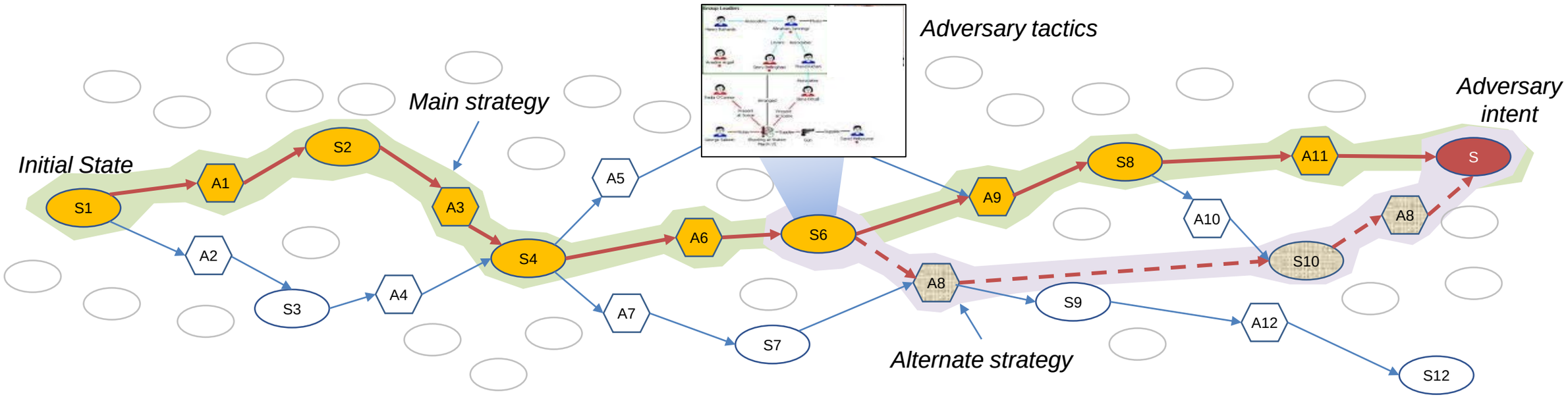
Gray zone warfare: *achieve objectives with or without violence*



- **Purposeful**, **incremental** and **low threshold** use of multiple elements of power
- Involves both **physical** actions as well as **cognitive** tasks
- Characterized by **multiple objectives** and **variety of actions**

