ELICIT Multistrike: Adapting ELICIT to Study Collaboration and Decision Making for Time-Sensitive Strikes

Nathan Bos, William Fitzpatrick, Nathan Koterba, Jennifer Ockerman, Max Thomas, Steve Carr and Jim Happel

APL
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

C2 and Decision Making

- Command and Control increasingly involves rapid decision making by teams that are geographically distributed. A commander will typically have some staff close by and other staff, often subject matter experts and analysts, providing information from another location.
- Prior research on geographic separation has shown that distance can inhibit trust, coordination, and information sharing.
- Better research tools and measures are needed to understand ***C2*** decision making in geographically separated teams and evaluate potential improvements in both communications and doctrine.

Naturalistic Decision Making

Orasanu and Connolly, 1993

- Ill-structured problems
- Uncertain dynamic environments
- Shifting, ill-defined, or competing goals
- Action/feedback loops
- Time stress
- High stakes
- Multiple players
- Organizational goals and norms

Geographically Distributed Collaboration

- Geographically distributed teams are not as efficient and effective as collocated teams
  - Coordination difficulty
    - (Gutwin and Greenberg, 2004; Teasley, et al., 2002)
  - Load balancing failure
  - Trust development failure
    - (Bos, et al., 2002; Rocco, et al., 2001; Cramton, 2001)
  - Lack of transactive knowledge
    - (Hollingshead, 1998; Woolley, et al., 2010)
- Partially geographically distributed teams magnify these issues

ELICIT Multistrike Project Objectives

- Conduct studies on geographically distributed C2 tasks
  - Evaluate how different distributions and quality of information affect collaboration (e.g., communication, rapid decision making, team situation awareness, team trust, cohesion, etc.)
  - Evaluate identified team performance/effectiveness measures' ability to differentiate between configurations
  - Evaluate physiological measures of team leader during high stakes decisions
- Make recommendations regarding the strengths and limitations of various command and control structures

Accomplishments To Date

- Prepared suitable experimental environment
- Planned initial experimental details
- Selected measures and prepare experimental materials
- Pilot tested experimental environment
- Wrote paper for ICCRTS 2011 and DTIC report

ELICIT Multistrike

- Built within ELICIT (Experimental Laboratory for Investigating Collaboration, Information-sharing, and Trust) developed by Evidence Based Research, Inc. for U.S. DoD (OASD/NII) CCRP
  - Investigate cognitive and social impacts of C2 organizational structure
- ELICIT Multistrike focused on
  - High risk decisions under time pressure
  - Multiple overlapping analytical problems

Experimental Hypotheses

- **Team performance, collaboration, and information sharing will be poorer when the team is geographically distributed**

