# KNOWLEDGE DISCOVERY

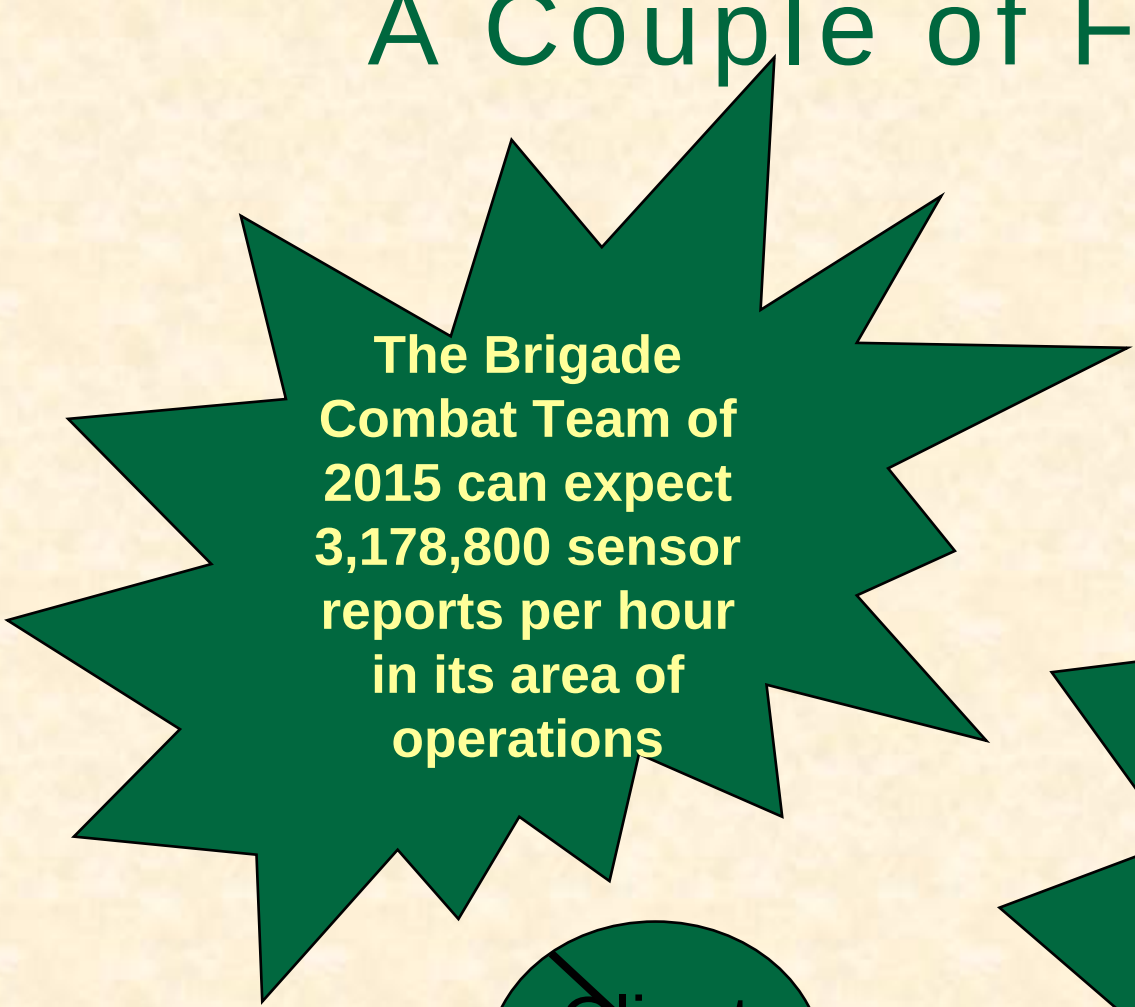
## From Situational Awareness to Bomb Damage Assessment

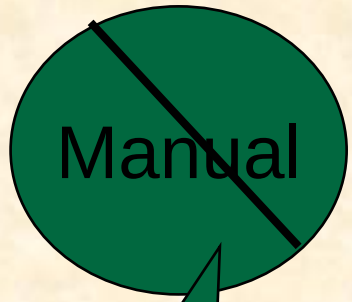
LTG (Ret) George A. Fisher
Oak Ridge National Laboratory

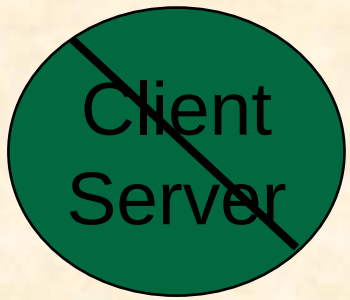
**“Connecting the Dots”**

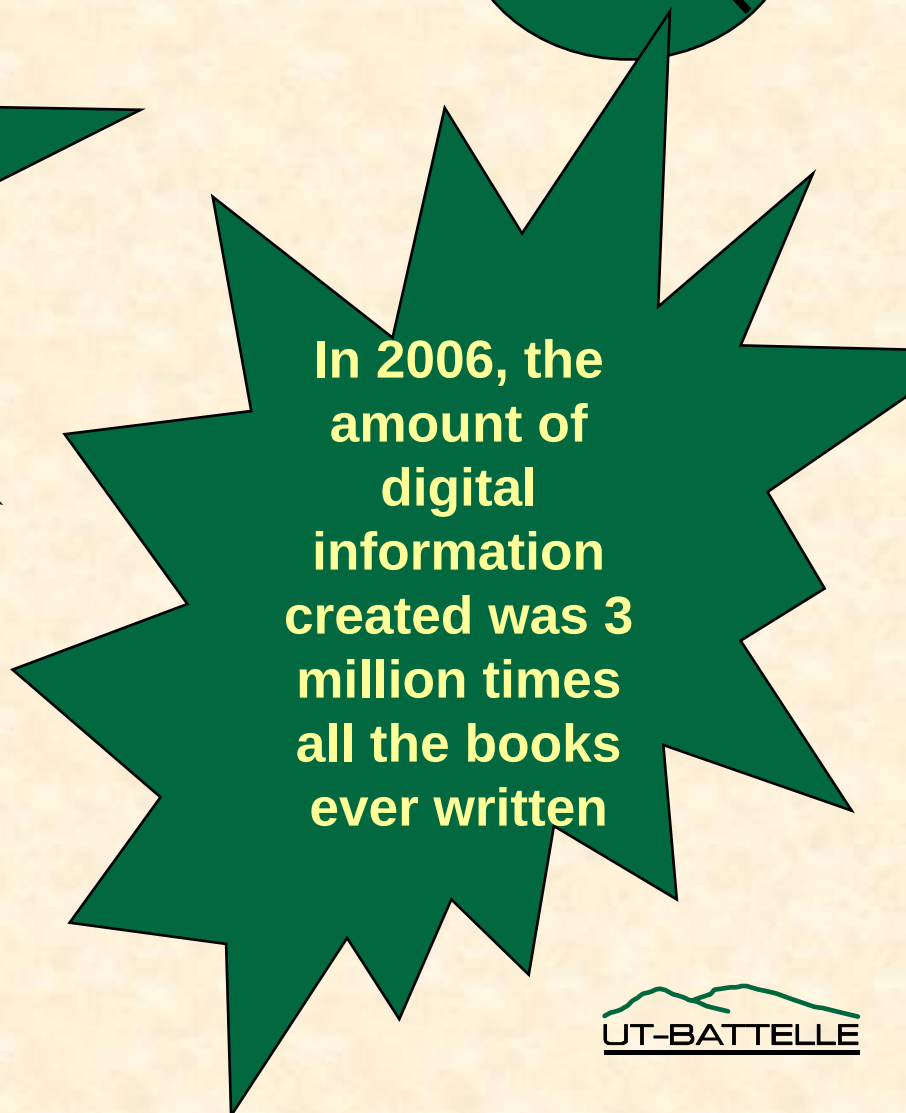
**“All I’m saying is, now is the time to develop the technology to deflect an asteroid.”**

