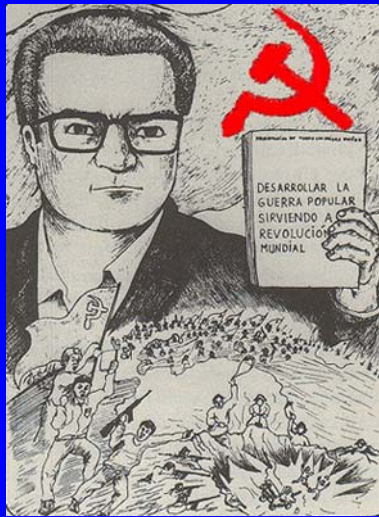


Using Systems Engineering Techniques to Model Complex Systems: A Case Study in the Growth of Terrorism



PROJECT FINDINGS:

- Systems engineering tools help us efficiently create high-level models of complex systems
- These models allow us to simulate the growth of Violent Non-State Actors (VNSA)
- Our model replicates Sendero Luminoso development in Peru
- This methodology and the tools created by it can be easily, quickly and inexpensively used by policy-makers & analysts for insights

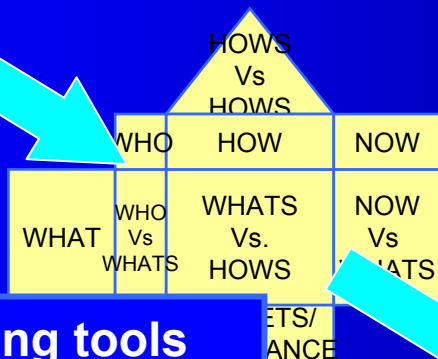
Briefing for the Security Poster Session, UCCS

Captain Jason Bartolomei, USAF Academy (Engineering Mechanics)

Maj Bill Casebeer, USAF Academy (Philosophy)

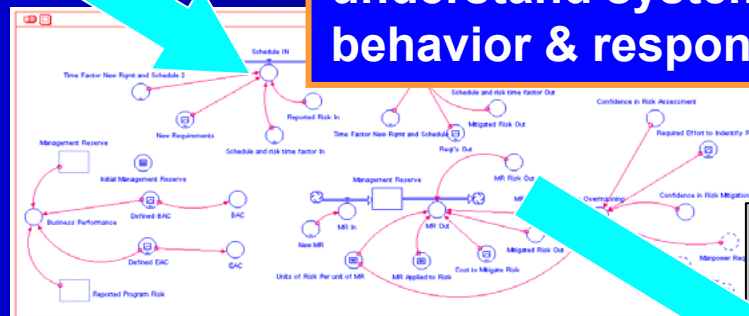
Proposed Approach

Complex System: Engineering, economic, social, military...