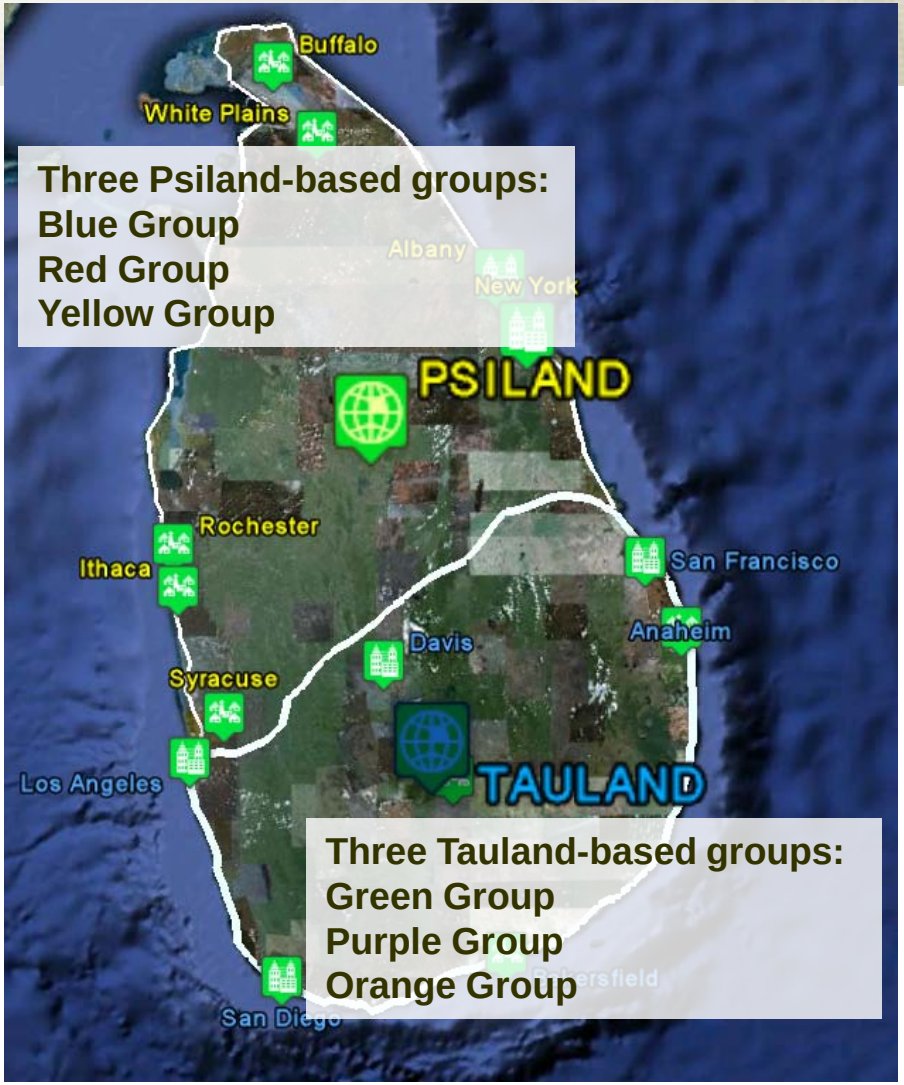
- **Trust will be stronger for collocated team members**

Experimental Task

- Pilot participants acted as members of a 7-person command and control team that:
  - received information via the web-based software platform called ELICIT,
  - rapidly shared distributed, partial information in order to identify the who, where, and when of a future terrorist attack planning meeting,
  - provided information to their commander who ultimately decided whether to strike a target and prevent the terrorist meeting.

Task Setup

- Six terrorist groups are meeting to plan attacks in the neighboring countries of Psiland and Tauland
- 7-person team trying to prevent these attacks by disrupting terrorist group planning meetings
- Team configuration:
  - Commander
  - 3 Psiland analysts
  - 3 Tauland analysts



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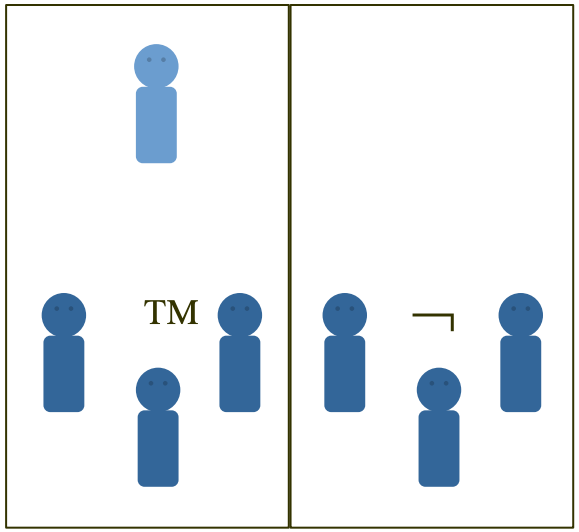
Experimental Setup