The human / machine partnership challenge



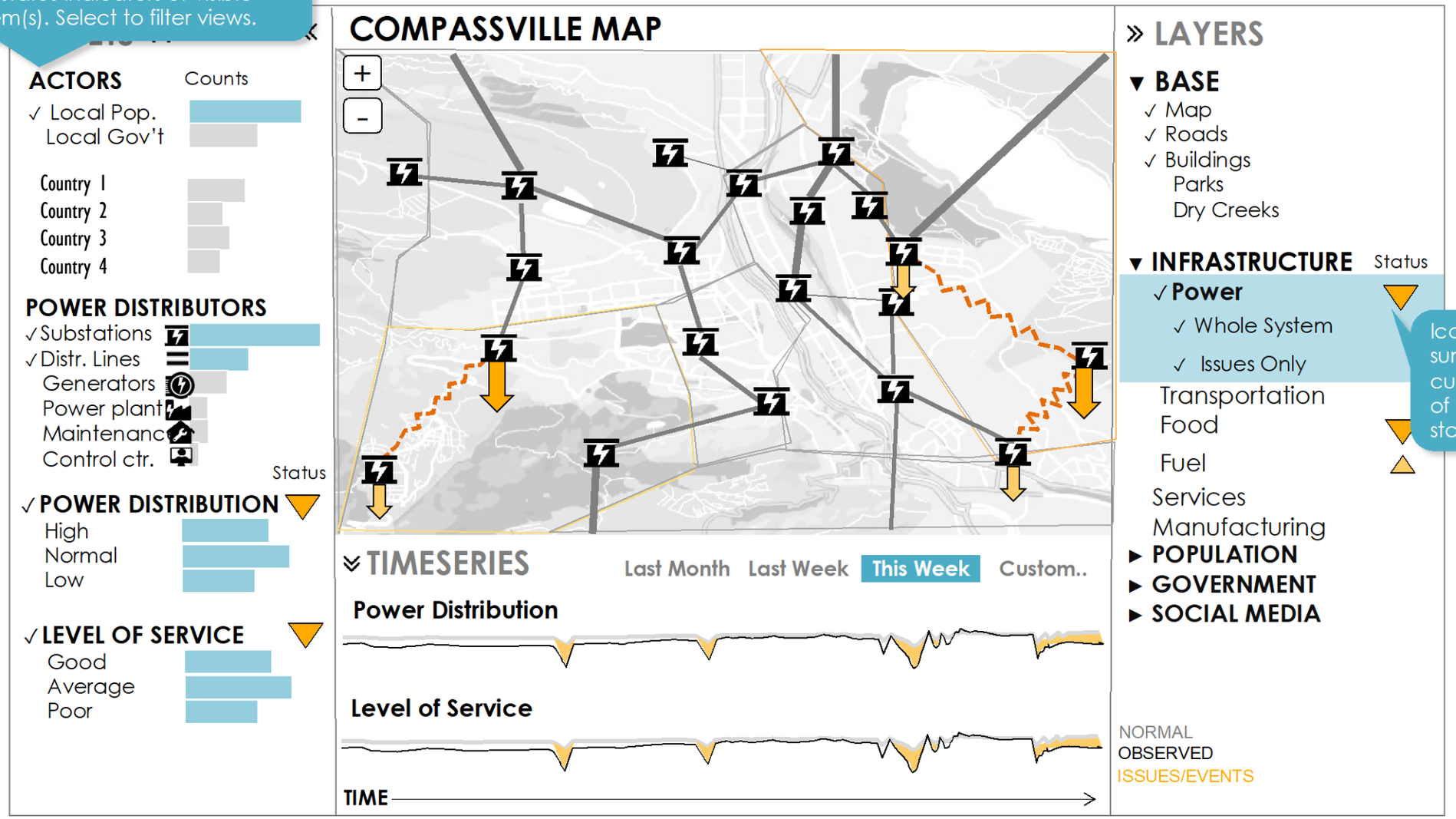
- Machines require structure for analysis
  - **Adversary intent**: end goal, represented as a state S in the n-dimensional space of the environment
  - **Strategy**: a sequence of [state, actions] that lead to the end goal; can include alternate sequences
  - **Tactics**: a graph pattern of [actors, locations, events, and relationships] associated with each state
- …, but humans need to understand the results:
  - Red is attempting to meddle with the elections; how are they planning to do it?

Understand system state – first wave

ANALYTICAL FACETS
Distributions of actor involvement and status indicators of visible system(s). Select to filter views.

