Strategies & Operations: Smarter, Faster, Cheaper

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The Center that I belong to: DHS COE – CAOE
Center for Accelerating Operational Efficiency

Data Analytics

REAL-TIME RAPID RESPONSE

Operations Research and Systems Analysis

IMPROVING PROCESS AND DECISION TIME

Economic Analysis

UNDERSTANDING THE TRUE COST

Homeland Security Risk Sciences

IDENTIFYING AND PRIORITIZING RISK

CAOE – Academic and Industry Partners

ACADEMIC PARTNERS

- Arizona State University **(lead university)**
- Georgia Institute of Technology
- North Carolina Agricultural & Technical State University
- Northwestern University
- Spelman College
- The University of Texas at El Paso
- University of Albany (SUNY)
- University of California at Irvine
- University of Chicago
- University of Maryland, START
- University of Southern California

INDUSTRY PARTNERS

- Skysong Innovations
- Georgia Tech Research Corporation (CTRC)
- Los Alamos National Laboratories (LANL)
- Maricopa County (AZ) Emergency Management Department
- Pacific Northwest National Laboratory (PNNL)
- Sandia National Laboratories

CAOE – Real World Impact

- *Split-second decision-making*
- *Wise allocation of scarce resources*
- *Accurately predicting cascading consequences of natural and manmade disasters*

CAOE research, systems and technology provide homeland security agencies with real-time information, predictive tools for resource and response planning, and systems that increase the odds of resolving security problems.

For Today's CBP Presentation

Disclaimer: The analysis and content presented today represents my own research efforts. It does not cover the vast scope and capabilities of the entire CAOE Center.

Challenges and Opportunities

CBP Mission

- Custom: Passengers, luggage at land entry, cargos at ports, agricultural
- Border patrol: illegal immigrants and cargos
- Air and marine operations: illegal entry by air and water (human, weapons, narcotics)

Analytics: Modeling and Computation

- **Risk Detection**: assessment, economic impact, tradeoffs, cascading effect, potential downstream terrorist risks.
- **Operations Efficiency**: safer, faster, more effective
- **Agile Workforce**: safer, improved morale, adaptable, quick strike



What We Can Offer

- Strategies, tactics, operations
- Risk assessment and safety
- Rapid disease modeling, assessment, and containment strategies
- Modeling of Human behavior and emotion, cognitive intelligence, environment (physical, cyber),
- Efficiency and resource allocation
- Risk-informed policies and decisions
- Adaptability and real-time capabilities

Three examples that we analyze in CBP context -

I. Risk Assessment and Interdependencies
II. Situation Awareness and Quick Response
III. Operations Efficiency and Risk Reduction

I. Risk Assessment and Interdependencies

A scenario

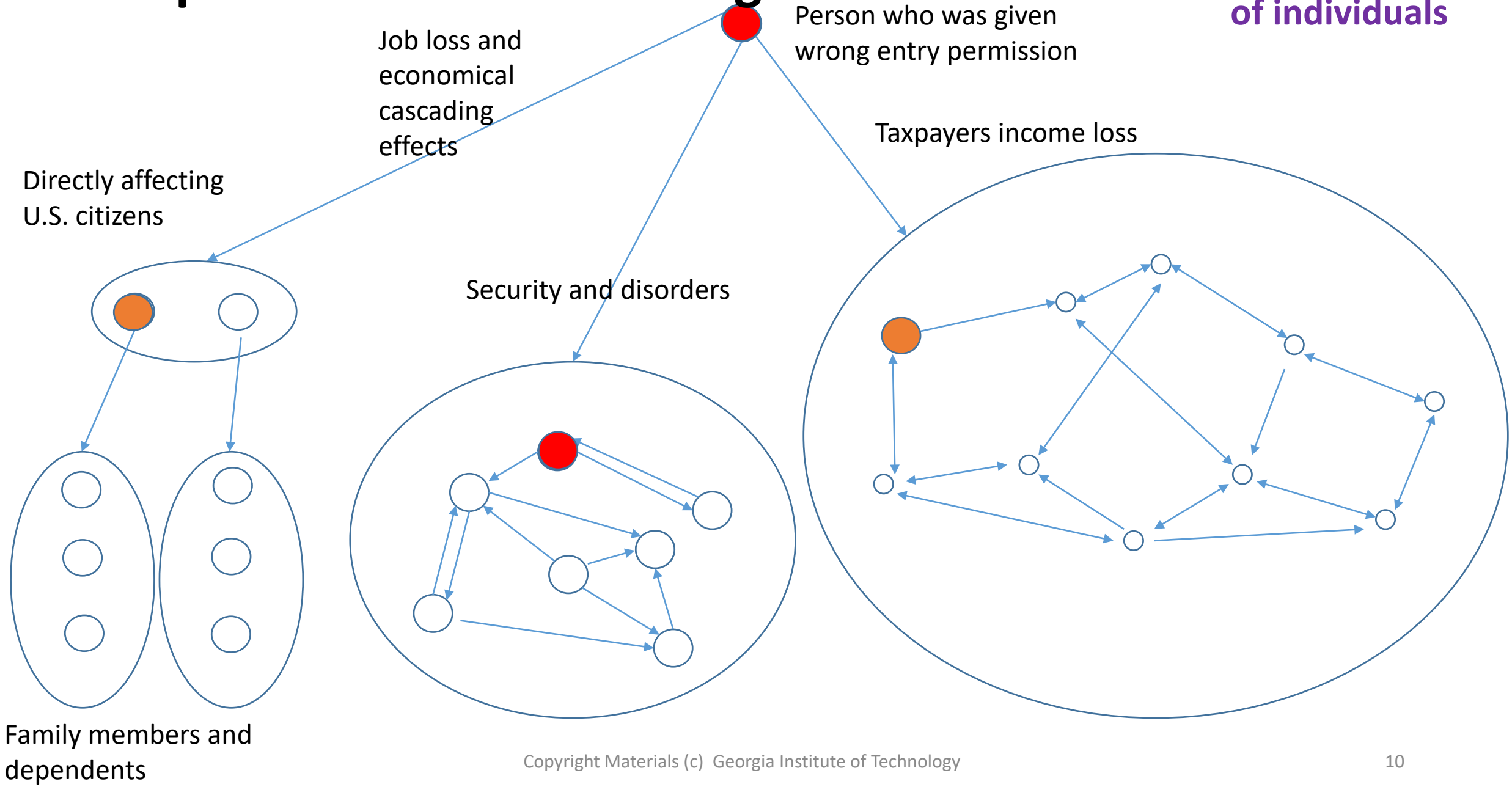
- Customs
  - Cyber threat: The identification database might be tampered allowing “risky” people (could be identified by fingerprint or facial) access to the U.S.
  - Unsuccessful entry intention check: Short term visa holders with intention to stay in U.S. permanently are not identified
    - Unnatural actions at the border examination.
    - Excessive luggages.
- Border patrol and air and marine operations
  - Unlawful entry to U.S.
    - Illegal immigrants.
    - Narcotics and other illegal substances.