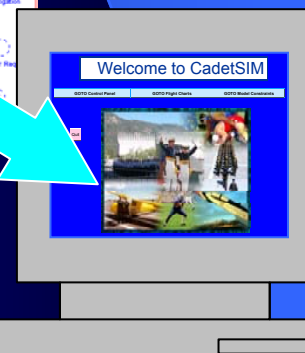


System Engineering tools and processes to highlight system structure

System Dynamics to understand system behavior & response



System Dynamic simulator to gain better insight into system and educate others

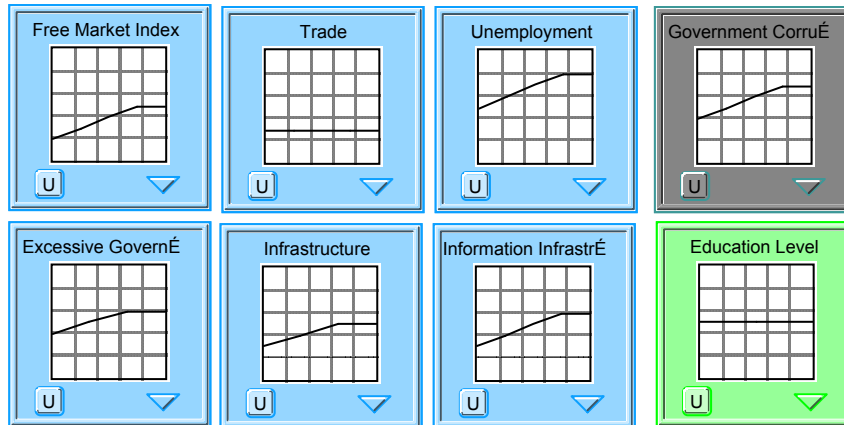


Violent Non-State Actor (VNSA) Framework

- VNSA have life-cycles: genesis, growth, maturity, transformation
 - Maturity: functional differentiation, environmental scanning, reorganization of input, product export
- Life-cycle characteristics: at the intersection of environment and psychology
- Relevant variables are efficiently modeled using dynamic system assumptions
- Ideally, a model will allow us to predict and control VNSA ontogeny
 - Realistically: all we seek is increased understanding/insight
- Begin with stakeholder functional decomposition: execute agenda, acquire material, attract people, develop agenda, propagate agenda, gather intelligence, protect critical organs