- Commander and Tauland analysts in one room
- Psiland analysts in separate room

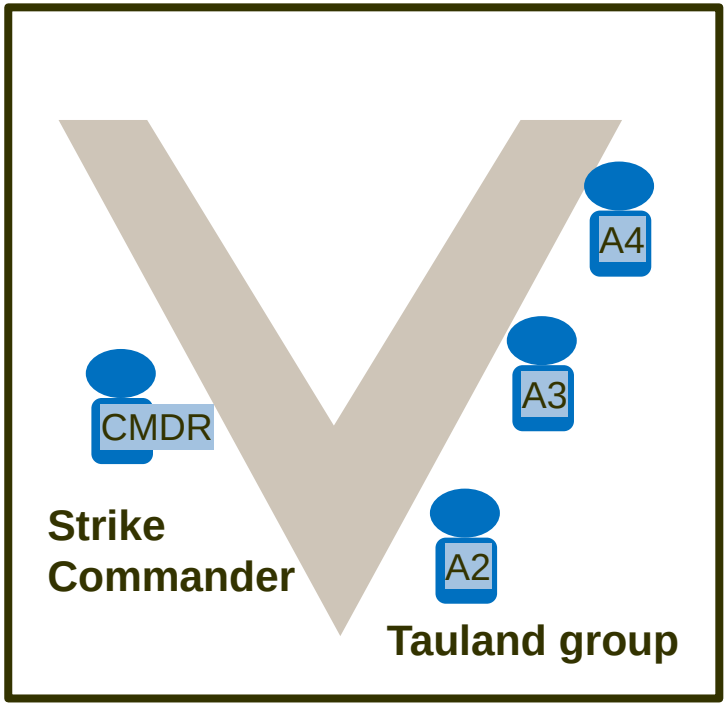
- All players have access to ELICIT and three chat rooms
  - Tauland room
  - Psiland room
  - Commander's room