Understand Current System State

GZ Terrain View of Power System Status



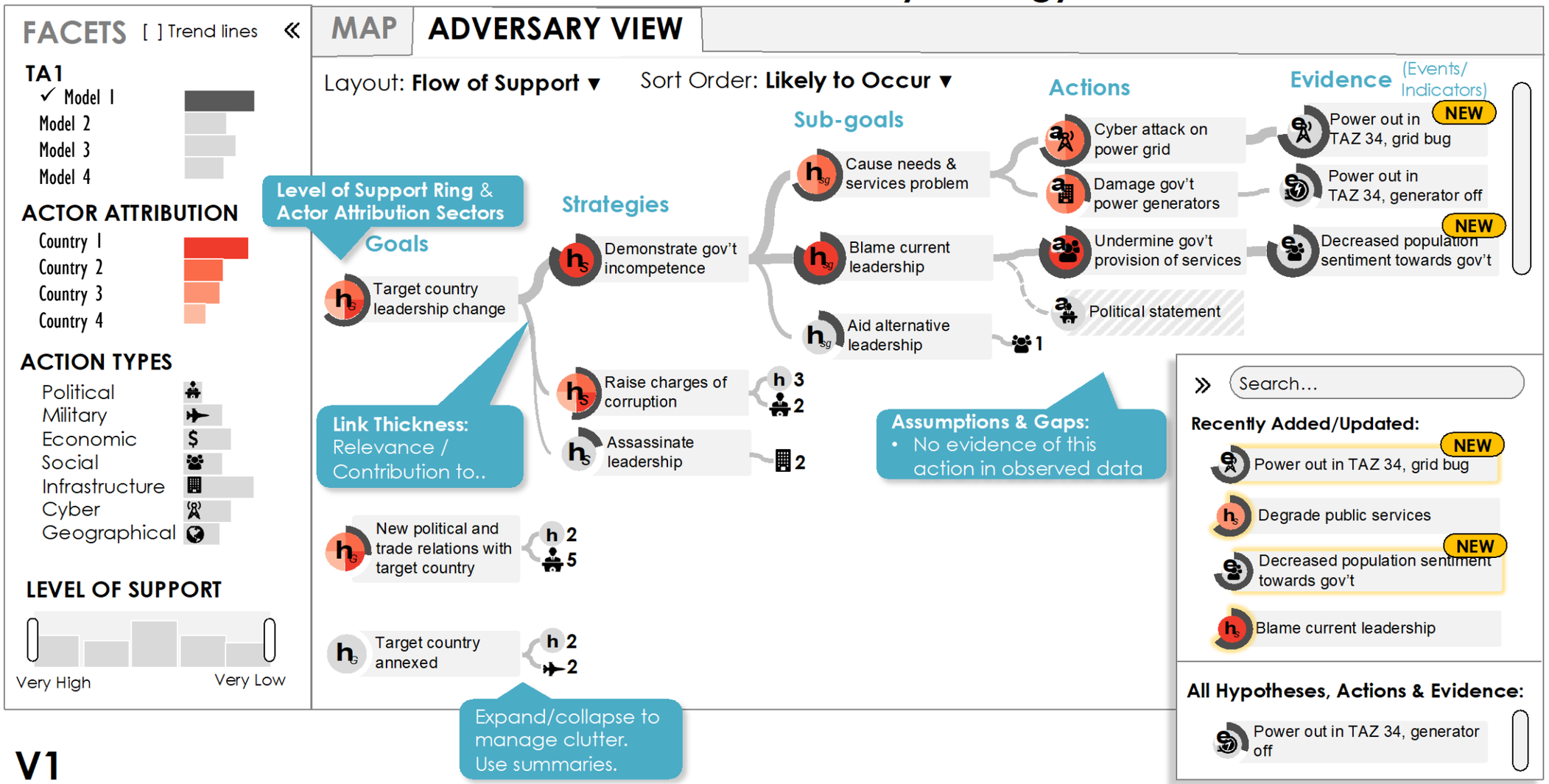
Icons summarize current status of system state