# A Couple of Facts

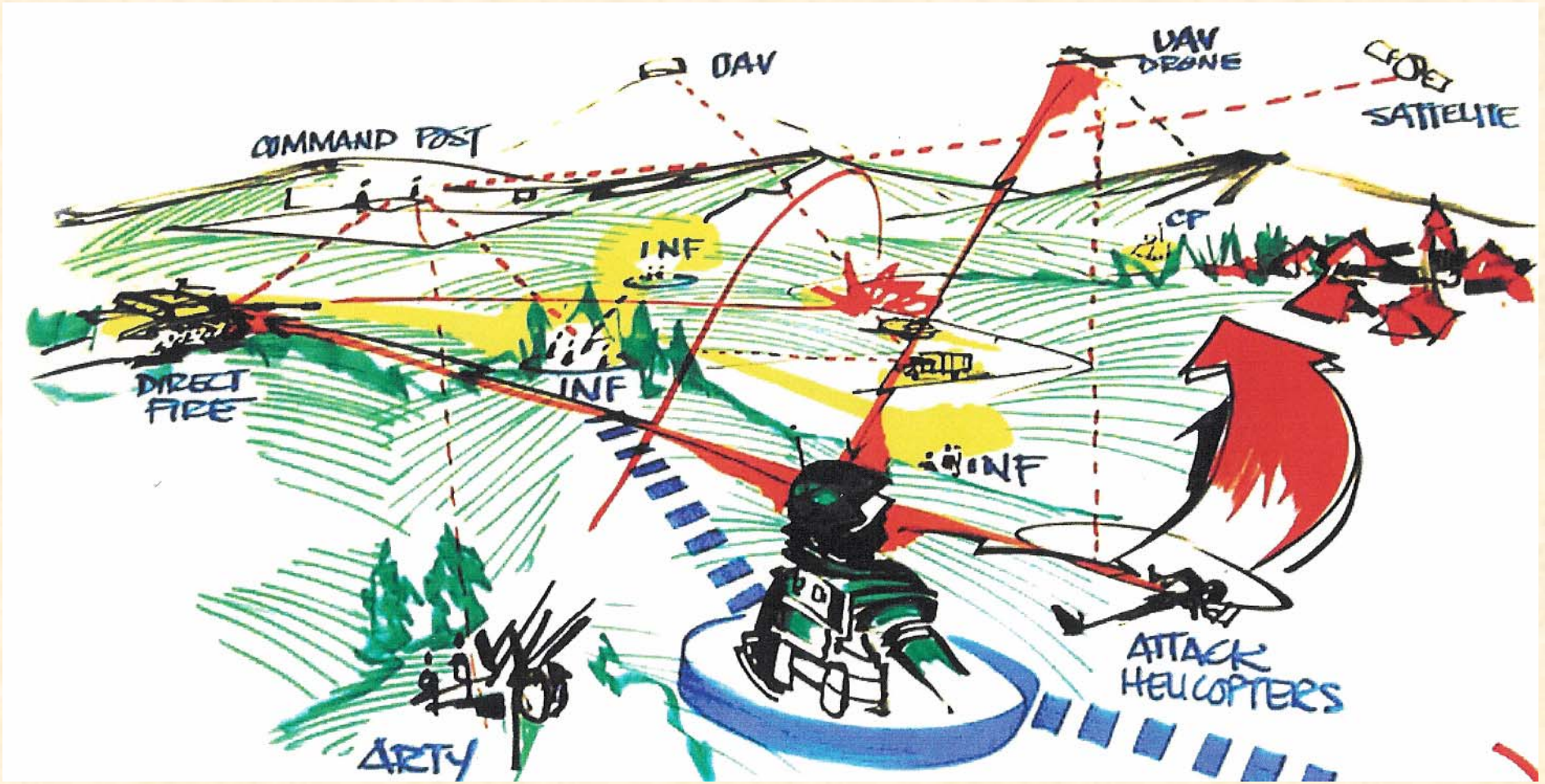


# THE 2020 War Fighter




**"Know what the Network Knows"**

# Challenge – What to do with this?

- **What is in there?**
- **Are there any threats?**
- **What am I missing?**

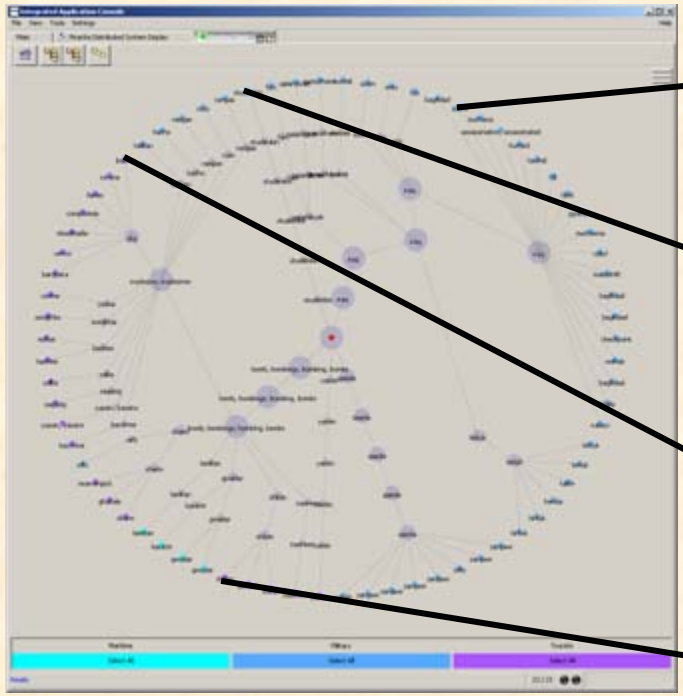
# Connecting the Dots

**Raw Documents**

**Organize the Information**

- Iraq
- Nuclear materials
- Chemical Weapons
- Threats
- Potential Targets
- Money Laundering
- Training Camps

