Robot Platoon Command & Control (RPC2)

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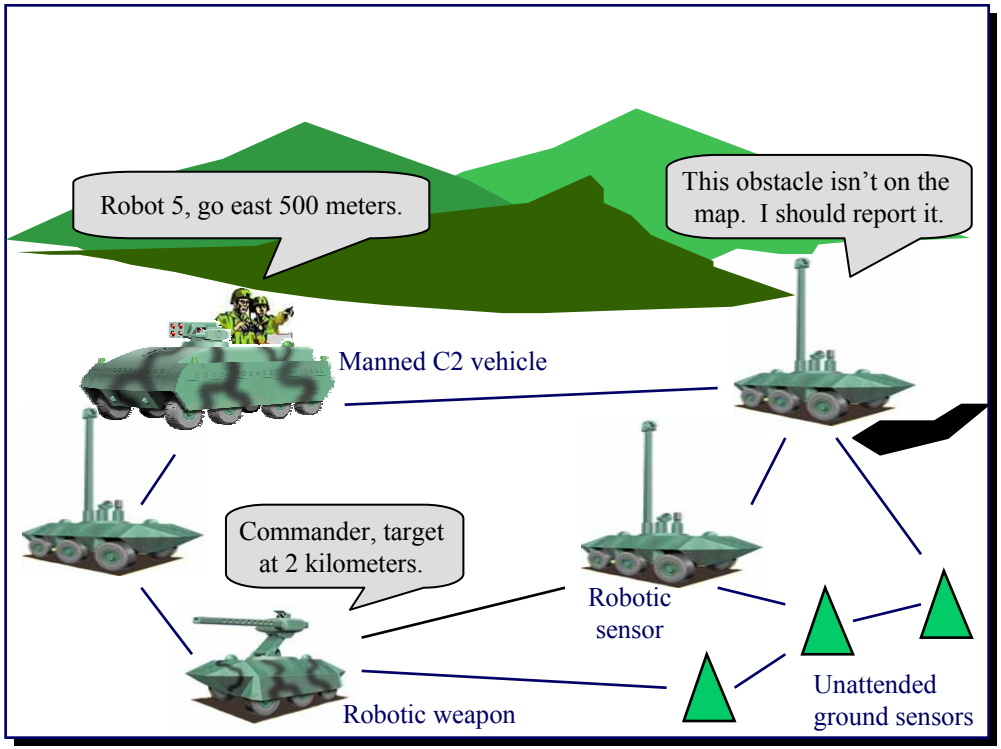
MITRE Sponsored Research

MITRE Technology Program

Problem

Enabling autonomous systems and humans to work together effectively

- Coordinating teams of robots for surveillance or reconnaissance
- Human-robot interaction
- Semi-autonomous behaviors for the robots
- Dynamically varying degree of human supervision



Future Combat Systems Cell Concept

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Background

Search and Rescue Tasks

- Find target(s) within a known space
  - Perform mapping as needed
- Report target location
- Create extraction plan
- Perform extraction

New York, NY, September 21, 2001 -- These rescue workers emerge from the pile of rubble at the World Trade Center.