V2

Represent adversary intent – second wave

Assess and Update Hypothesized Adversary Behaviour

Machine-Generated Adversary Strategy View

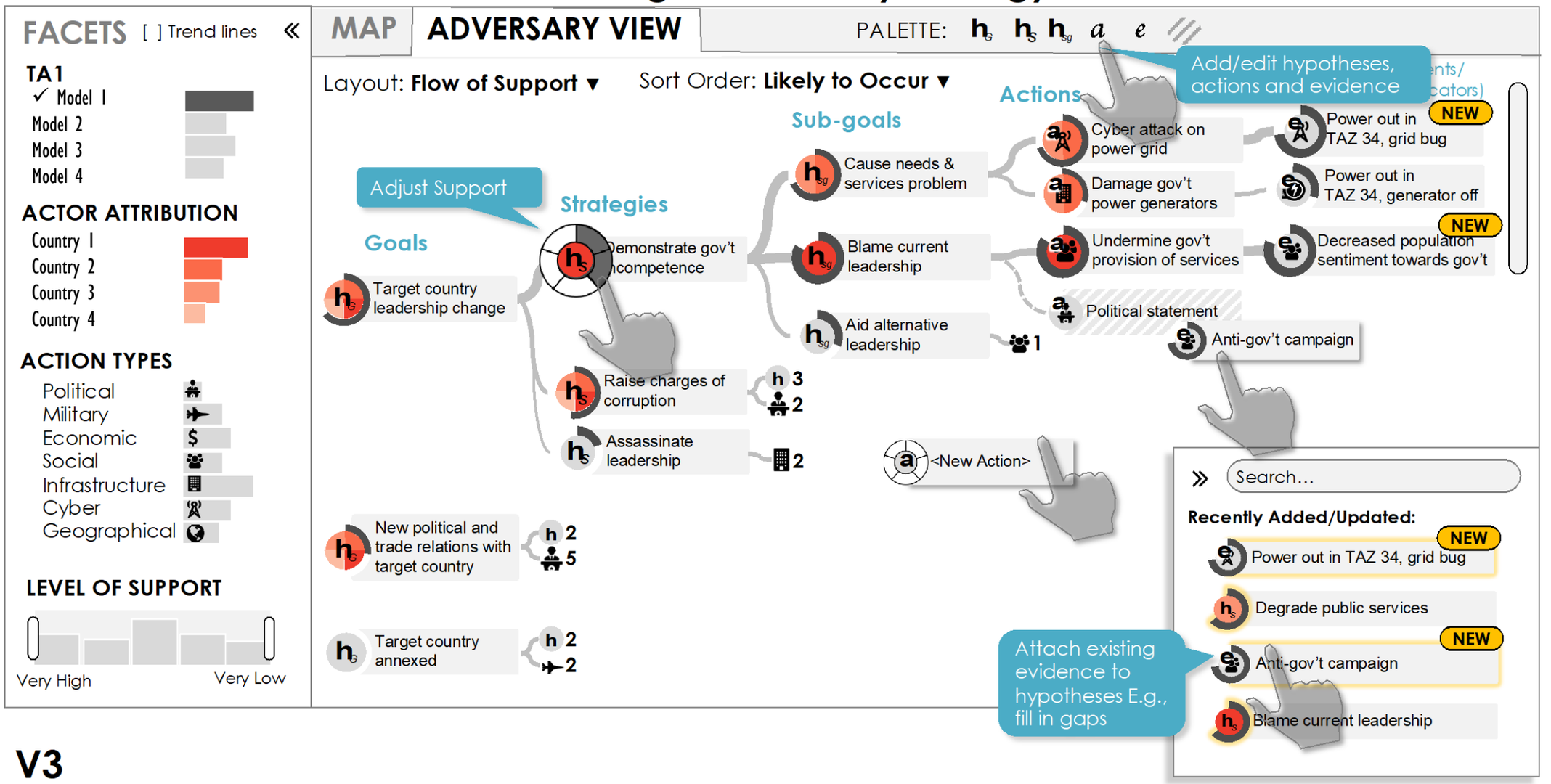


V1

Assess & update hypotheses – third wave

Assess & Update Hypothesized Adversary Behavior

User Editing of Adversary Strategy?



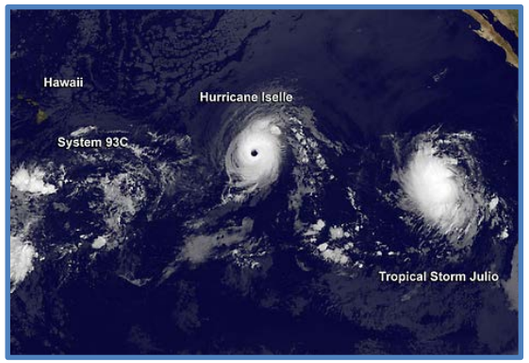
V3

Space: Critical, Crowded and Threatened

Space assets/services are increasingly critical

Relied upon across the DoD, the economy and the world for communications, surveillance, weather and security