**Connect the Information**



**Find the Threats**

**Take Action**

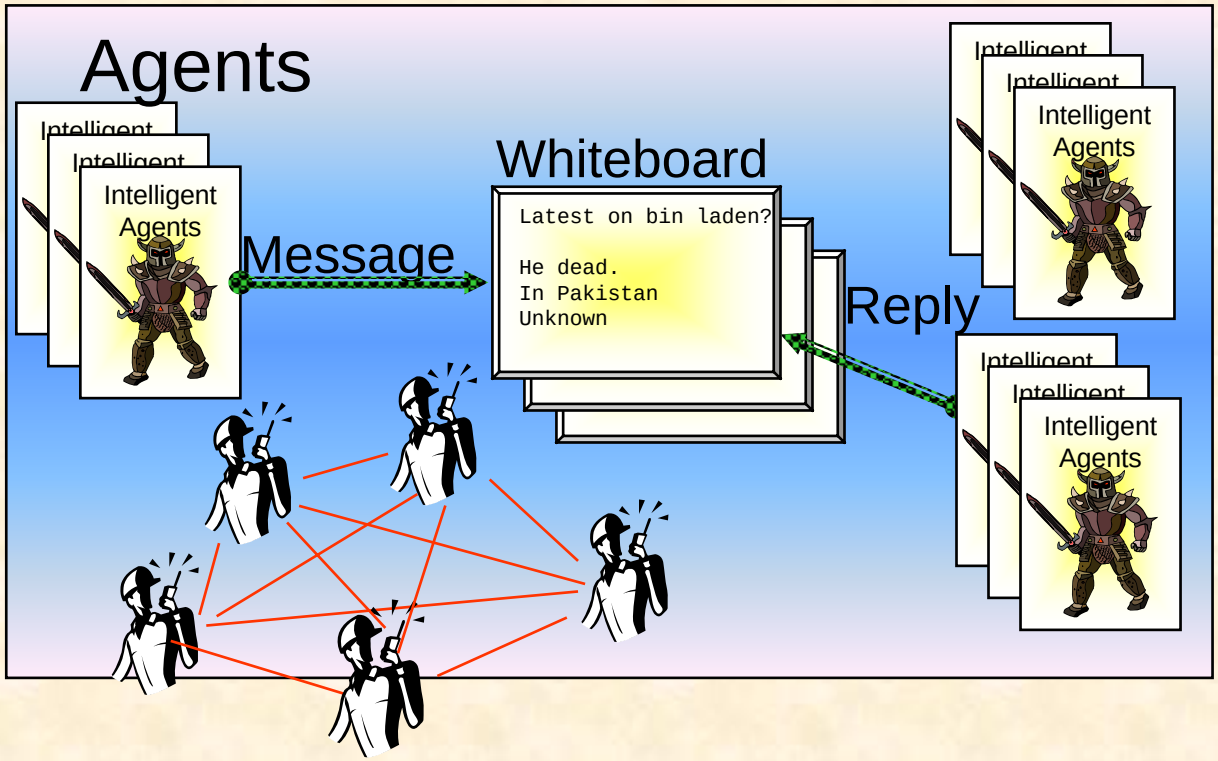
**What do we have?**

**What are the connections?**

**What are they planning?**

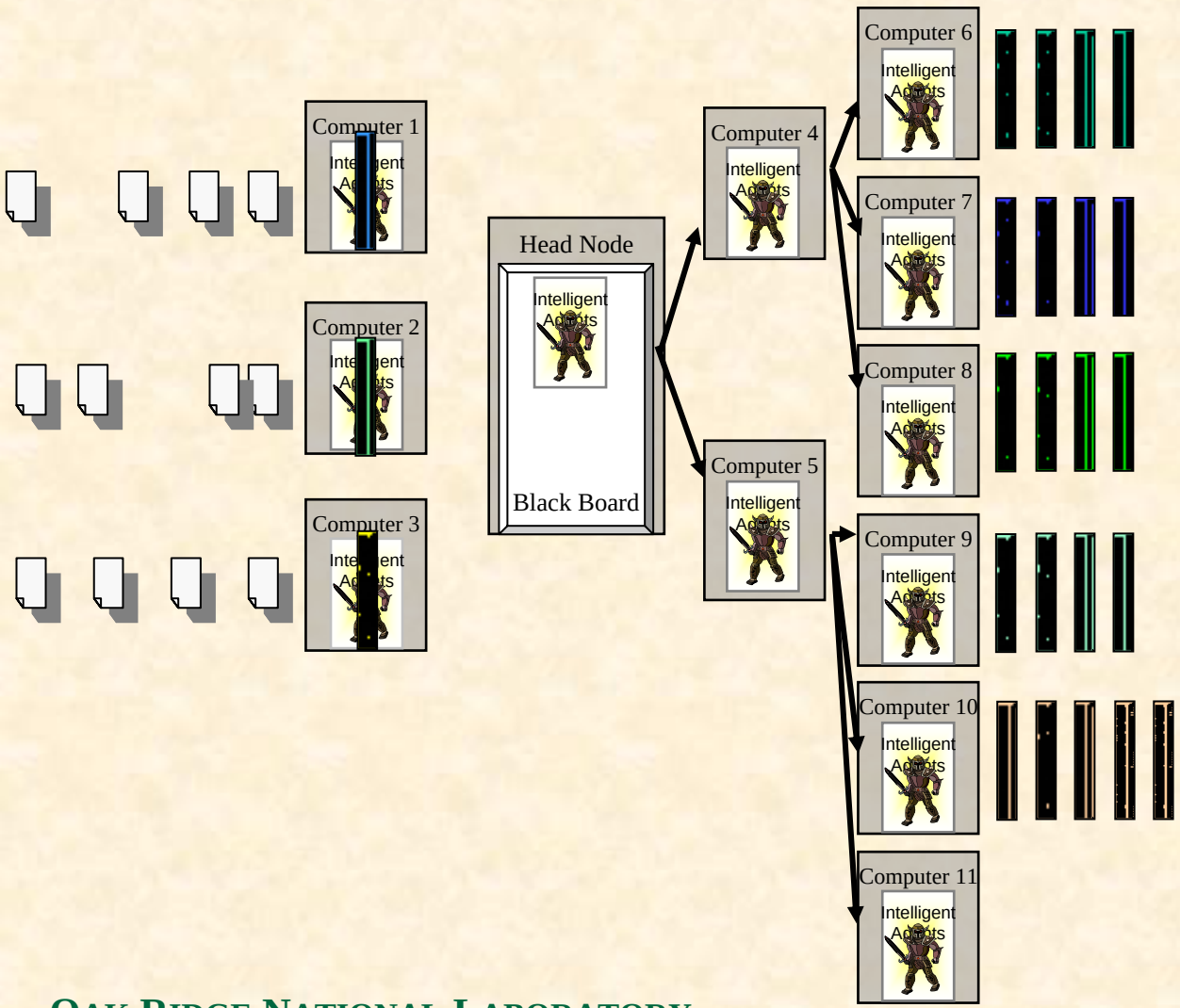
**How credible is the threat?**

# Intelligent Software




- **Intelligent Agents**
  - **Software processes**
  - **Can communicate in unstable environments**
  - **Form teams to solve problems**
  - **Live, die, and reproduce to solve problems**