Photo by Andrea Booher/ **FEMA News Photo**

Our focus: search teams for target localization

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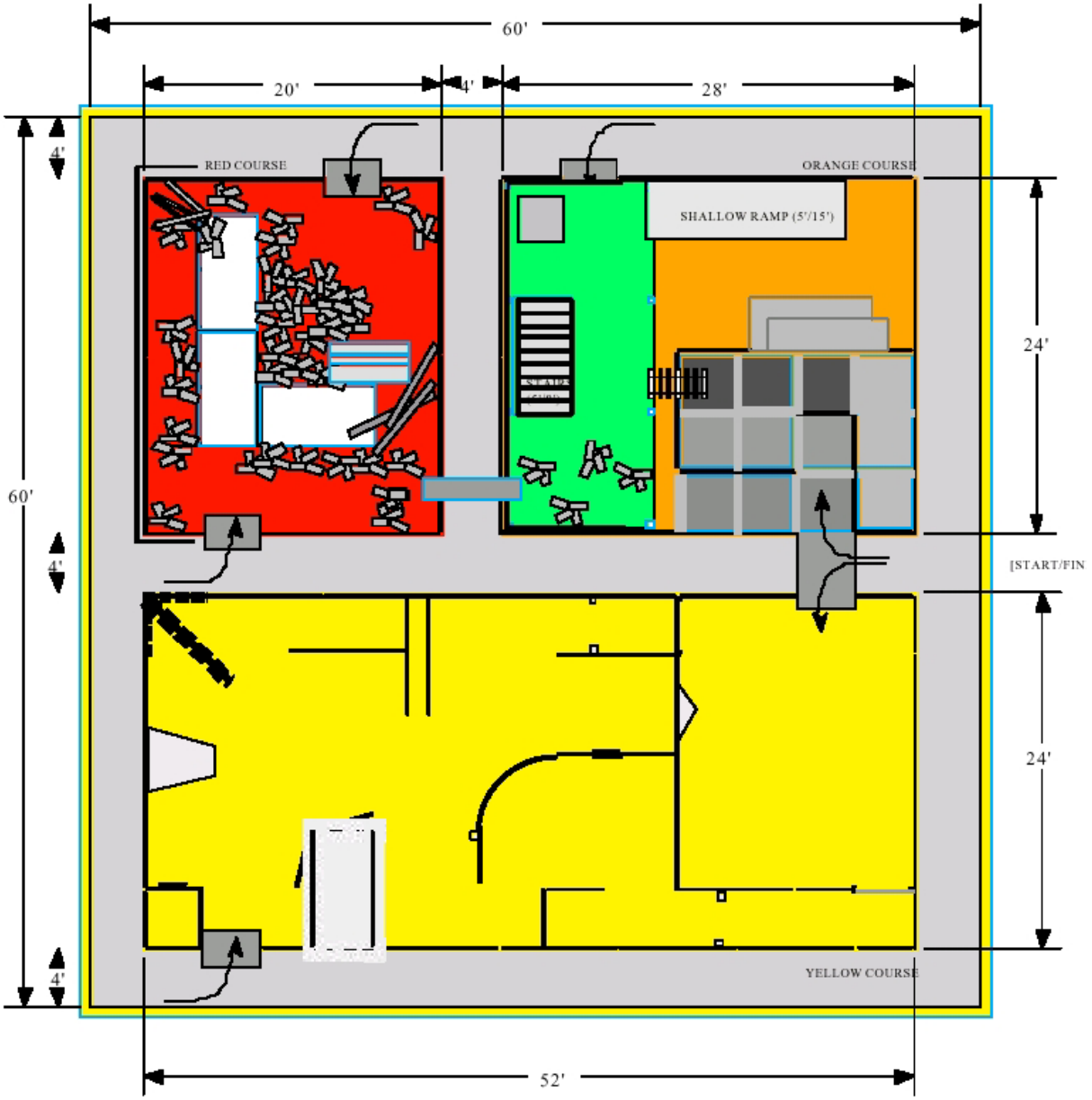
Objective

Demonstrate collaborative human-robot teaming

- **Testbed: NIST Search and Rescue Test Course**
- **Challenge: RoboCup Rescue and AAAI / IJCAI Robot Rescue Competitions**