A Scenario: Wrong entry permissions

- Wrong entry permissions could be given when:
  - Database is tampered that officers could not identify the people who had criminal records or proven to be harmful to the U.S.
  - Long-term stay intentions are not identified for short-term visa holders.
- Consequences
  - Safety of U.S. citizens is threatened.
    - Possible disorders, increase risks
  - Loss of working opportunities for U.S. citizens.
    - Family member and other dependents might be affected.
  - Unnecessary social welfare expenses paid by U.S. taxpayers.
    - Less disposable family disposable income.

Interdependencies & Cascading Effects

Wrong entry of individuals



Interdependencies & Cascading Effects

Illegal entry of food/drugs

Wrong product entered through inspection errors

Job loss and economical cascading effects

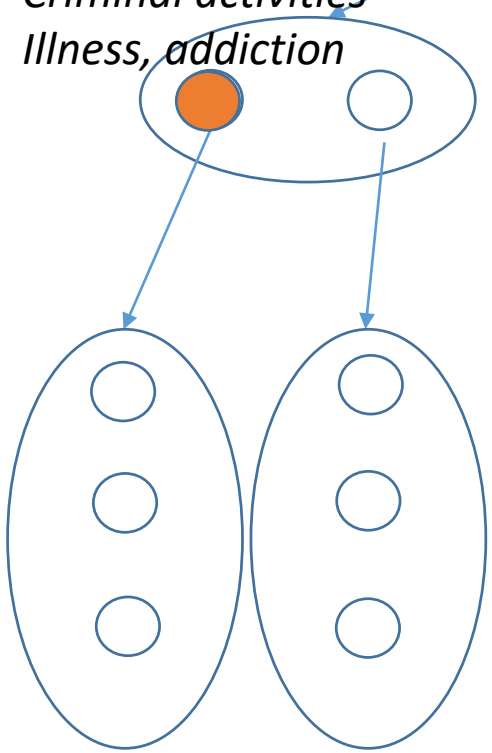
Directly affecting U.S. citizens

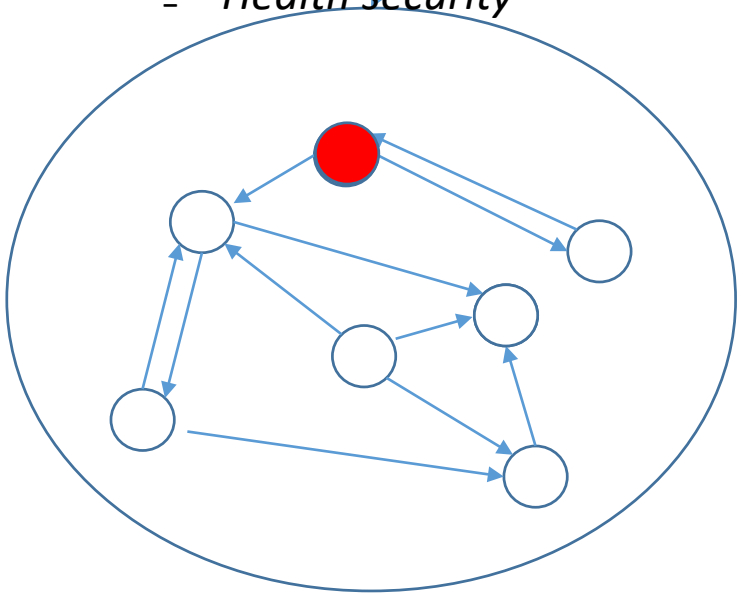
- *Business/Commerce*
- *Inferior/unsafe products*
- *Criminal activities*
- *Illness, addiction*