Deployed Tactical Comms

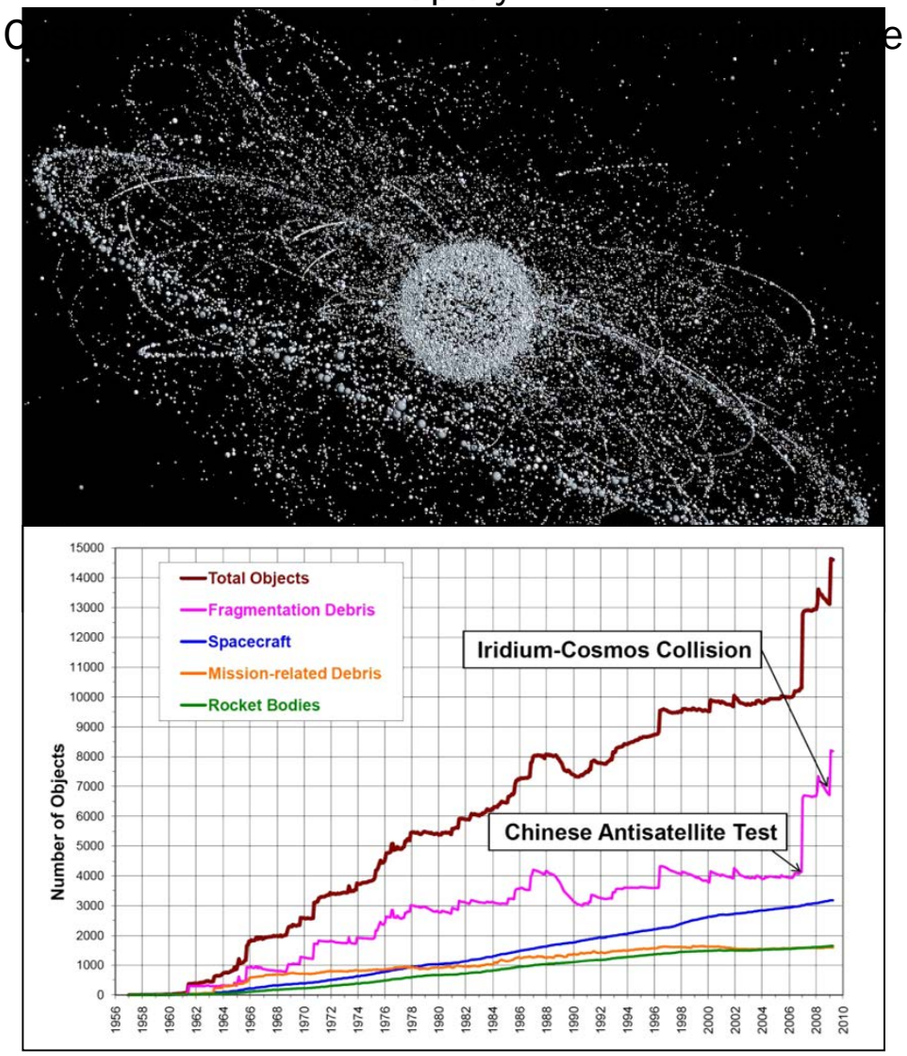


Hurricane warning and tracking

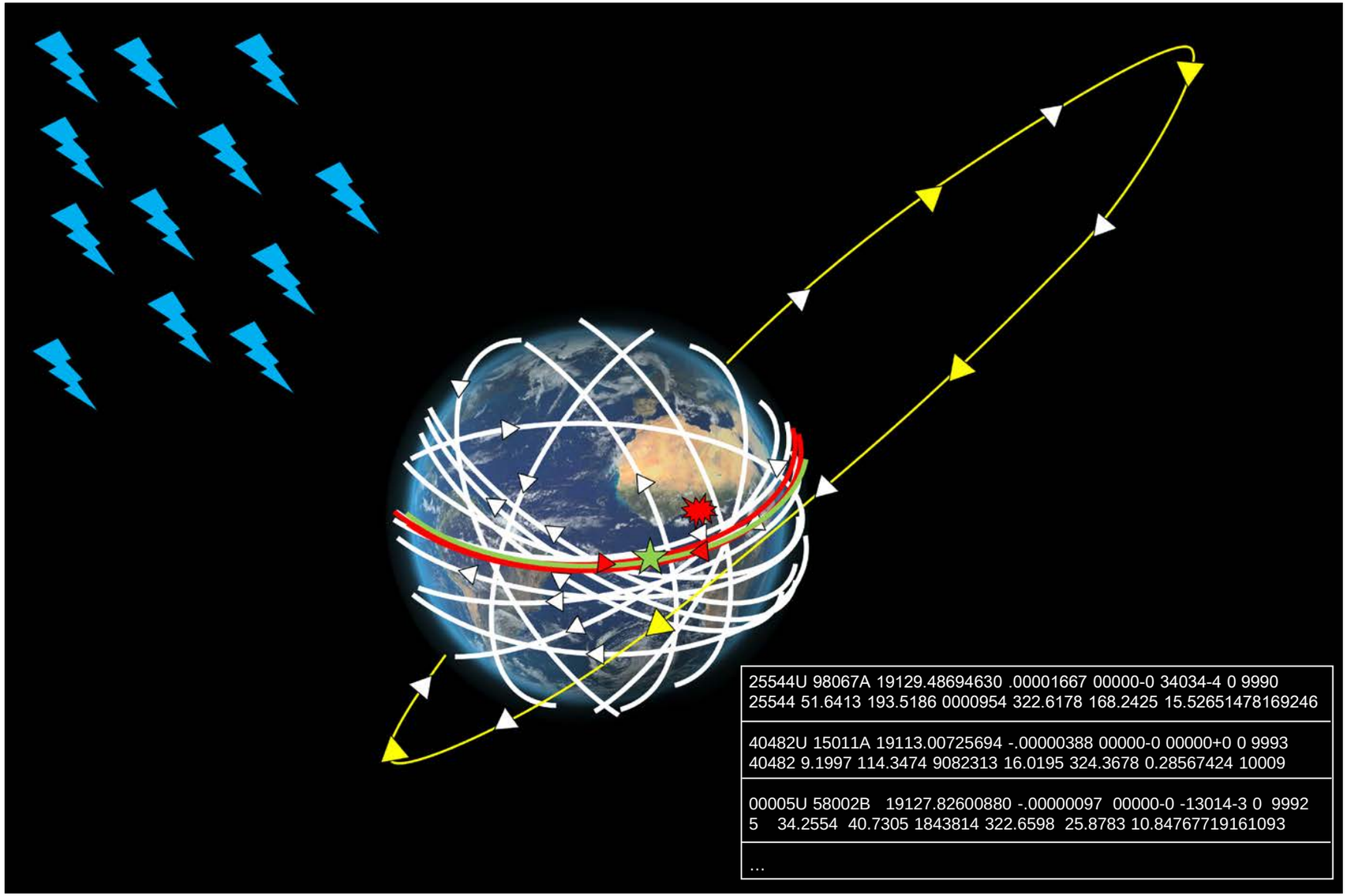
UN Policy enforcement in the Sudan

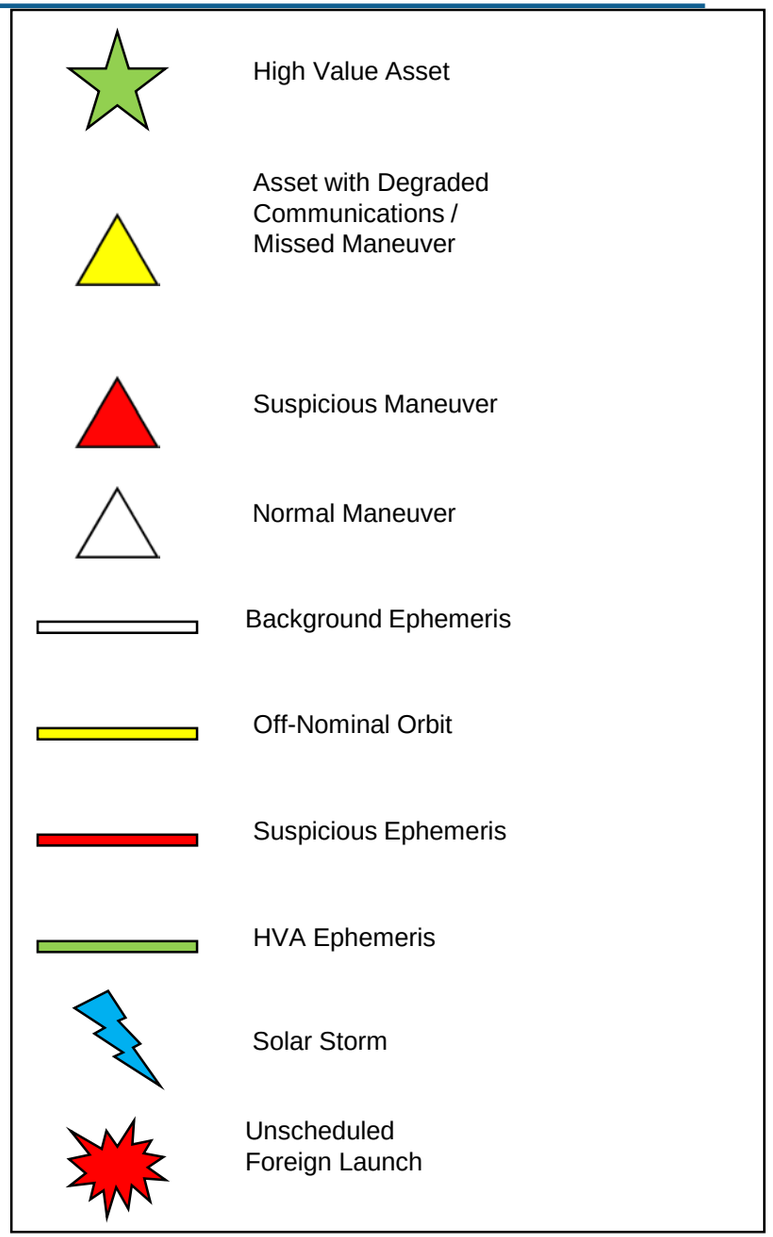
Orbital congestion is increasing

Number of total objects in orbit is increasing rapidly

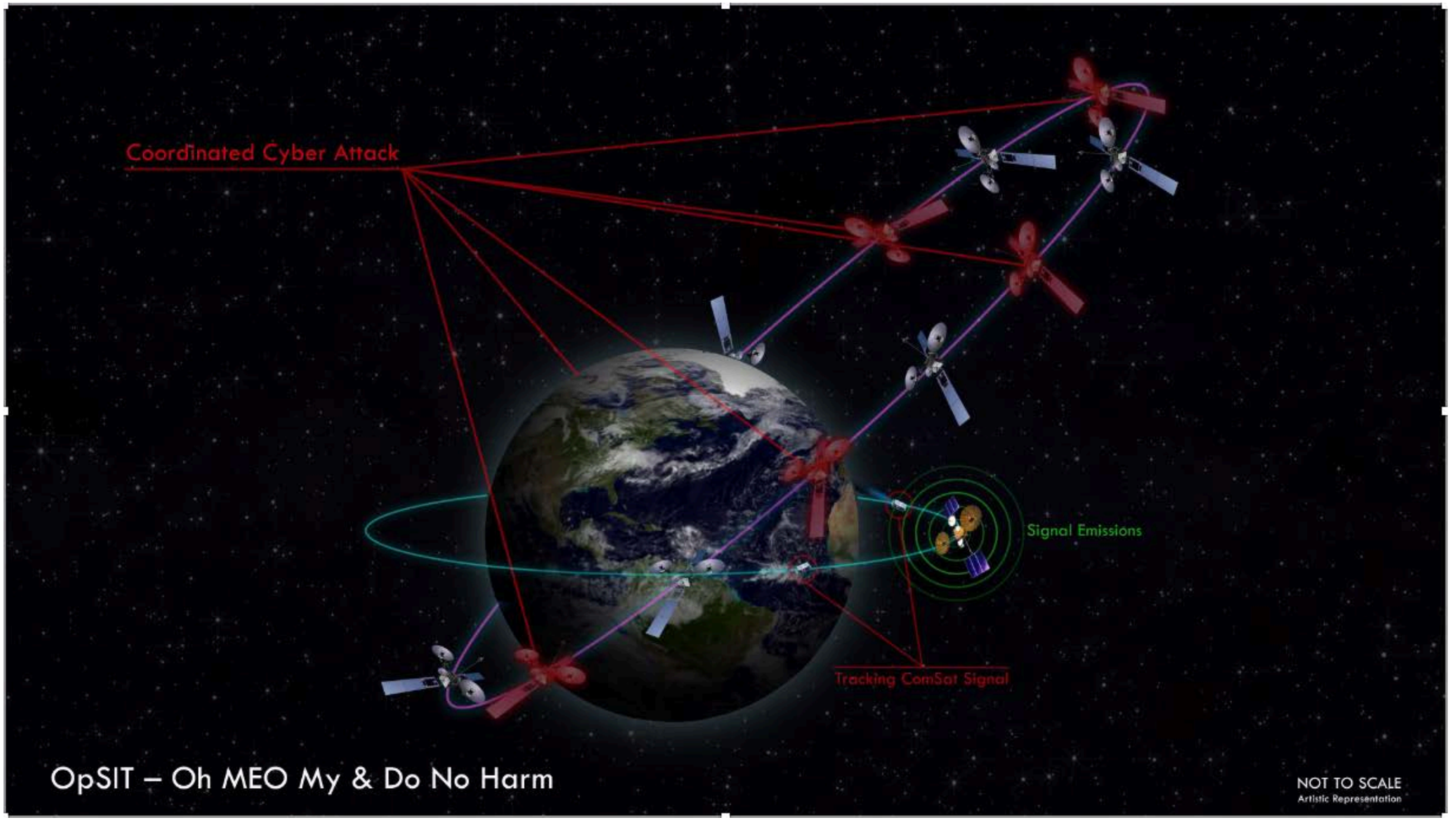


