



**Multi Agent & Cooperative
Robotics Laboratory**

Human – Robot Teams

Scott A. DeLoach

Kansas State University

Computer and Information Sciences Department

Manhattan, KS

Overview

Human-Robot Teams in Practice

iRobot PackBot®



Predator Cockpit



Typical Human-Robot Interfaces



PackBot EOD Controller



Modified X-Box Controller



Talon Controller

Human-Robot Teams in Action



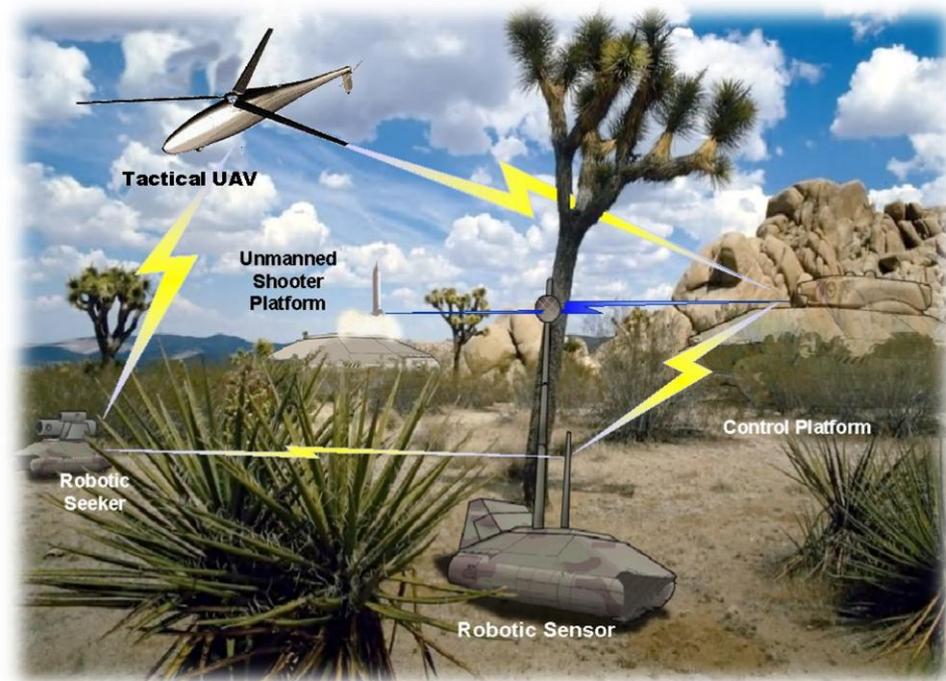
Questions

- How many robots were in the pictures?
- How many humans were in the pictures?
 - What were the humans doing?
- How might we want to change the pictures?



Future Combat Systems

- Distributed
- Large
- Open
- Complex
- Adaptive



System Characteristics

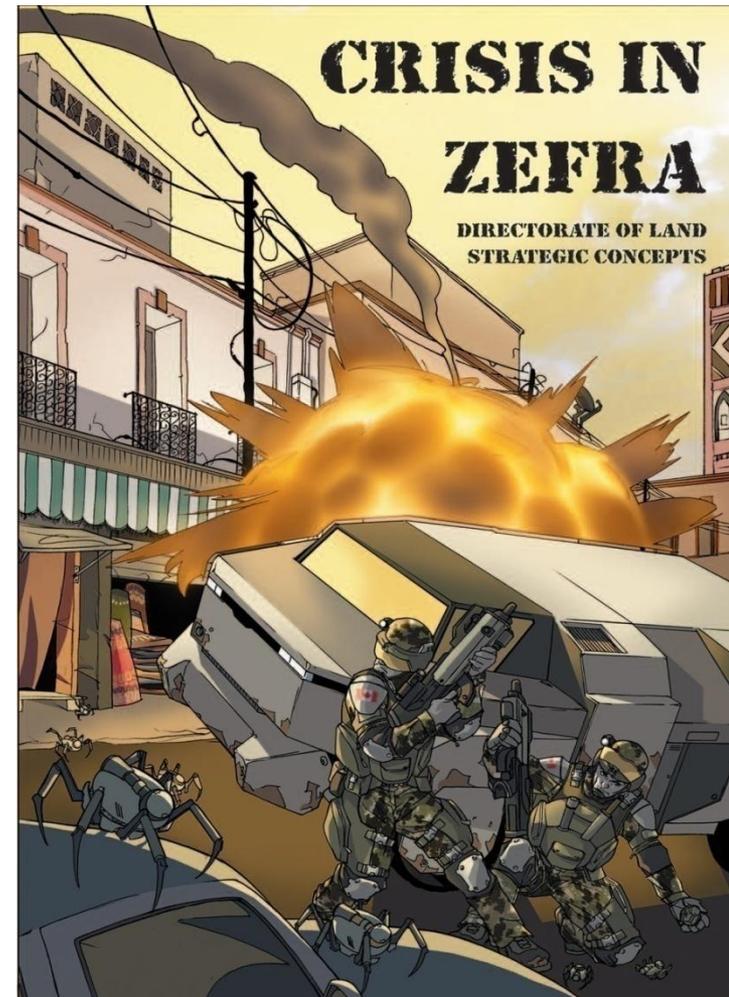
- Inherent distribution
 - Geographically
 - Temporally
 - Semantics – requires different ontologies and languages
 - Functional – requires different cognitive capabilities
- Inherent complexity
 - Too large to be solved by single, centralized system
- Requires system to be able to reorganize itself in order to achieve goals

Human-Robot Team Reorganization A Simple Example



Futuristic Human-Robot Teams

- Emerging concepts and technologies:
 - E.g., Canada's Army of the Future
- Features
 - Human-robot teams
 - Teams of human-robot teams
 - No explicit human controllers



Where are we today?



Where Do We Need to Go?

- Short term: small number of humans controlling large teams of robots
 - Traditional control/feedback mechanisms
 - Adjustable levels of autonomy on part of robots
- Long term: humans and robots working together as teams
- No separate control mechanisms
 - Commands given orally as to current soldiers
- Unobtrusive (?) feedback mechanisms
 - HUDs, auditory feedback
- Robots adapt interactions with humans based on robot and human performance and robot capabilities
- Teams adapt

Critical Missing Technologies (Non-exhaustive)

- To become reality, we need the ability to
- Model humans and robots as an integrated team
- Interact based on team role, situation, and member performance capabilities
- Carry out adaptive communications from robot to robot, robot to human, and human to human
- Select the best human and robots for specific roles at a given time
- Predict future problems and adjust assignments for future contingencies
- Employ advanced autonomous capabilities for robotic vehicles
- Measure and predict human performance when interacting with robots
- Provide doctrine and strategy for employing human-robot teams

Conclusions