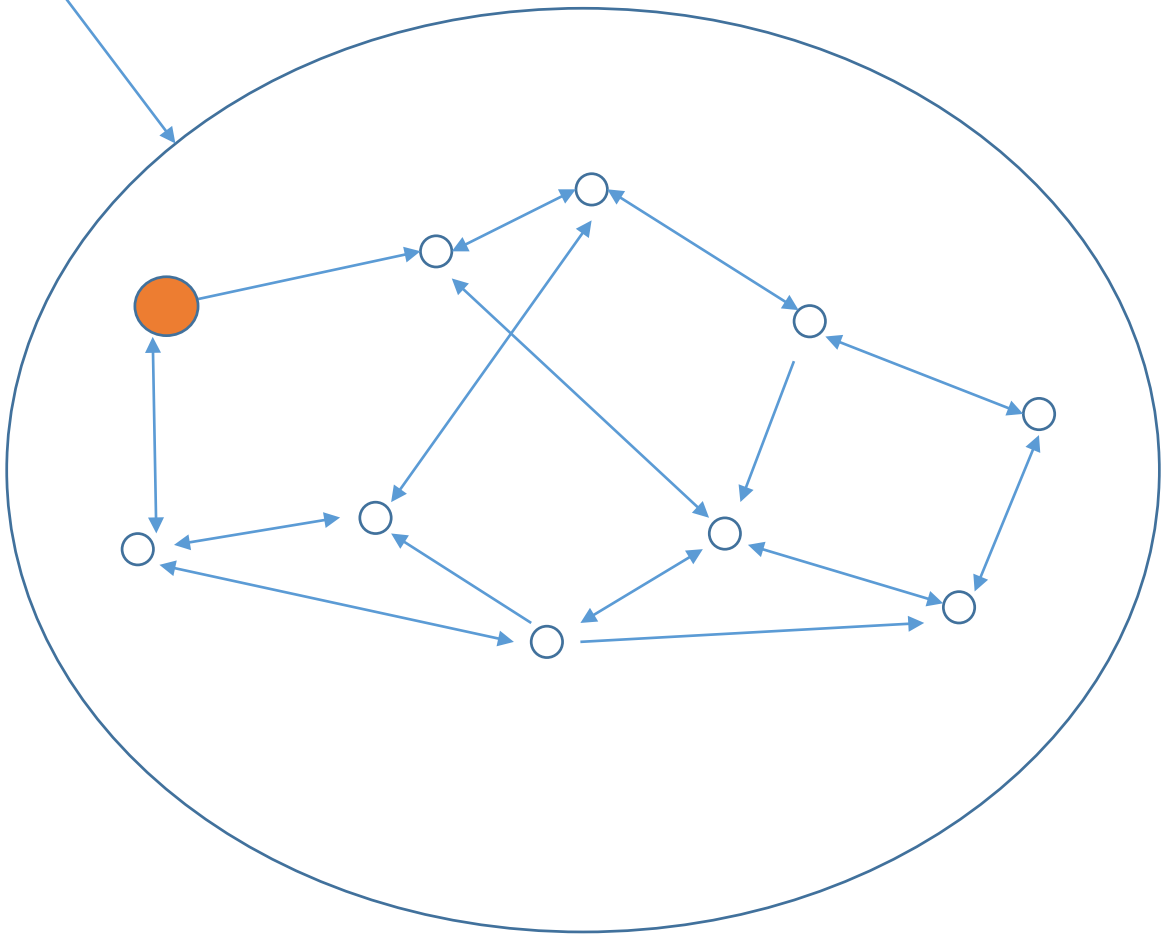
Security and disorders:

- *Disease spread*
- *Illegal/criminal drug activities*
- *Health security*

Taxpayers income loss



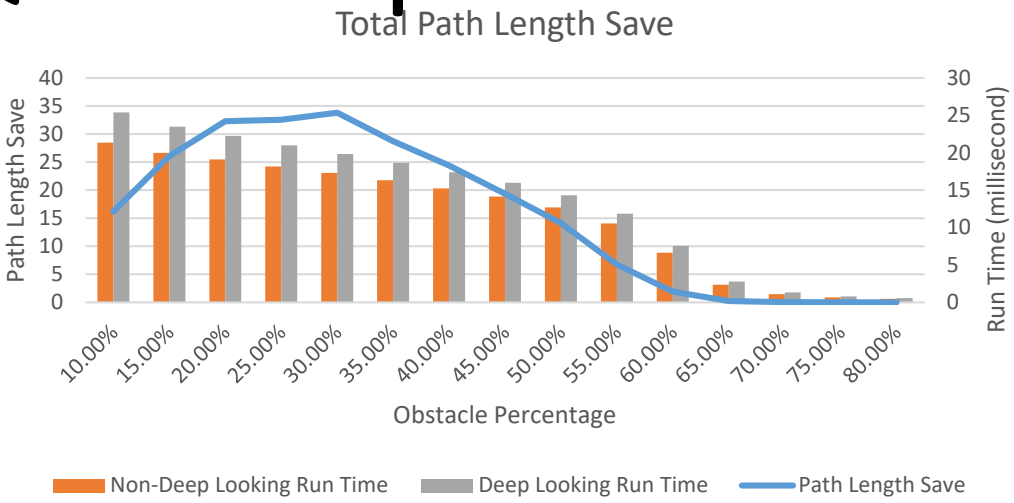


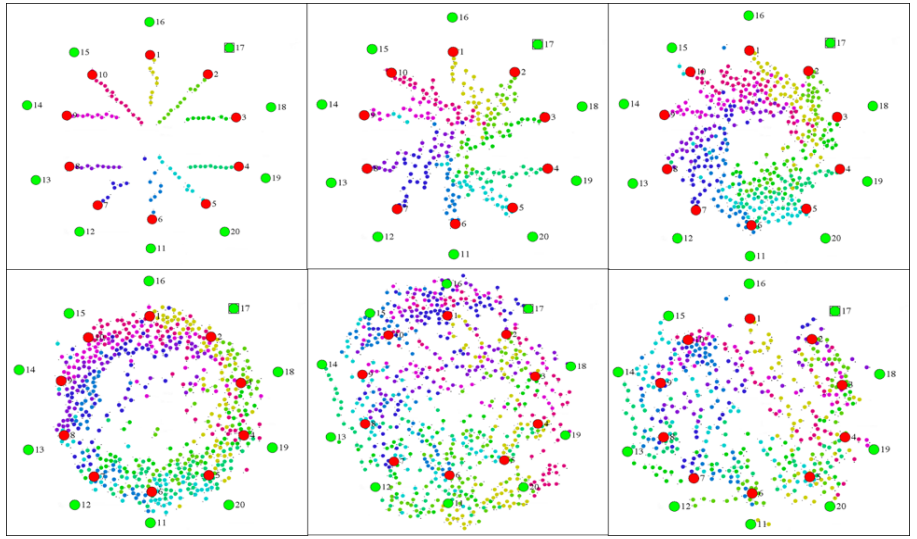


Family members and dependents

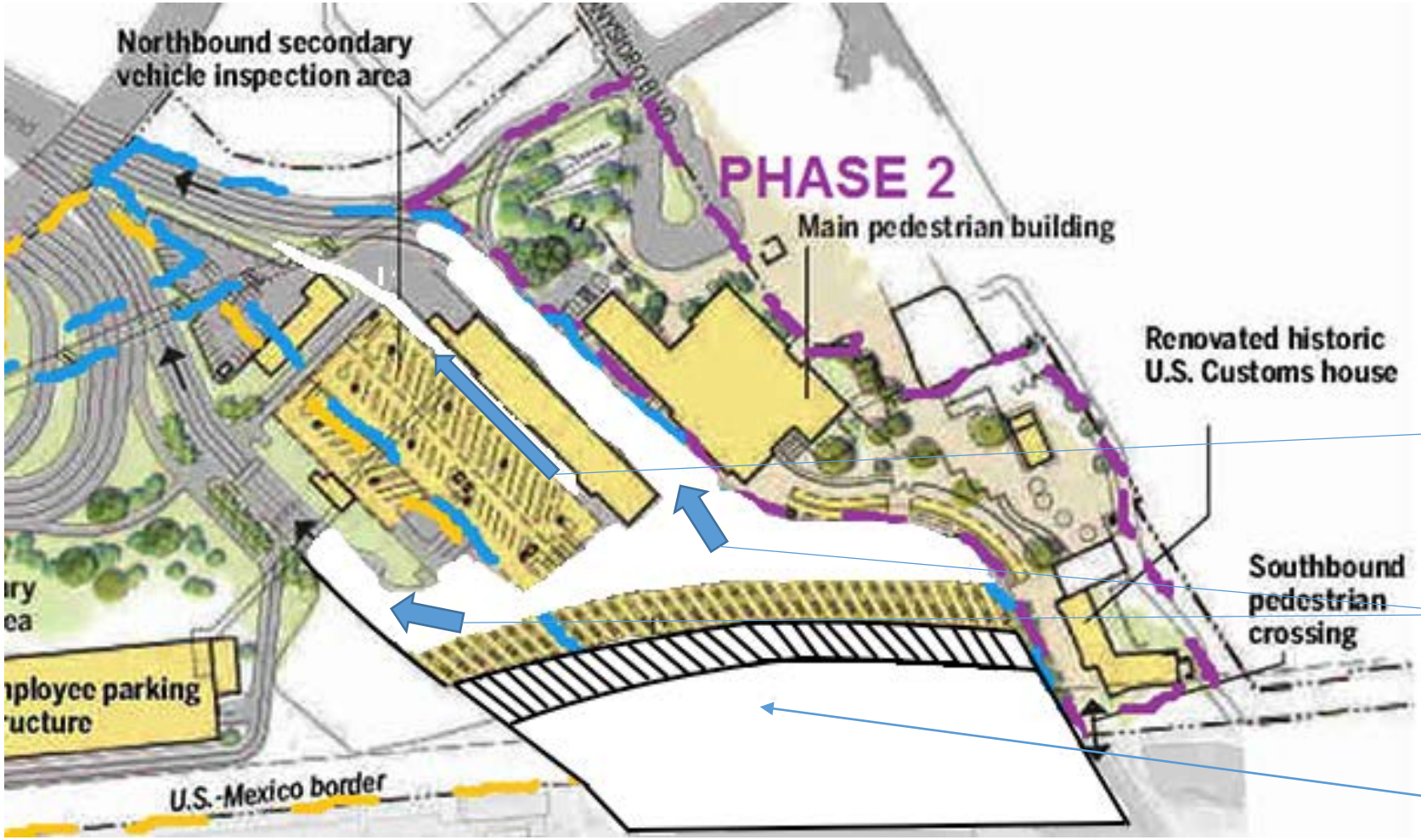
II. Situation Awareness & Quick Response

- Develop a multifunctional agent based simulation platform
- Incorporate logistics, operations, human behavior with emotion and information contagion
- Coupled with optimizer (deep learning, machine learning, & mathematical programming) *to facilitate real-time response*
- ***Model situation and operations for situation awareness and quick adaptive response***





San Ysidro Handles ~54000 vehicles Daily



Exit route after secondary inspection.

Exit route after primary inspection.

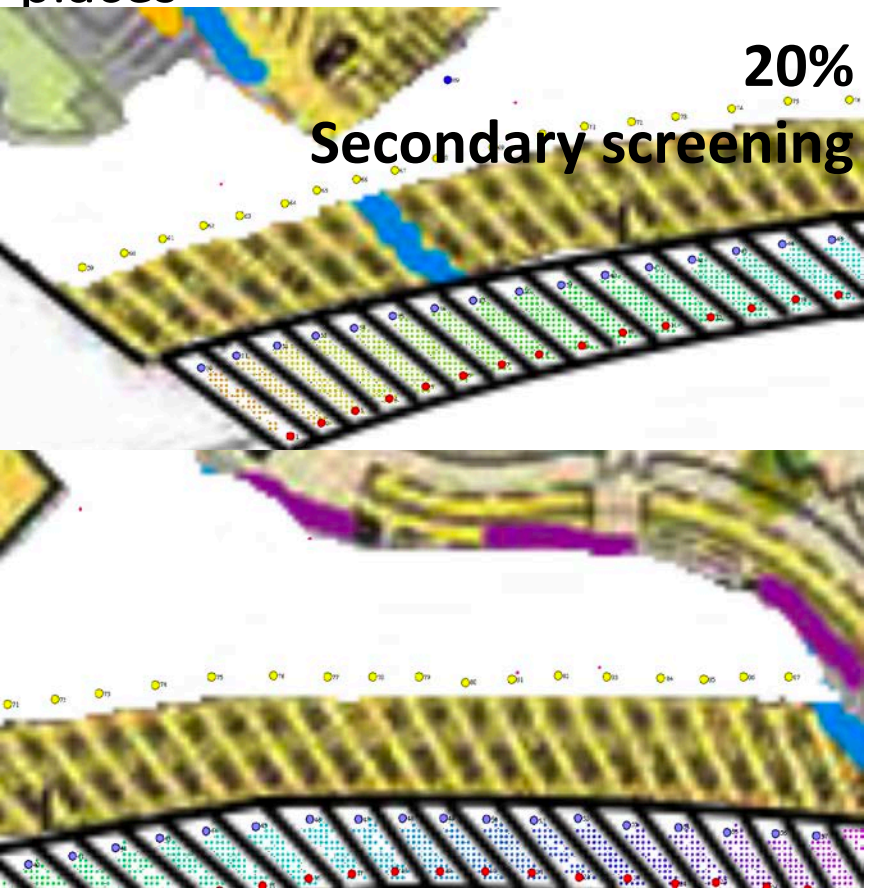
Incoming vehicles.

