The Global Nuclear Detection Architecture

- Sources: Locations at which material might be obtained
- Pathways: Routes the material must travel to reach its destination
- Detection Sites: Locations of detector systems which may be able to interdict the material
- Targets: Locations at which the material can be used for nefarious purposes

Strategic Problem

- Deal with multiple ports: foreign ports and domestic ports
- Each of these nodes requires a solution to the tactical problem, different operation parameters at different port
- Detector deployment with limited budget: where to deploy what type of detectors?
- Radiography equipment at foreign port or domestic port?

Simple Network Problem

- Adversary has only one HEU source, and needs to determine when to put it into the container:
  - Before loading at the foreign port, with probability $p_O$
  - Infiltrating container during transit, with probability $p_I$, where $p_O + p_I = 1$

Radiography at Domestic Port

- Always obtain correct radiography information
- ATS system at foreign port, and HYB system at the domestic port
- Sojourn time increase at the domestic port due to radiography

Risk of Infiltration

- Infiltration will turn “easy” container into “hard” container
- Misclassification error and prior distribution change if radiography at the foreign port
- Correct prior information if radiography at the domestic port

Prior Information Adjustment

- Each container scenario has a different detection probability at the foreign port
- Inspection at the foreign port changes prior distribution, $P(q_{HEU})$ into the domestic port
- It is advisable to use the prior information and adjust the thresholds at domestic port

Numerical Example

- Results show that:
  - If infiltration probability is very low (close to 0), choose to install the radiography equipment at the foreign port
  - Otherwise, the radiography equipment should be installed at the domestic port