# Agent Approach




- **Standard Approach**

  **11.5 Days**

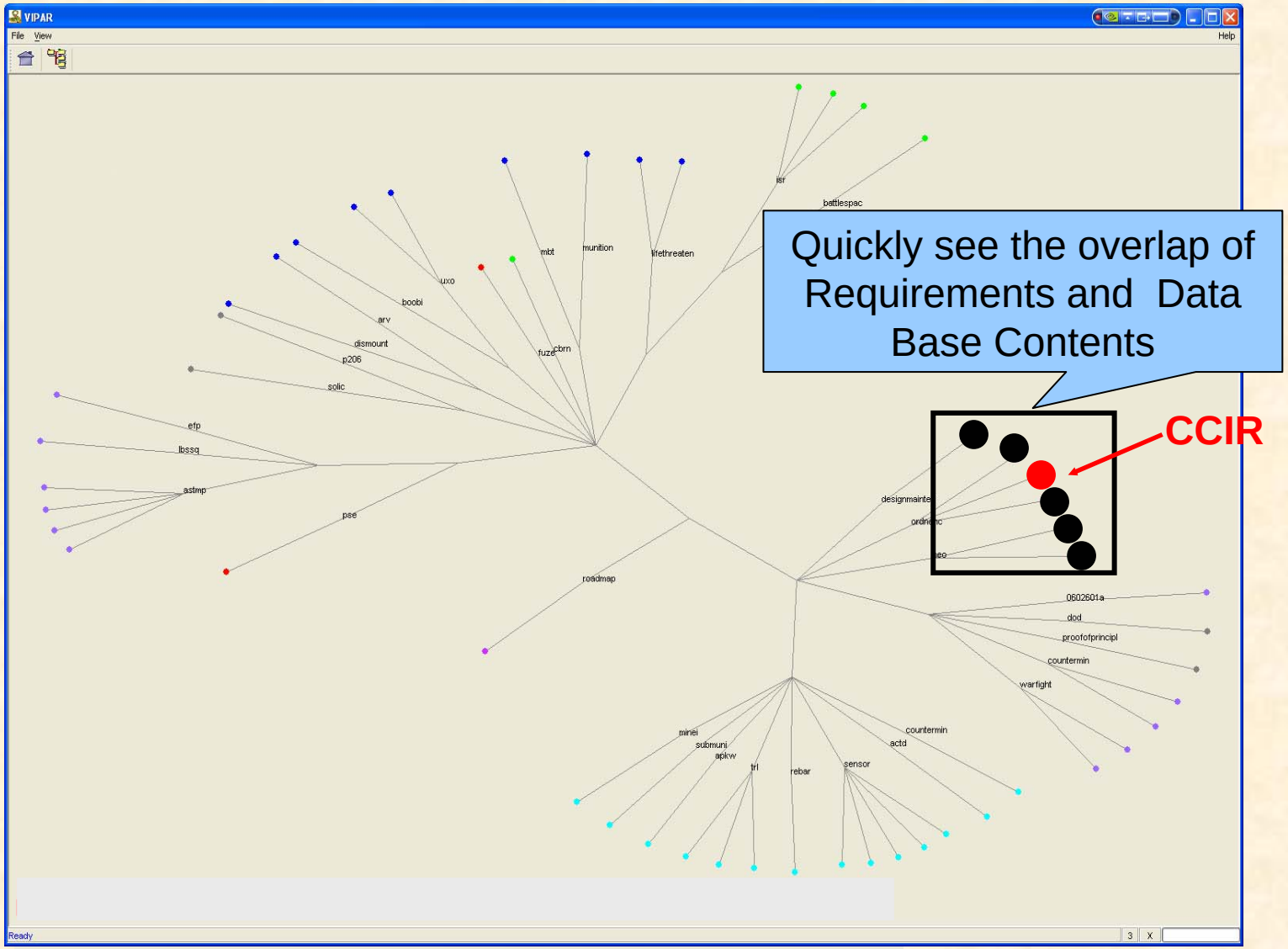
- **Agent approach**

  **8 minutes 24 Seconds!**

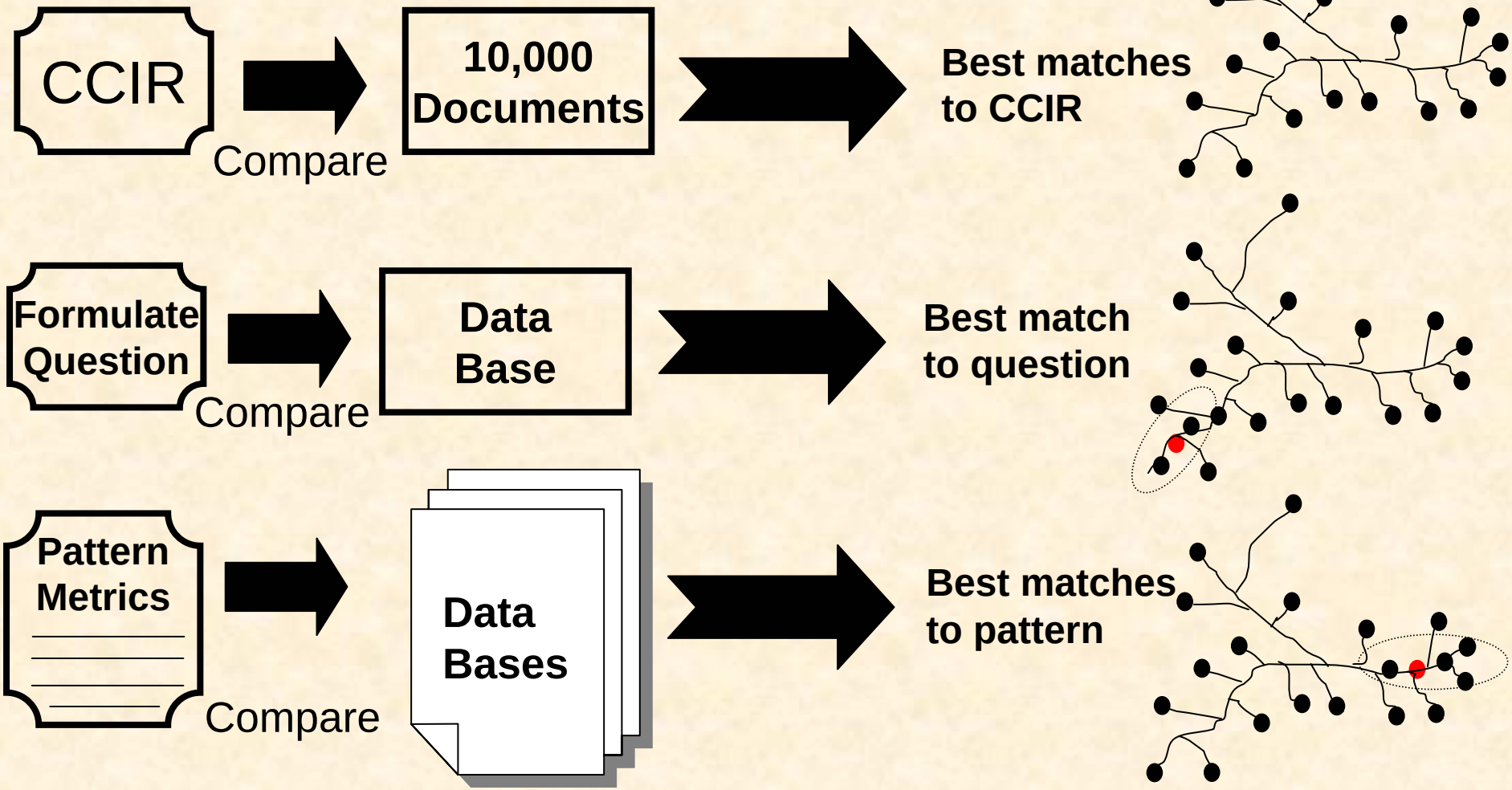
  **2000 times faster**

  **With no loss of accuracy**

# Results

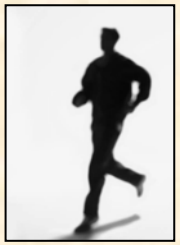

VIPAR
File View
Help
isr
battlespac
mbt
munition
lifethreaten
uxo
boobi
arv
dismount
p206
solic
cbrn
fuze
efp
lbssq
astmp
pse
roadmap
designmainte
ordnanc
eo
0602601a
dod
proofofprincipl
countermin
warfight
countermin
actd
sensor
rebar
trl
apkw
submuni
minei
Ready
Quickly see the overlap of Requirements and Data Base Contents
CCIR

# Software Agent Applications



# Next Step: Adding DNA to Agents

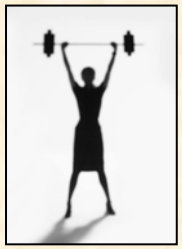
Endurance



Speed

Agility

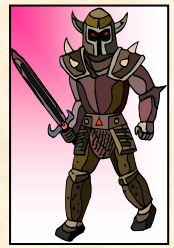
Strength



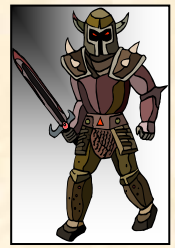
Group

Method

Target



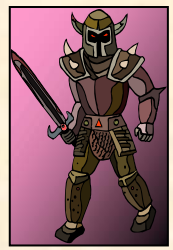
Location



Speed/Strength

Group/Method

Target/Location



Group/Method/Target/Location

# Connecting the Dots

**Threats**

**6 Indonesians Barred From U.S.**
Current and Former Military Officers Pl
*By* *Slevin*
Wa ters
Fri
The
dozen current
officers, includ
on a watch list
barring them from entering the United States, according to U.S. government officials.

**US naturalized citizen indicted for hiding**

**Cold war leaves a deadly anthrax legacy**

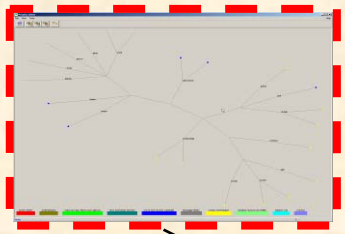
**Miller**

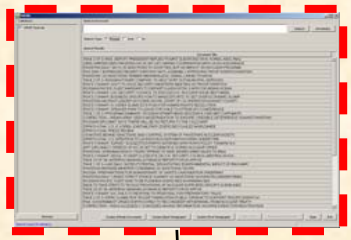
VOZROZHDENIYA ISLAND, Uzbekistan -- In the spring of 1988, germ scientists 850 miles east of Moscow were ordered to undertake their most critical mission.