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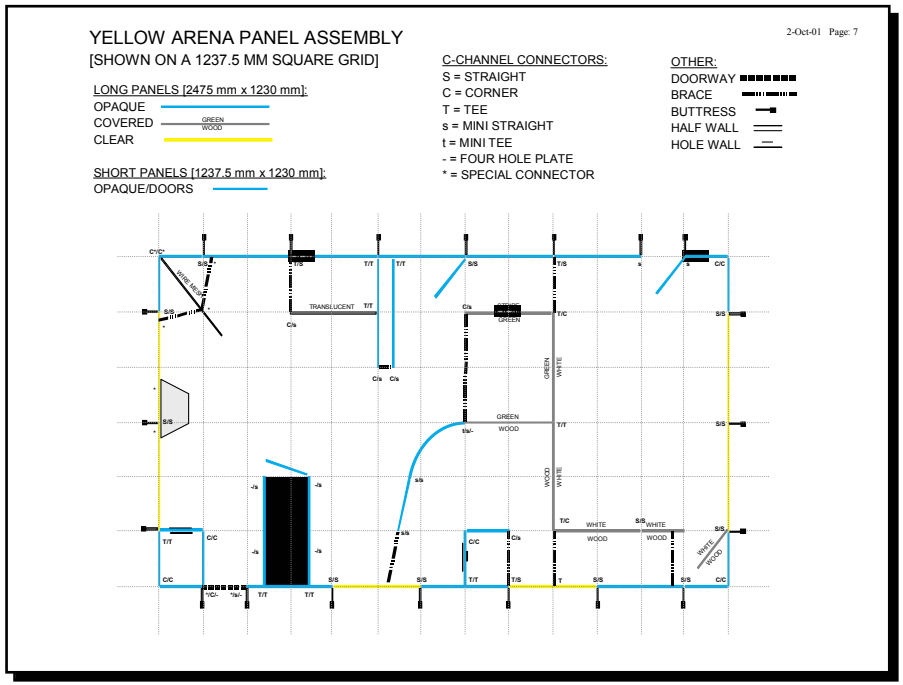
Activities

- Test Course Construction
- Development of:
  - Sensor processing
  - Simultaneous localization and mapping
  - Obstacle avoidance, navigation, and path planning
  - Coordinated search behaviors
  - Human-robot interface
- Observation of AAAI-02 Robot Rescue Competition
- Preparation for Competition at RoboCup Rescue 2003



MITRE robot in arena at AAAI-02 Robot Rescue Competition

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Highlight

Cooperative Mapping

- Central map allows combining and sharing data among robots
- Separate map layers represent obstacles, regions to investigate or avoid, potential or confirmed victims, and robot locations

- Operator can perceive sensed information and use the map to specify location-based commands

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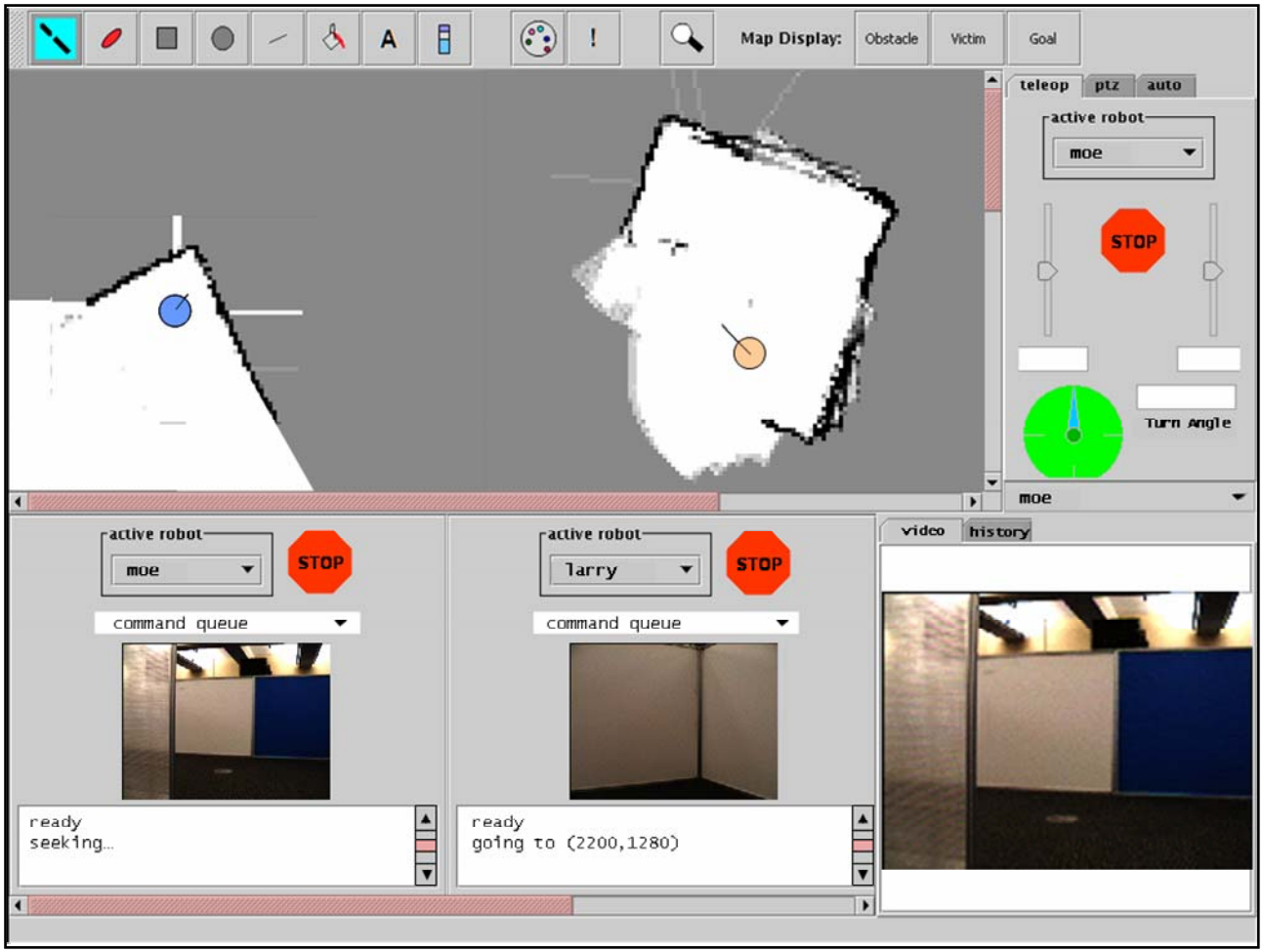
Highlight / Demonstration