- All communications to the commander go through chat

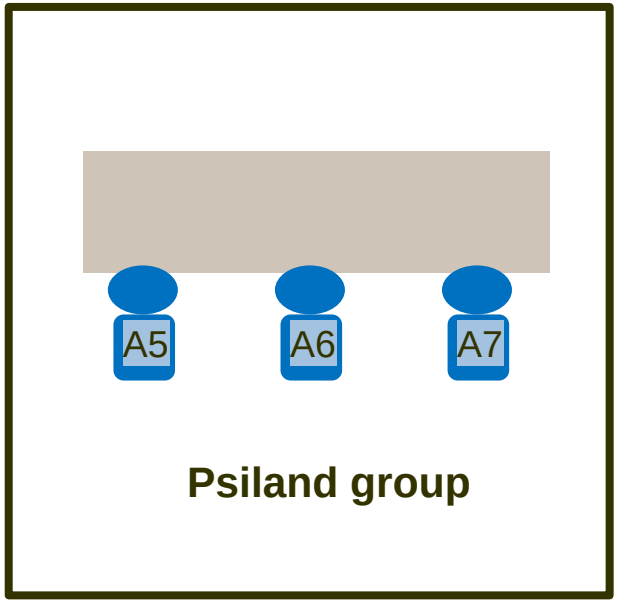
- Talking is allowed within each room



Team Configuration



Collocated room

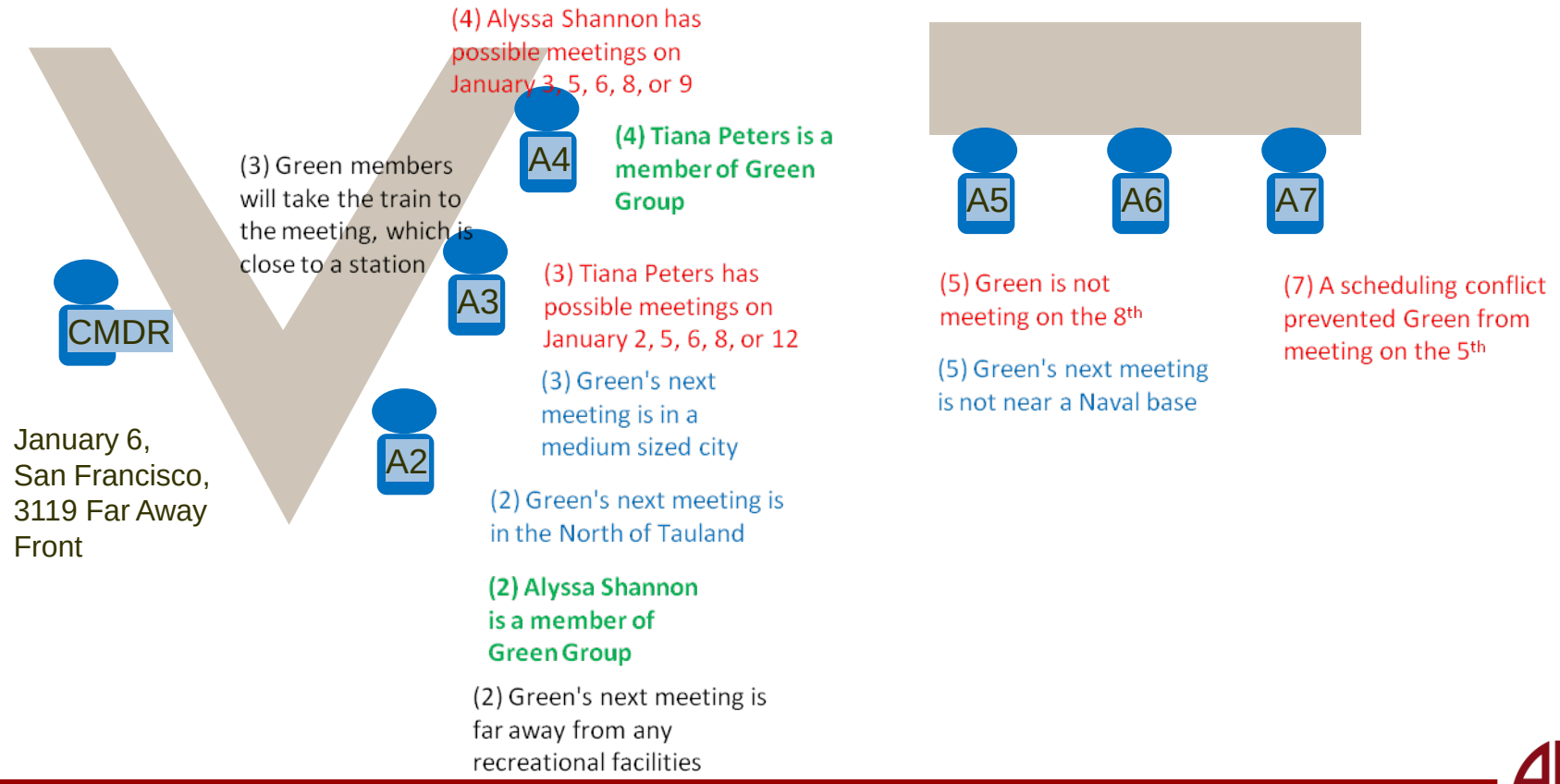


Remote room

Example Information Distribution

- **Where/ when is Green meeting?**

Factoid types:
People
Date
City
Address



Example Address Look-up Table

ID	City	Name	Type of Building	Closest Recreational Facility	Near a Major Highway?	Near a Construction Site?	Age of Structure (years)	Nearest Public Transportation
18	New York	2112 Hopper Street	House	swimming pool	yes	yes	12	Bus stop
19	New York	897 Oak Tree Road	Hotel	none	yes	no	15	Metro
20	New York	553 Runner Circle	Public Building	swimming pool	no	yes	20	Railroad
21	New York	7880 Whiskey Bottom	House	city park	no	yes	25	Railroad
22	New York	4343 Lincoln Lane	House	city park	no	yes	33	Railroad
23	New York	8899 Merganzer Drive	House	swimming pool	no	no	30	Bus stop