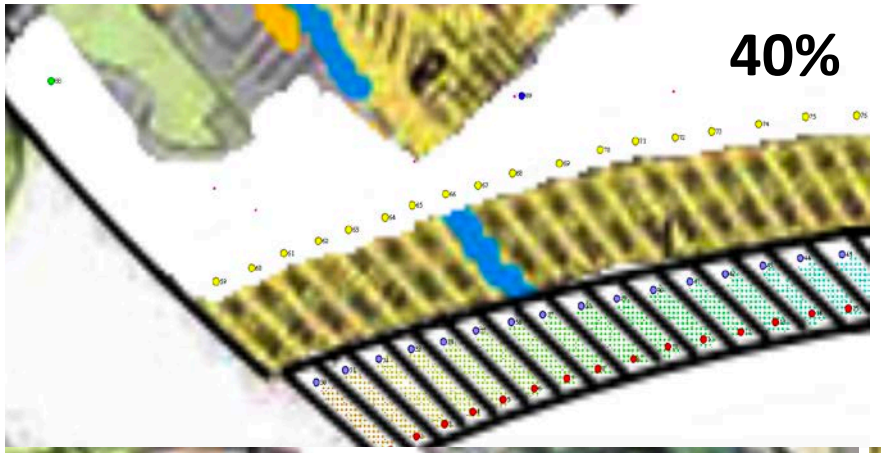
Real-Time Operations and Interventions

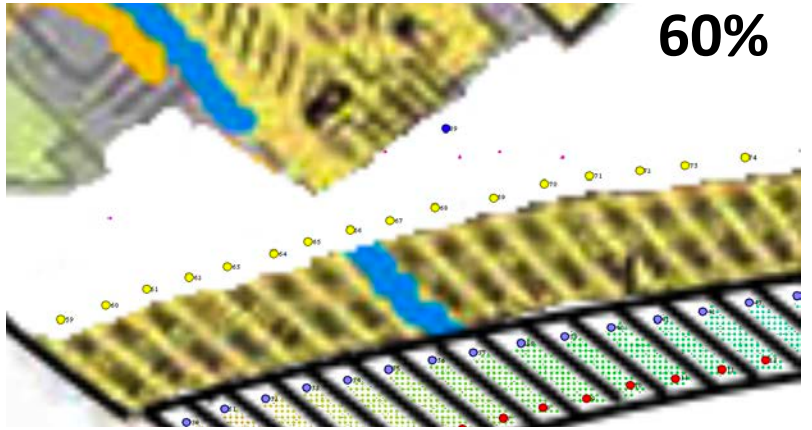
Congestions happen before entering the primary inspection places

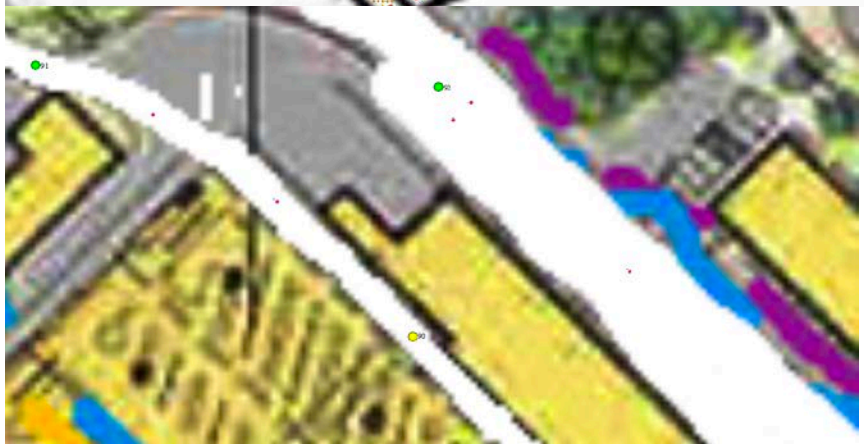
Similar to 20% secondary screening

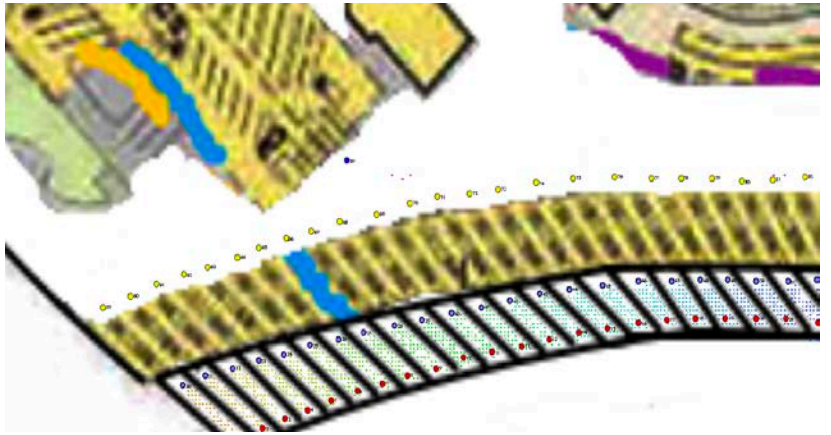
Large flow of traffic are directed to secondary inspection.