**Agents**

**OSCAR High Performance Computer Cluster**

**Analysis**





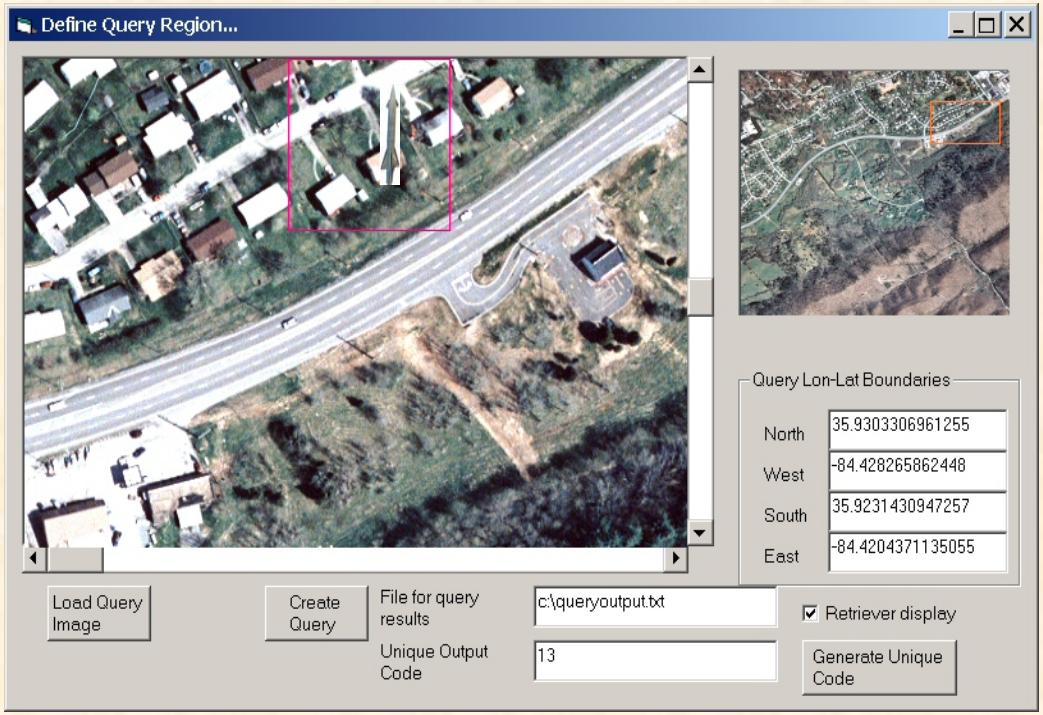
**Decision**

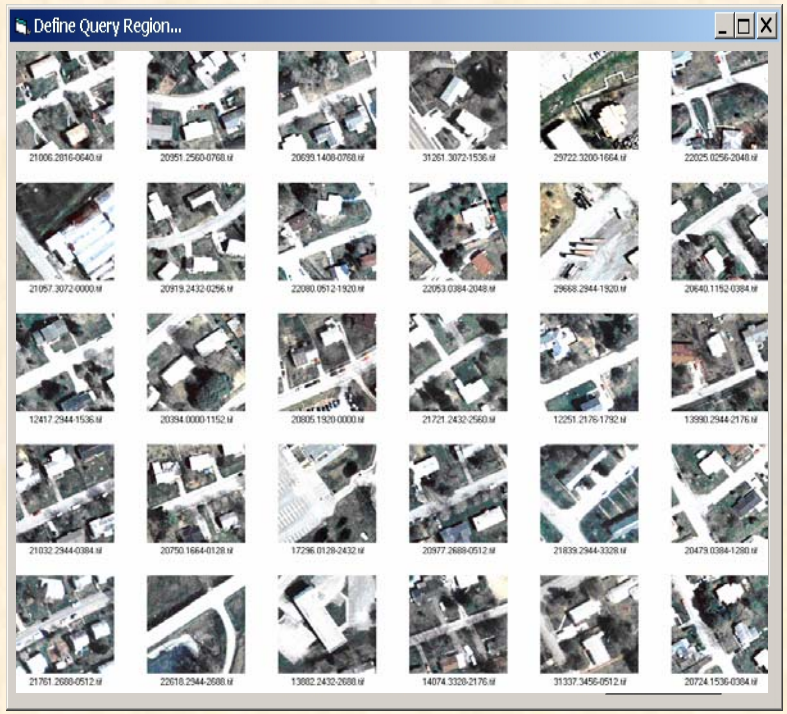
**Synthesizing and Disseminating Information**

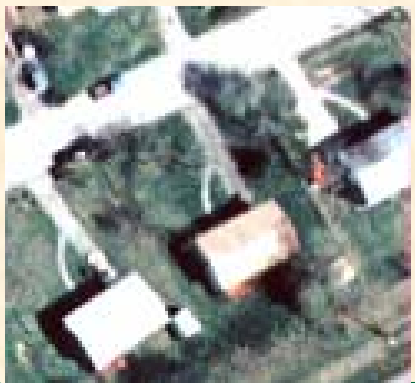
# Screen Satellite Photos at Machine Speed

- **Is your image repository up-to-date and accurate?**
- **How can you search through thousands of images in seconds?**
- **How can you comprehensively search based on:**
  - **Longitude and Latitude**
  - **Box on a map**
  - **Time**
  - **"Just like this one"**

# Find “Just like this one…”



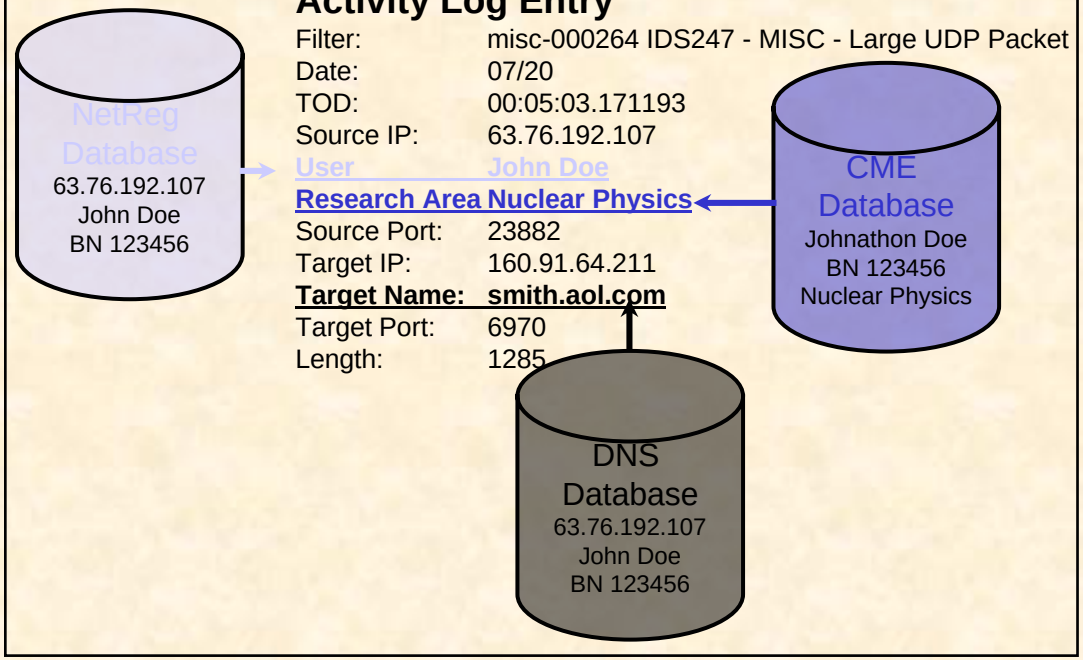



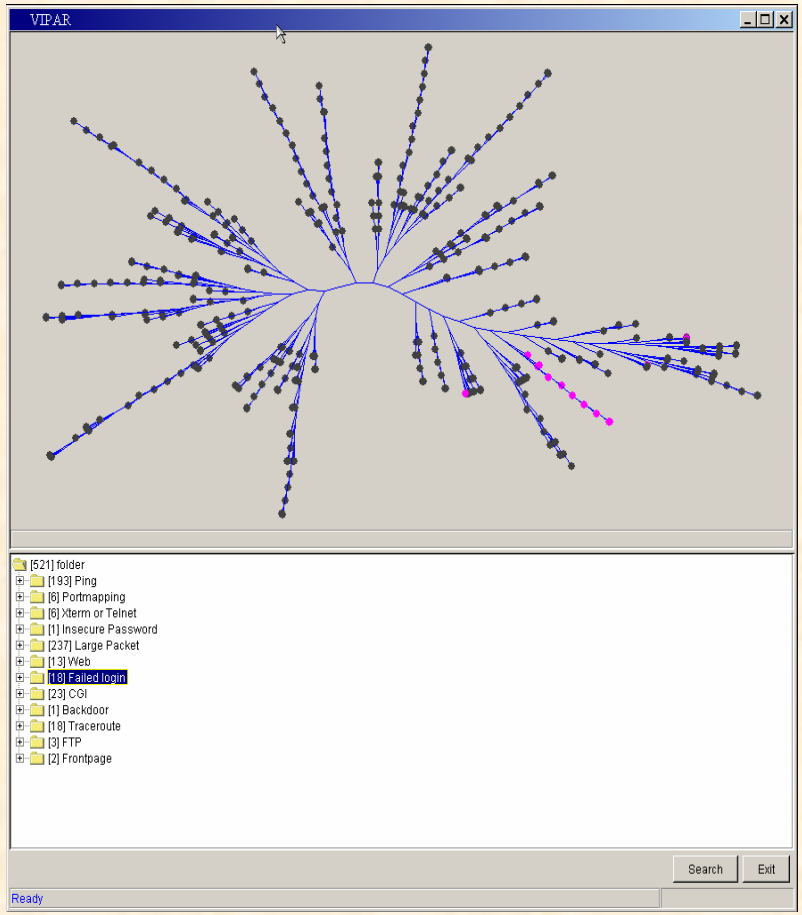
Where is the missile ?

# Cyber Security

## Relate Sensitive Research to IP addresses

- **1,000,000 suspicious records daily**
- **Critical Decisions**
  - **Is someone trying to hack into the system?**
  - **Are attack from "script kiddies" or state sponsored?**
  - **What are they going after and why?**