Timeline of All Meetings

Each day was 5 minutes for a total of 60 minute trial

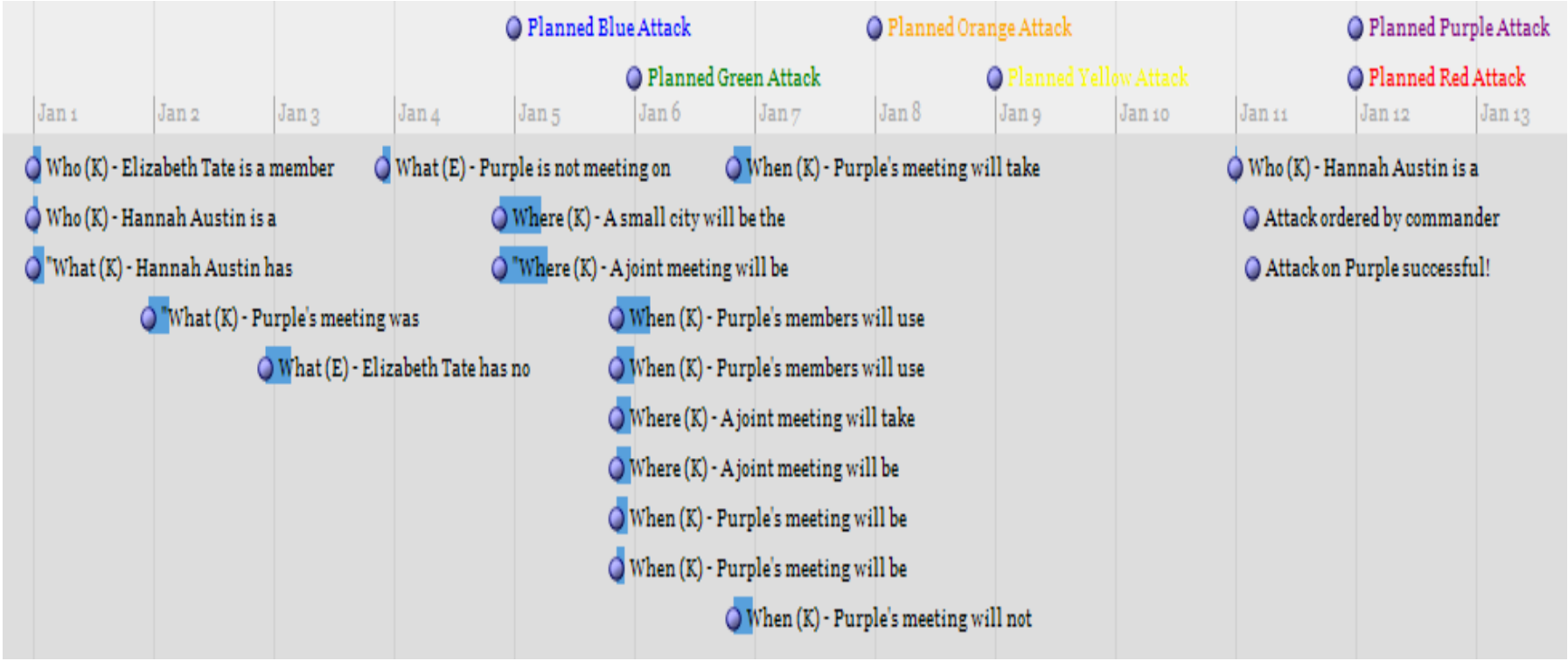
Metrics

- Decision Quality
  - Accuracy – ratio of correct to incorrect
  - Speed – time to make decisions
- Collaboration
  - Number of posting & collaboration specifics
  - Chat activity
  - Group Processing Scales (team cohesion)
  - Relationship Rating (trust)
- Situation Awareness
  - SART (Situation Awareness Rating Technique)
- Workload
  - NASA TLX (Task Load indeX)
- Bio-metrics
  - Eye-tracker indirect measure of collaboration

Data Collection

- ELICIT logging
- Chat collection via JHU/APL developed chat collector
- On-line survey data collection via Vovici
  - Demographic survey
  - Automated Neuropsychological Assessment Metrics (ANAM)
  - Situation Awareness Rating Technique (SART)
  - NASA Task Load indeX (TLX)
  - Group Processing Scales
  - Team Relation Rating
- Eye-tracker logging (commander only)

Team Activity Timeline



Initial Pilot Run Results

- ✓Ensured connectivity
- ✓Ensured software applications were compatible with hardware
- ✓Created and employed on-line surveys
- ✓Acquired, positioned, and utilized eye-tracker
- ✓Defined experimenter roles and responsibilities
- ✓Showed that ELICIT could be manipulated and modified to suit our purpose
- ✓Ensured scenario and factoid logic
- ✓Ensured data we intended to collect is in fact collectable
- ✓Ran pilot participants

Future Activities

- Refinement of experimental designs, metrics, and data collection
- IRB approval
- Participant recruiting
- Execute experiments with at least 10 groups
- Analyze data
- Publish internally and externally
  - Recommendations on best methods for measuring and analyzing C2 team performance and behaviors
  - Recommendations on strengths and weaknesses of various C2 organizational structures

Thank You