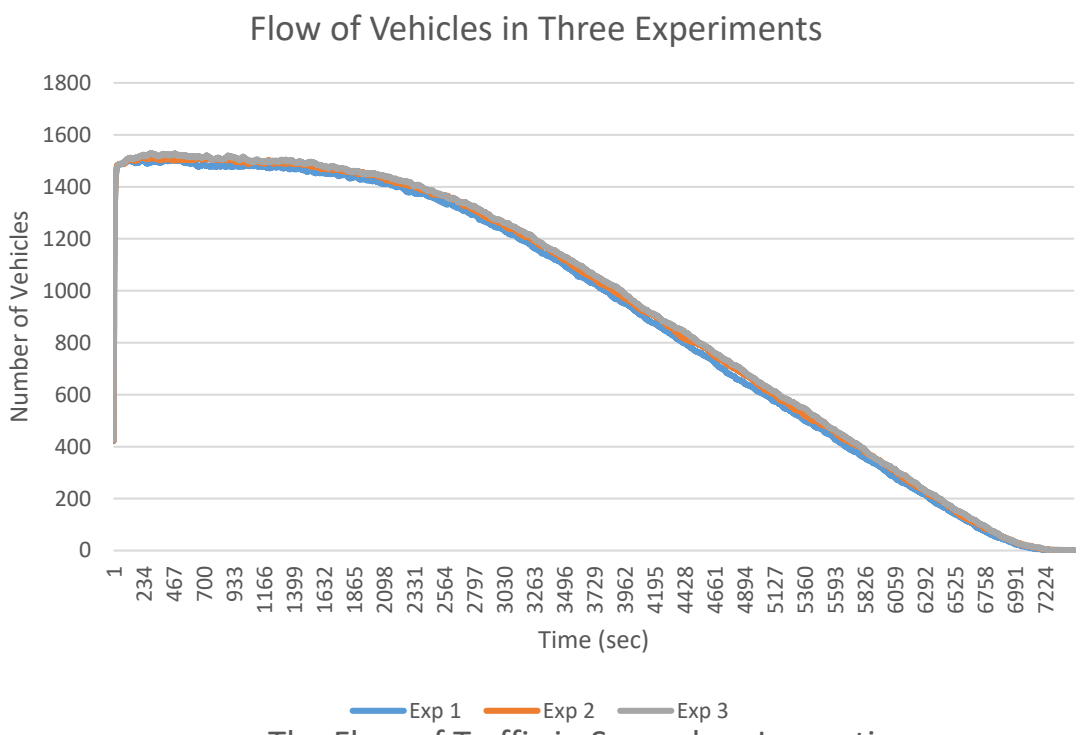


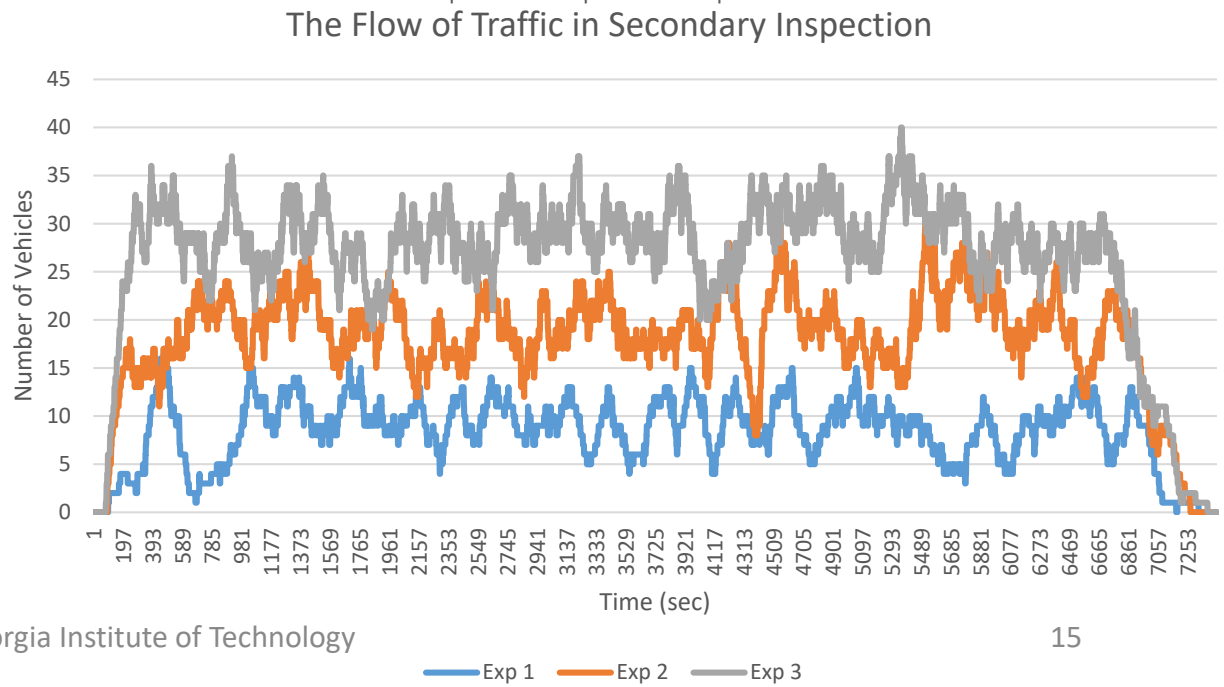


Comparing Results

- Logistic flow can be maintained efficiently
- Traffic flow in secondary inspection station is different, primarily due to increased volume vehicles being inspected.
- Increase of secondary inspection could push the limit of resource to its extreme