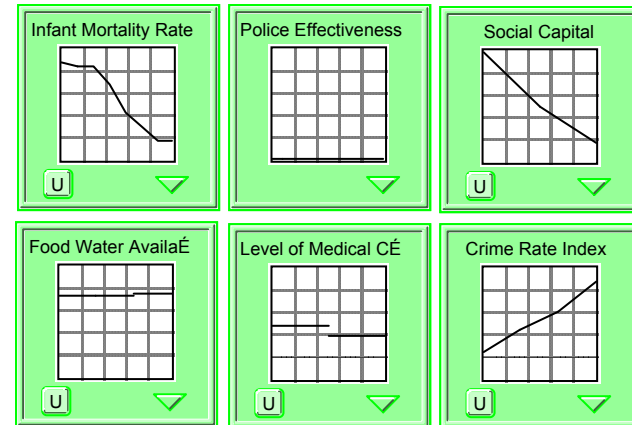
Variable Interface

SMITH VARIABLES



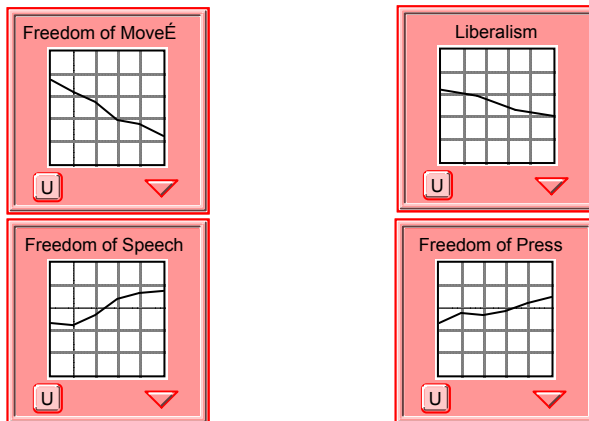
Smith Quotient 0.27

MASLOW VARIABLES



Maslow Quotient 0.2

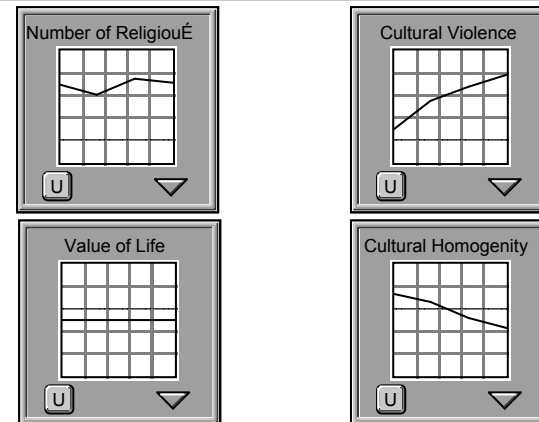
DEWEY VARIABLES



Dewey Quotient 0.52

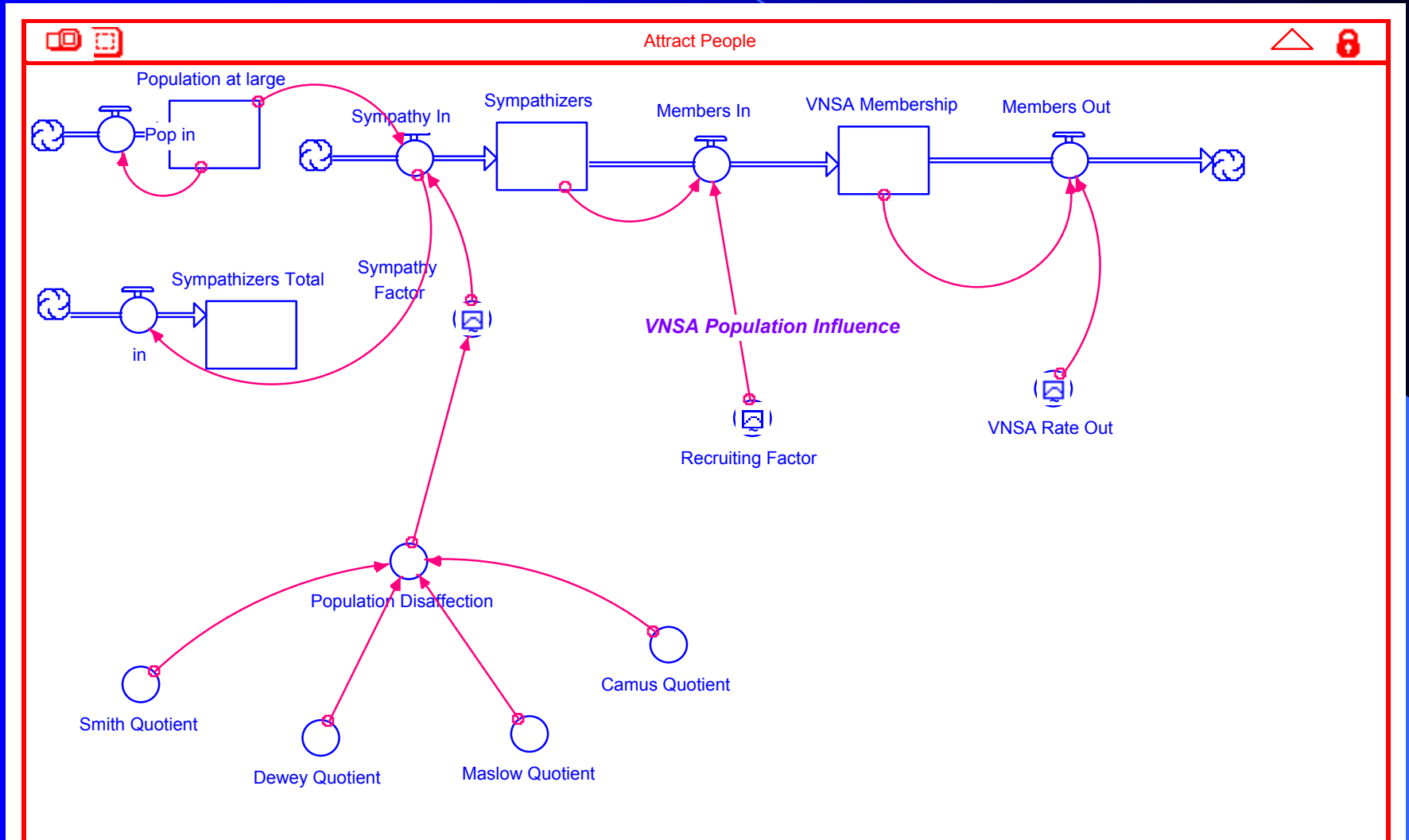
Return