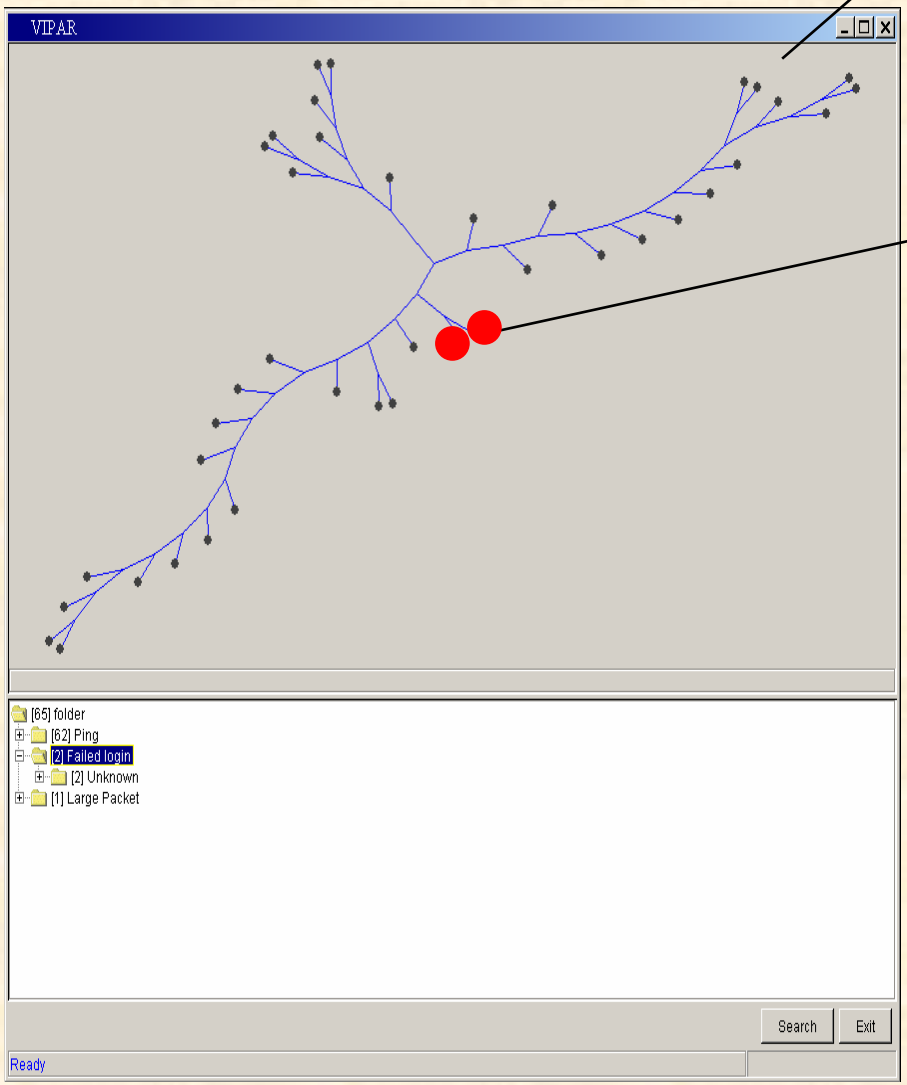


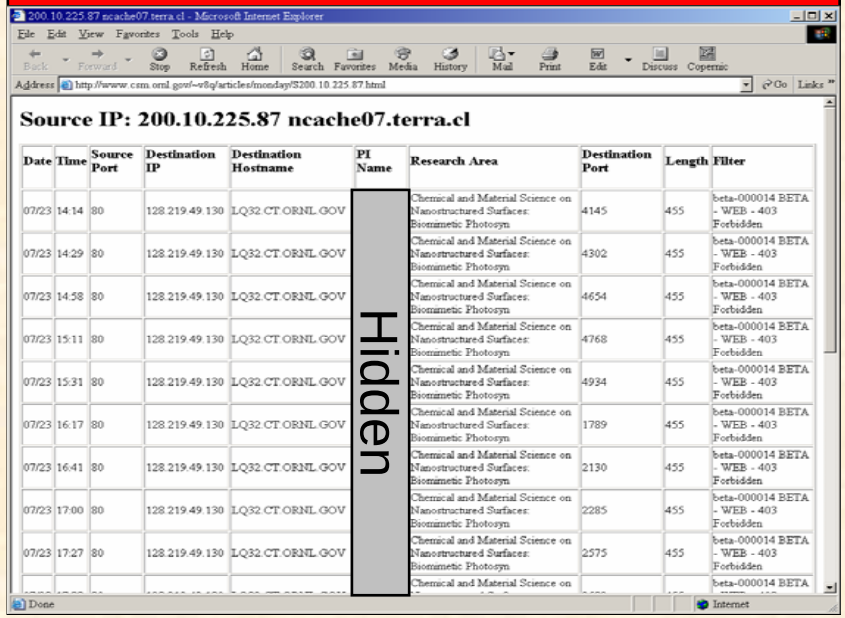
# Caught in 30 Minutes!