The cognitive complexity – many tracks, conflicting information





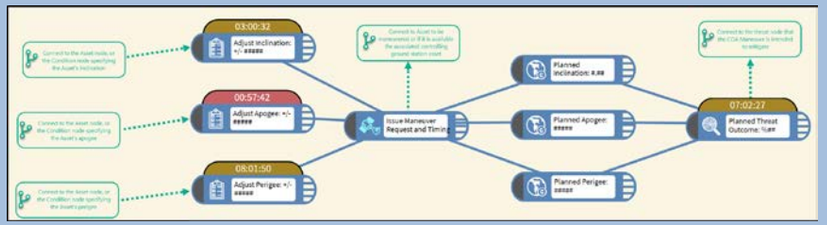
Operator needs – visualize the threat



Hallmark: *Understand the Threat and Respond*

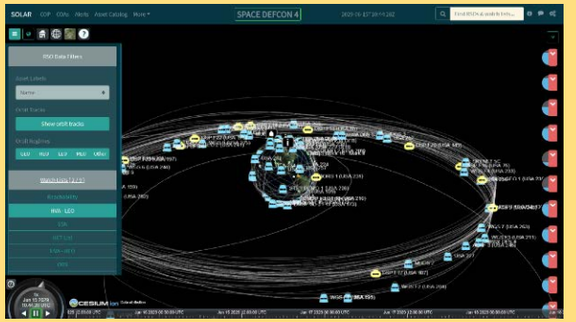
Course of Action (COA)

- ADS ReCoAT: determines if a HVA can be reached by a RSO
- Charles River PICASSA: increases available response time from I&W to COA execution using AI



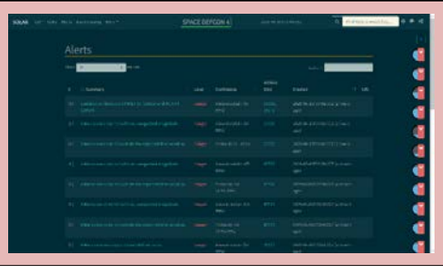
Space Situational Awareness (SSA)

- BAE PedAmp: improves decision-making with access to trusted information
- Polaris Alpha ISSA: high-accuracy actor-target satellite conjunction assessment
- VT SOSI / RESONAATE: uses AI to rapidly detect, ID, and track maneuvering spacecraft and new launches



Indication & Warning (I&W)

- Aptima SatMAP: decision-support tool that alerts operators to unexpected and evolving spacecraft behaviors
- BAE MAJICS: provides timely warning with actionable information of impeding threats



Business Process & Action: Stottler Henke C2-SPACE | CACI PALIMP-SEST

Visualization: Charles River SOLAR | CACI ASTRONOMICON