Optimize to handle larger volume and complex/intense tasks

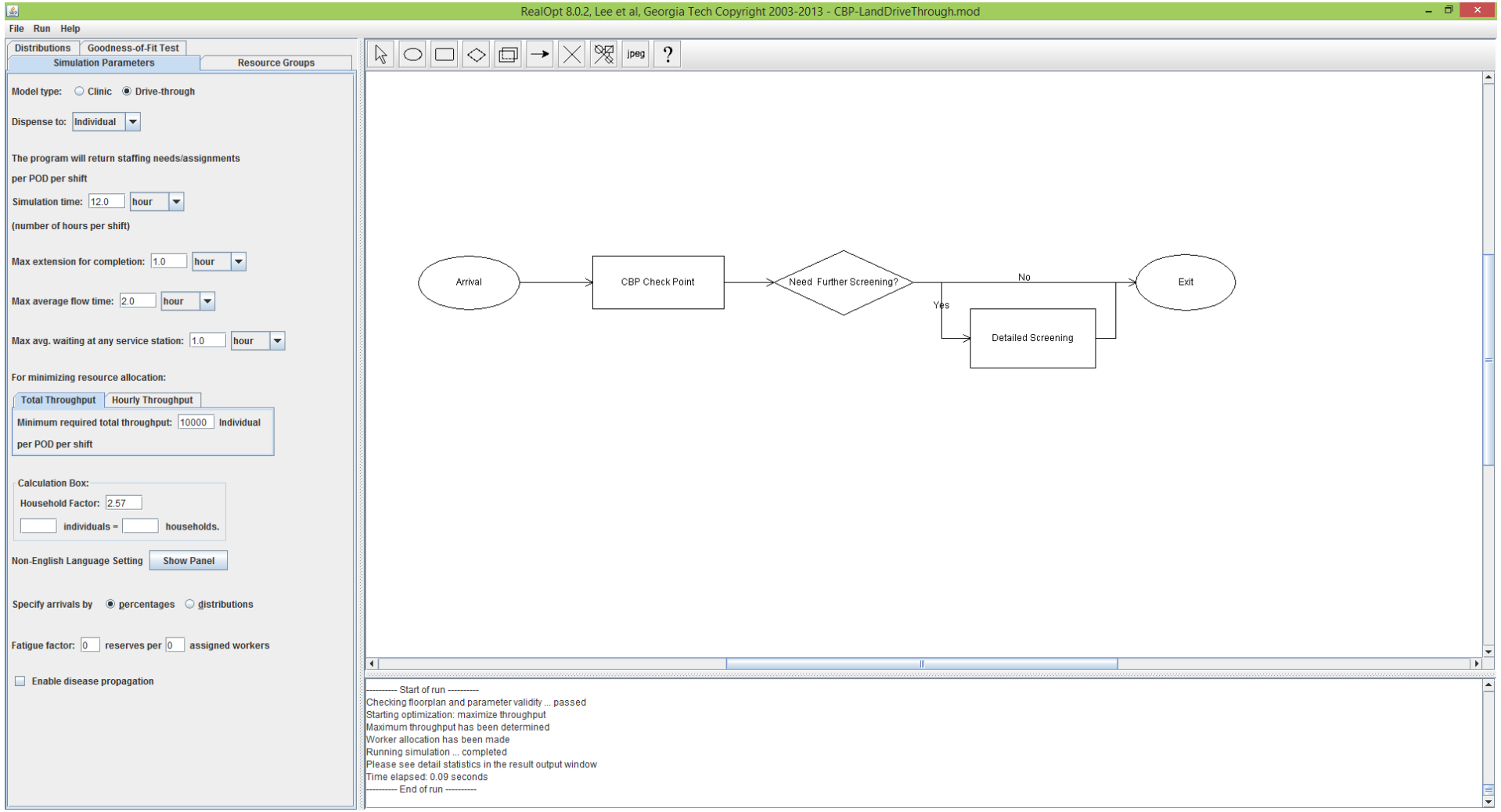




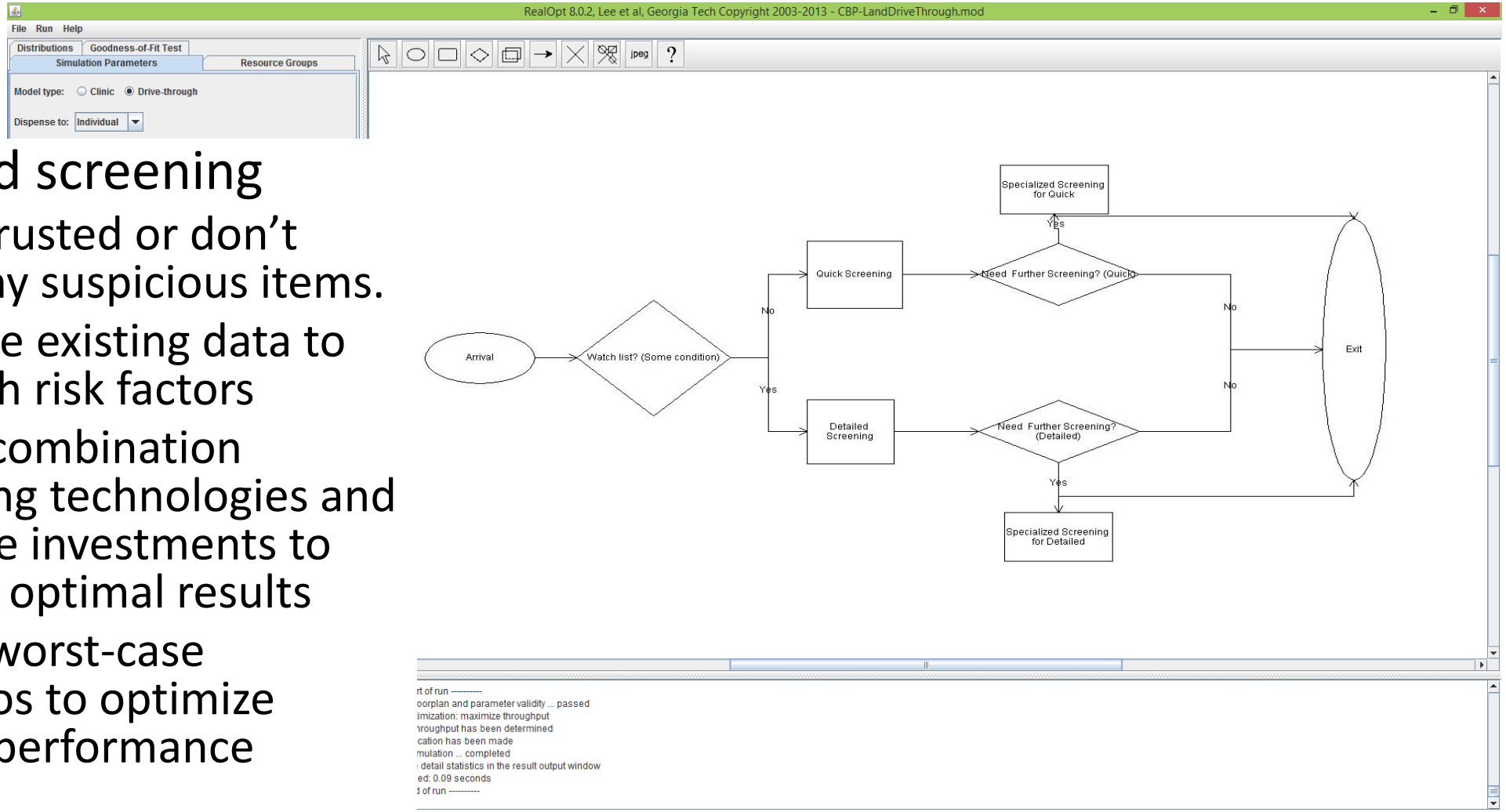
III. Operations Efficiency, Risk & Crowd Control