**45 "low and slow" pings from:**

- **Country X**
- **Country Y**
- **Country Z**




**2 attacks on nanotechnology scientists**

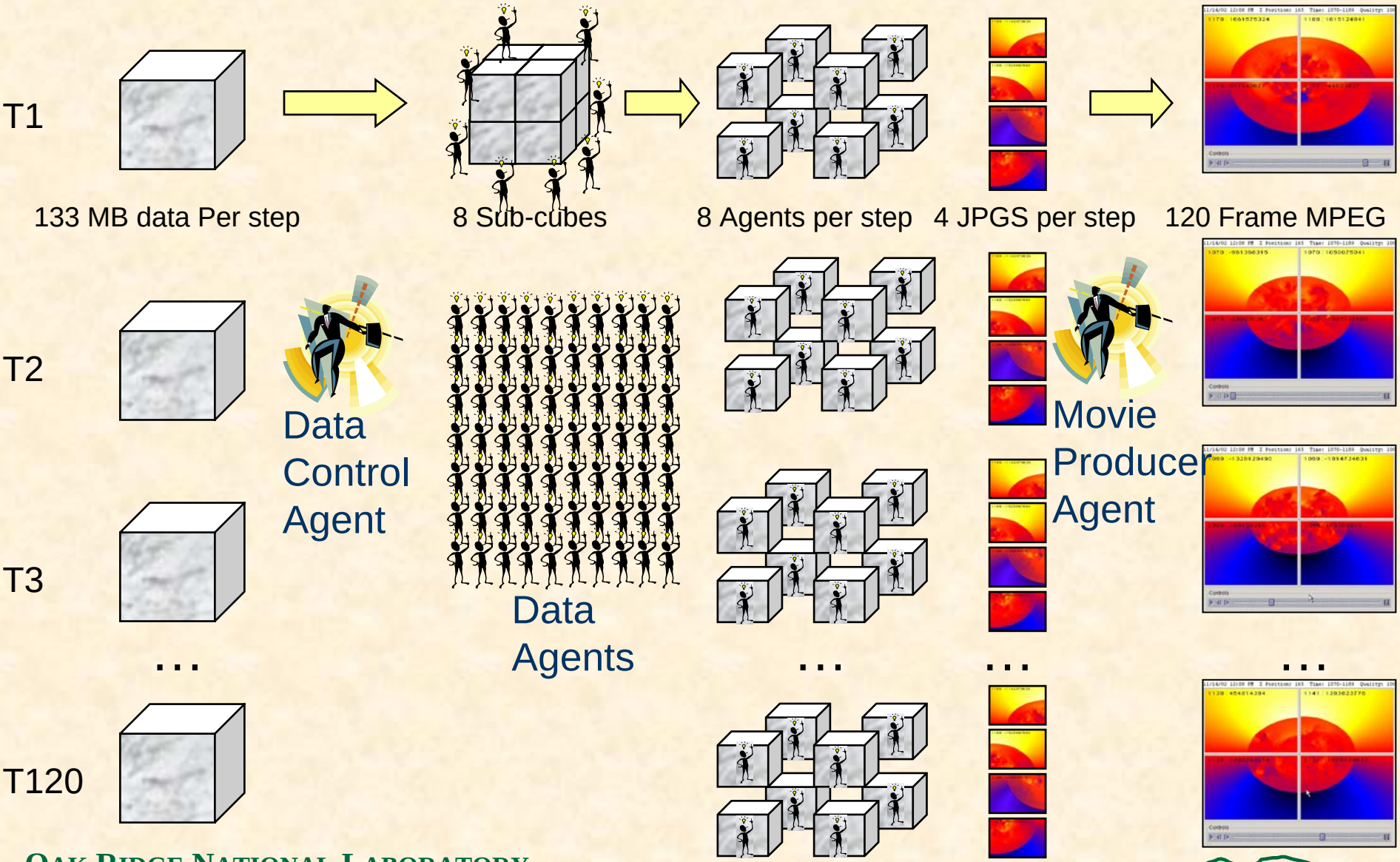



Patent Pending

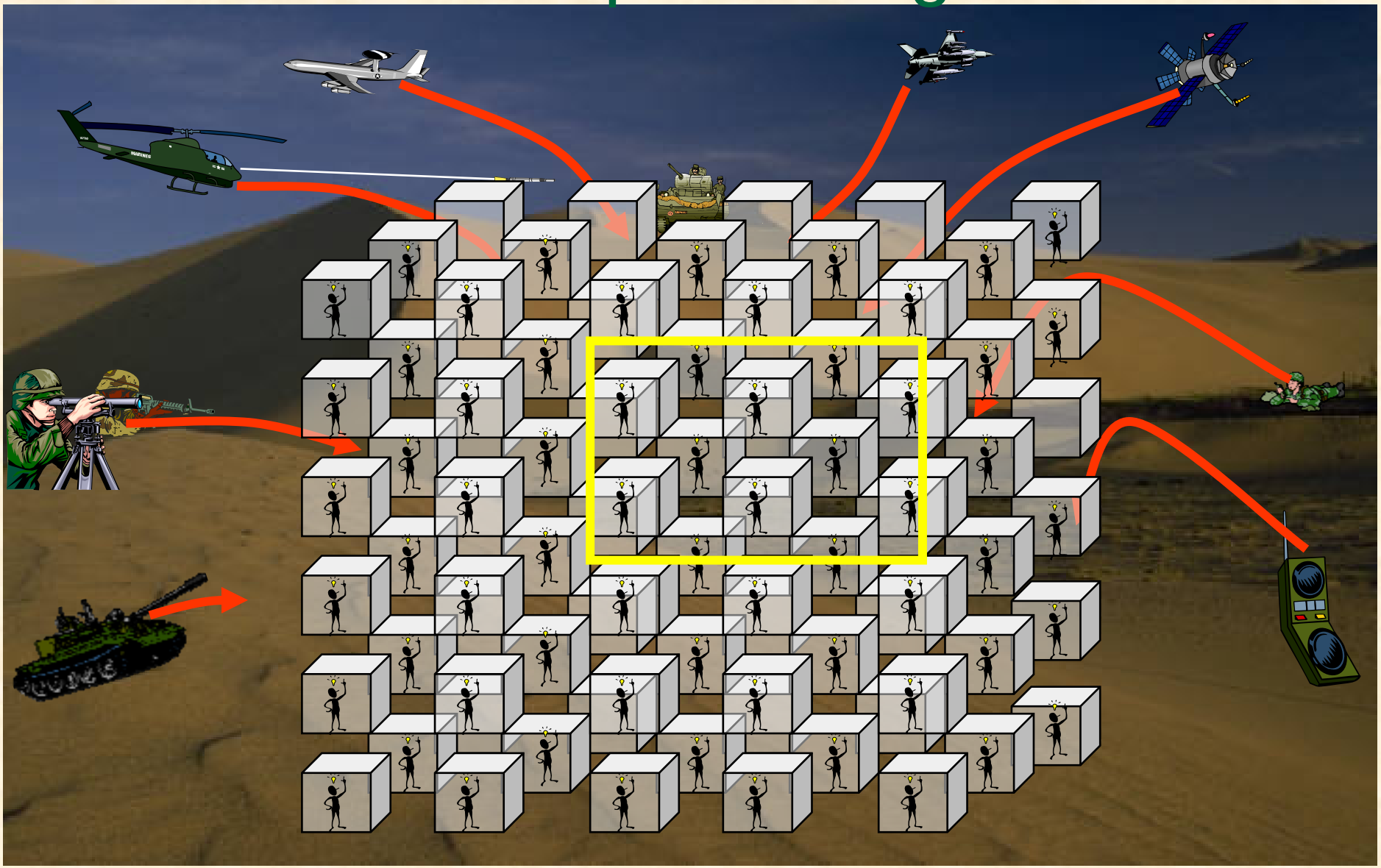
# Agent Example "Pictures from Data"

- 1 Terabyte of streaming astrophysics data
- 1000 agents analyzing
  - 120 time steps of 300x300x300 matrix for 5 variables
  - 33 million units density in 194 files
- Each time step governed by an oversight agent which redraws picture with most recent information

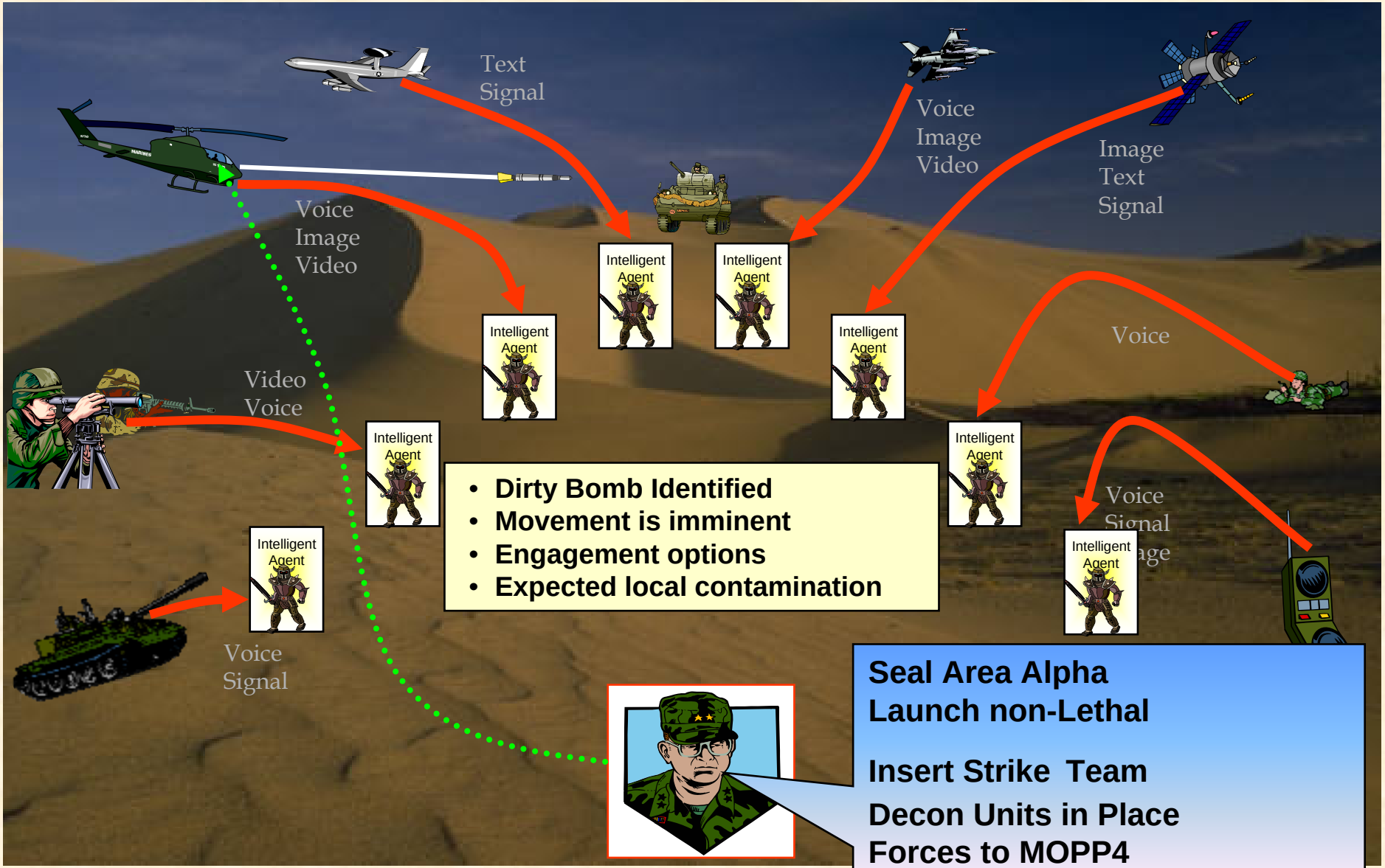
# Astrophysics Common Operational Picture