Human-Robot Team Interface

- Global map
- Robot state monitor
- Real-time camera feeds
- Teleoperation and camera controls
- Selection of behaviors
- Command history



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Impacts

- Extend MITRE's expertise in command and control into the robotics domain
- Prepare to meet sponsor needs during the next 10 years
  - Future Combat Systems
  - Autonomous ground, sea, and air vehicles
  - Autonomous teaming and coordination
  - Automated reconnaissance
- Develop expertise in human-robot interaction

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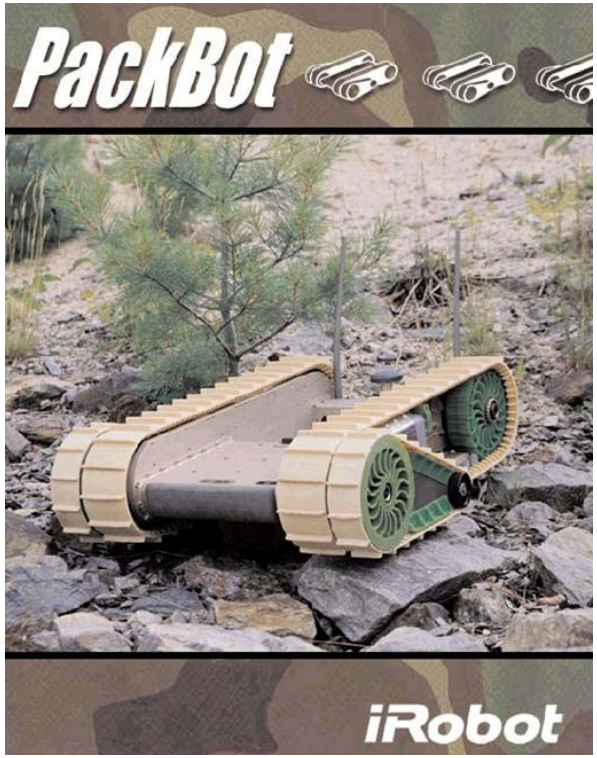
Future Plans



- **Perception / Sensor Fusion**:
  - Motion detection
  - Heat sensing
- **Action**:
  - Improved mobility with PackBot
- **Reasoning**:
  - Robot recognition of situations that require human guidance
  - Integrated path planning and search
- **Human-Robot Team Interface**:
  - Specification of goals and regions to avoid
  - Integrated PDA interface from multimodal command MSR project

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