- Optimize systems performance: throughput, flow time, queue, wait-time
- Optimize resource allocation
- Control crowd & reduce risks (triage)
- Incorporate human behavior: operators service time, fatigue factor, emergency emotion; clients behavior, crowd emotion, uncertainties
- *Real-time dynamic updates*
- Apply to CBP land border checkpoint (human/products/agri)
- Data/knowledge-driven risk-based screening

CBP Land Border Checkpoint

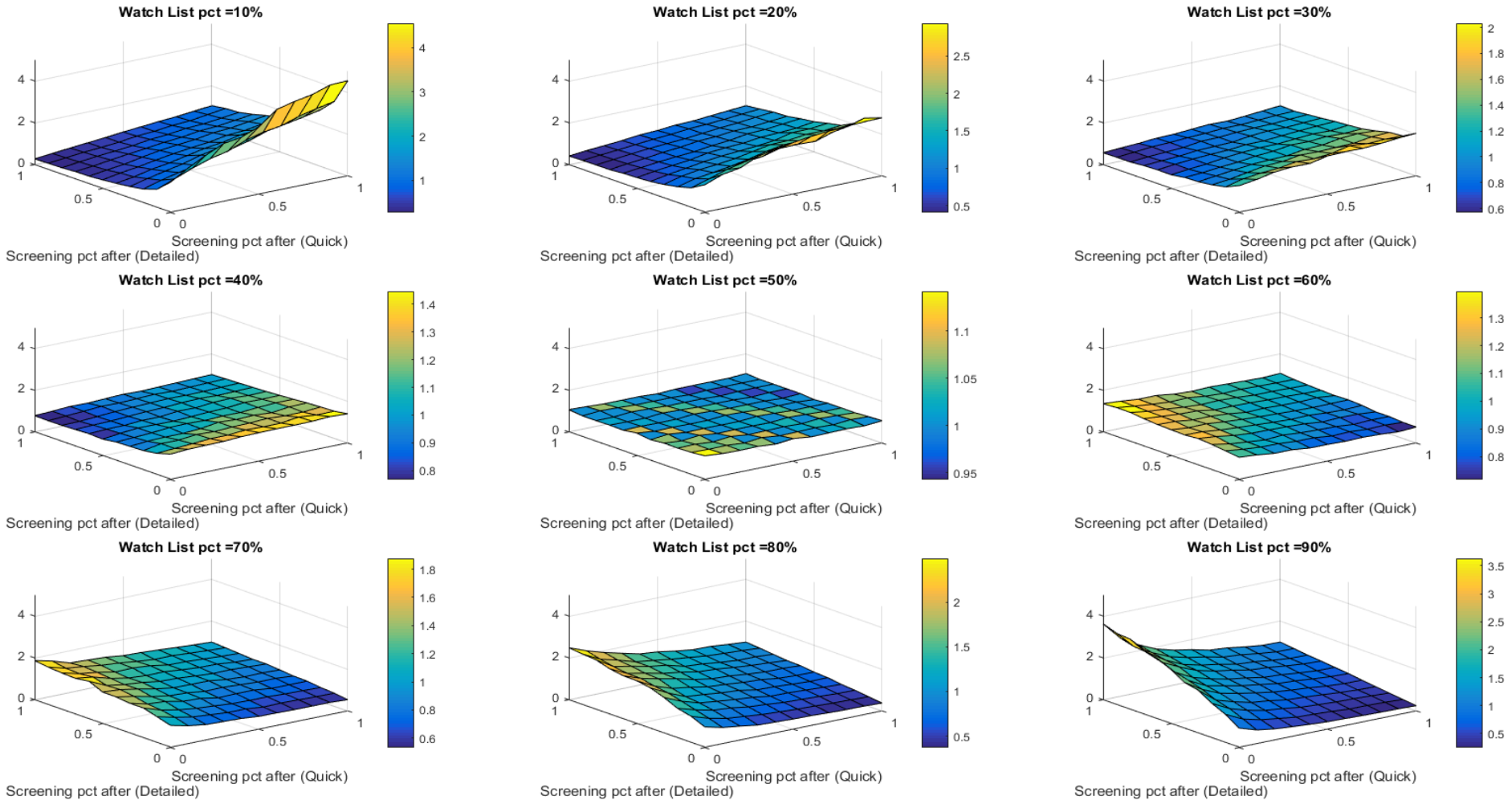


CBP Land Border Checkpoint



- Risk-based screening
  - highly trusted or don't carry any suspicious items.
  - Leverage existing data to establish risk factors
  - Model combination screening technologies and optimize investments to provide optimal results
  - Model worst-case scenarios to optimize overall performance

Gain in Performance: Sensitivity Analysis



Thank you

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