# Common Operating Picture



# Future Battlespace – Forward Analysis

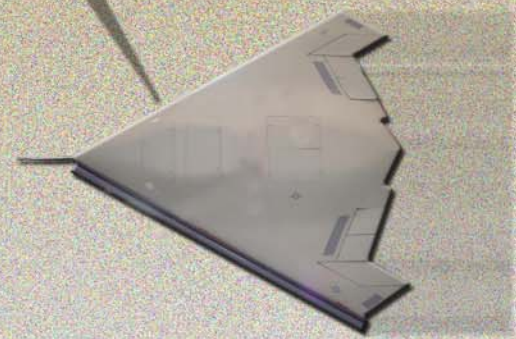


# Knowledge Discovery

## "The Art of the Possible"

**Info Transmitted**

- Engine (MTBF)
- Transmission (MTBF)
- Weapon System (MTBF)
- Ammo
- Fuel

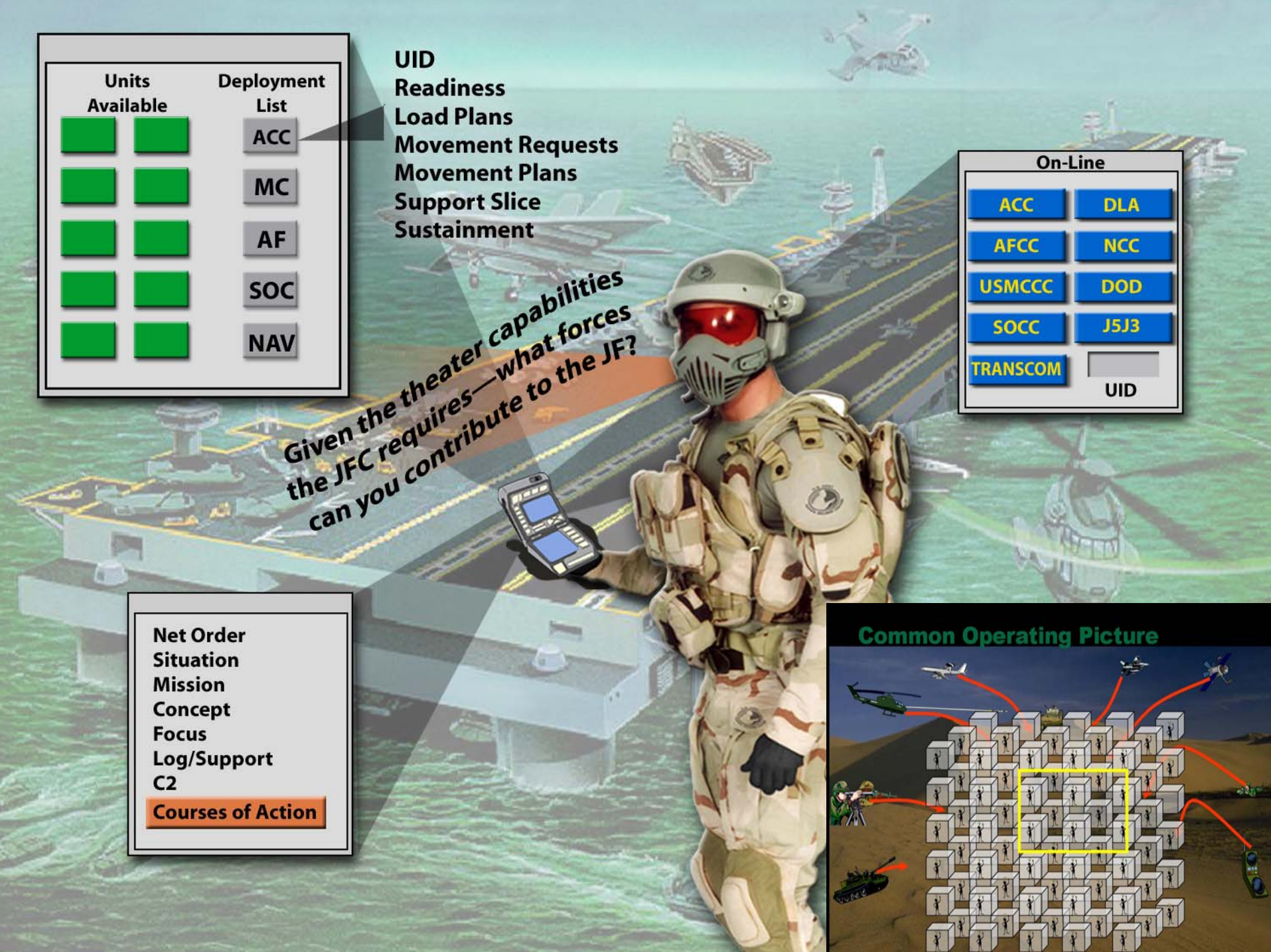


**END ITEMS**

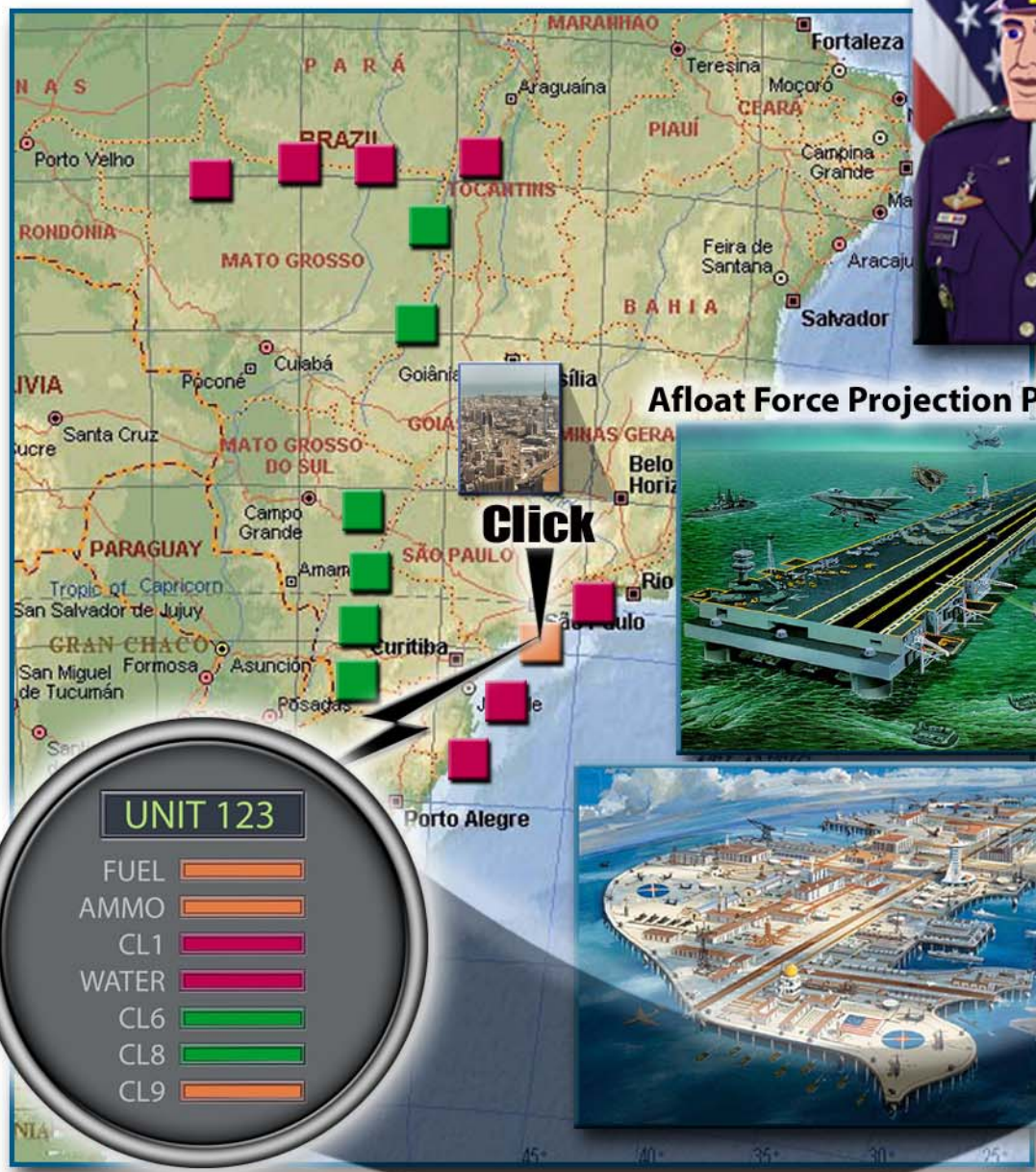
Fixed Wing Attack
Fixed Wing Non-Attack
UAV (Attack)
UAV (Intel)
Ground Support Equipment

**Sqdn Cdr**

Warning Order at 1200 Z
UNITED STATES TRANSPORTATION COMMAND
U.S. AIR FORCE
On-Line
DEPARTMENT OF THE NAVY
UNITED STATES MARINE CORPS
DEFENSE LOGISTICS AGENCY
UNITED STATES COAST GUARD 1790
UNITED STATES MARINE CORPS
AIR FORCE SPECIAL OPERATIONS COMMAND
DEPARTMENT OF THE ARMY
1775
UNITED STATES OF AMERICA
DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA
JFC J3


Units Available
Deployment List
ACC
MC
AF
SOC
NAV
UID
Readiness
Load Plans
Movement Requests
Movement Plans
Support Slice
Sustainment
On-Line
ACC
DLA
AFCC
NCC
USMCCC
DOD
SOCC
J5J3
TRANSCOM
UID
Given the theater capabilities the JFC requires—what forces can you contribute to the JF?
Net Order
Situation
Mission
Concept
Focus
Log/Support
C2
Courses of Action
Common Operating Picture

# Day 5: Combat Power



# Path to Success

- **Vision the Capability**
- **Articulate the Development Path and Priority**
- **Leverage the niche Centers of Excellence**

Knowledge Discovery 2020
Know all that can be known
Apply the Power of the Force
“The Force Is Always With You”