CAMUS VARIABLES



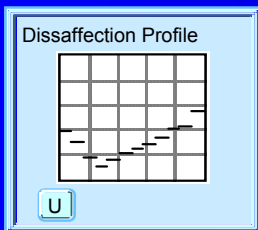
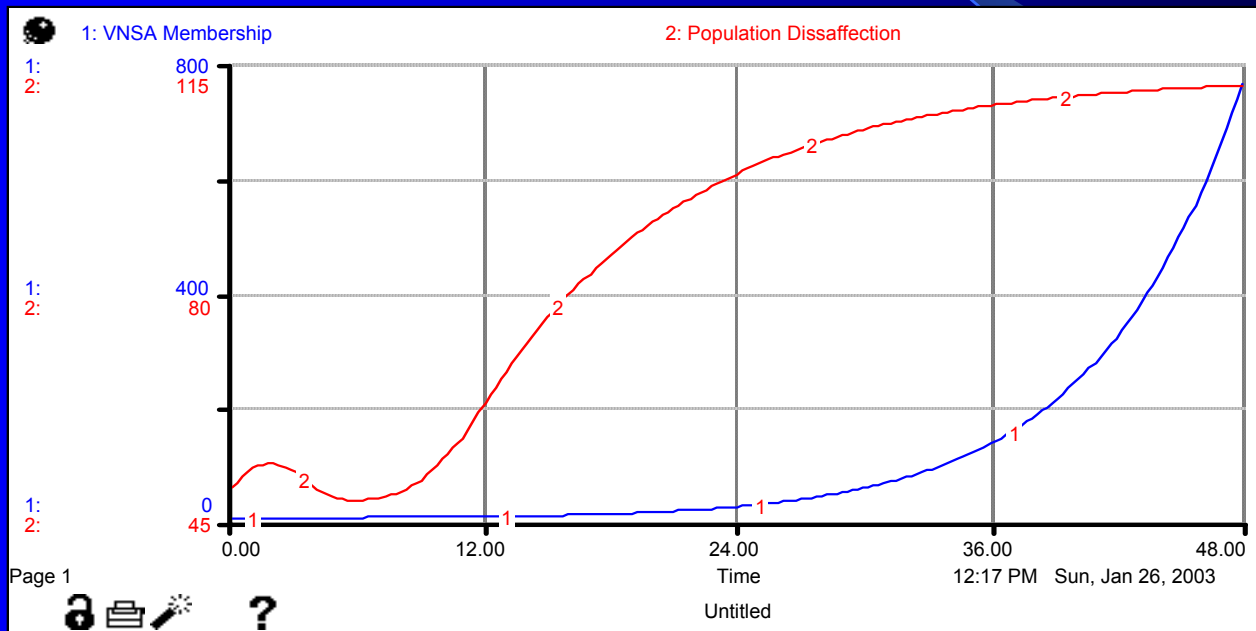
Maslow Quotient 0.17

Structural Relations Derived from Matrix

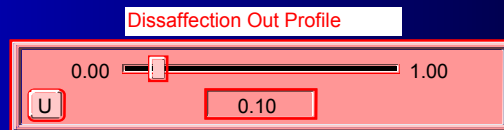
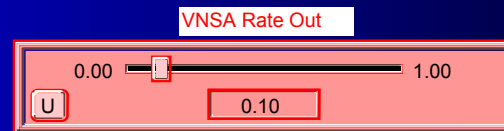


Systems-level Model Disaffection & Growth Module

- Output of model:

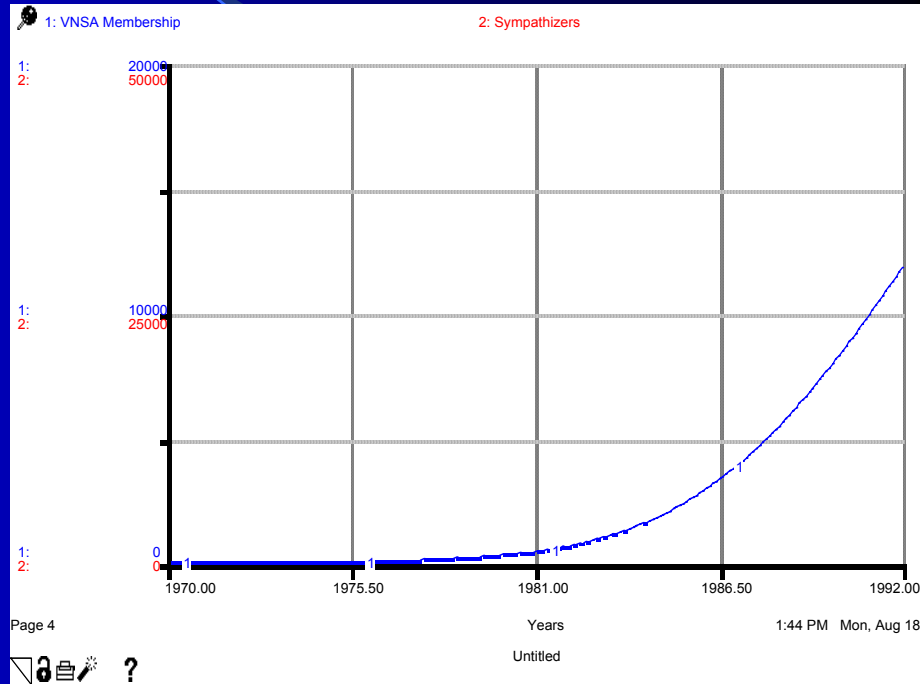
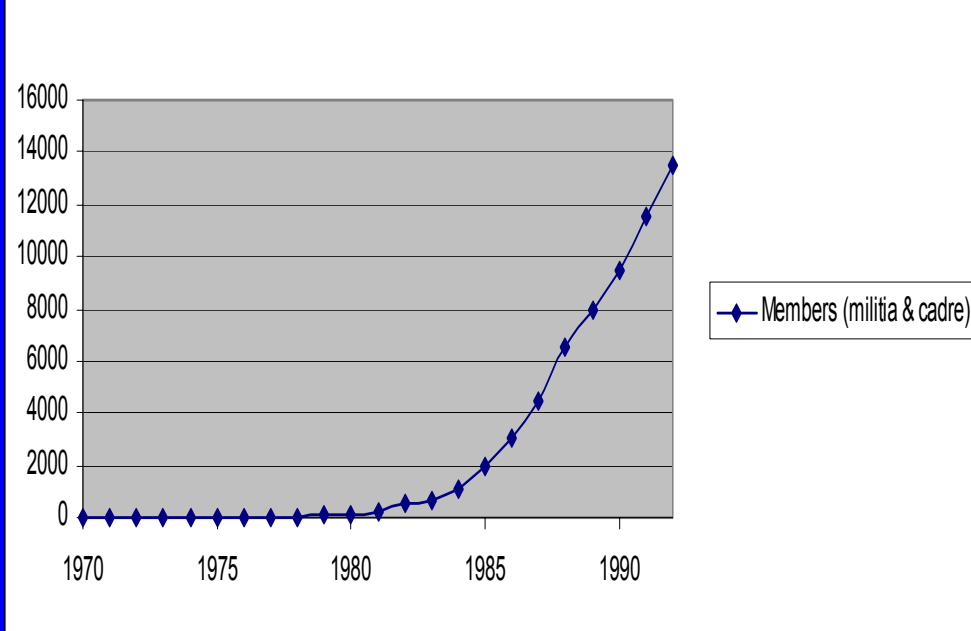


Run



Results and Model Demonstration: Quantitative Case Study of Sendero Luminoso

Members (militia & cadre)



Page 4

Years

1:44 PM Mon, Aug 18

Untitled

Bonus: Model matched only data point for SL sympathizers (50,000 people)...note data anemia

Advantages of the Methodology

- Efficient and cost effective process
 - Santa Fe Institute experience:
 - *Working model...significantly less cost*
- It offers a valid repeatable process for attacking Effects-Based Operations, Planning, and Analysis
 - Terrorism, Cadet Life, North Korea, Innovation
- It can usefully drive ISR requirements
- Friendly GUI = easy use for policy-makers
- Easily make on the fly changes to model
 - Assumptions can be manipulated by decision-maker

Research Agenda

- Develop additional modules for all functions
- Test model against other data sets/VNSA
 - Pro-active in solicitation...mine our own data
- Improve feedback relationships
 - Encourage community to focus research
- Disseminate agenda/product to community
- Questions?
- POCs: william.casebeer@usafa.af.mil;
jason.bartolomei@usafa.af.mil