

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

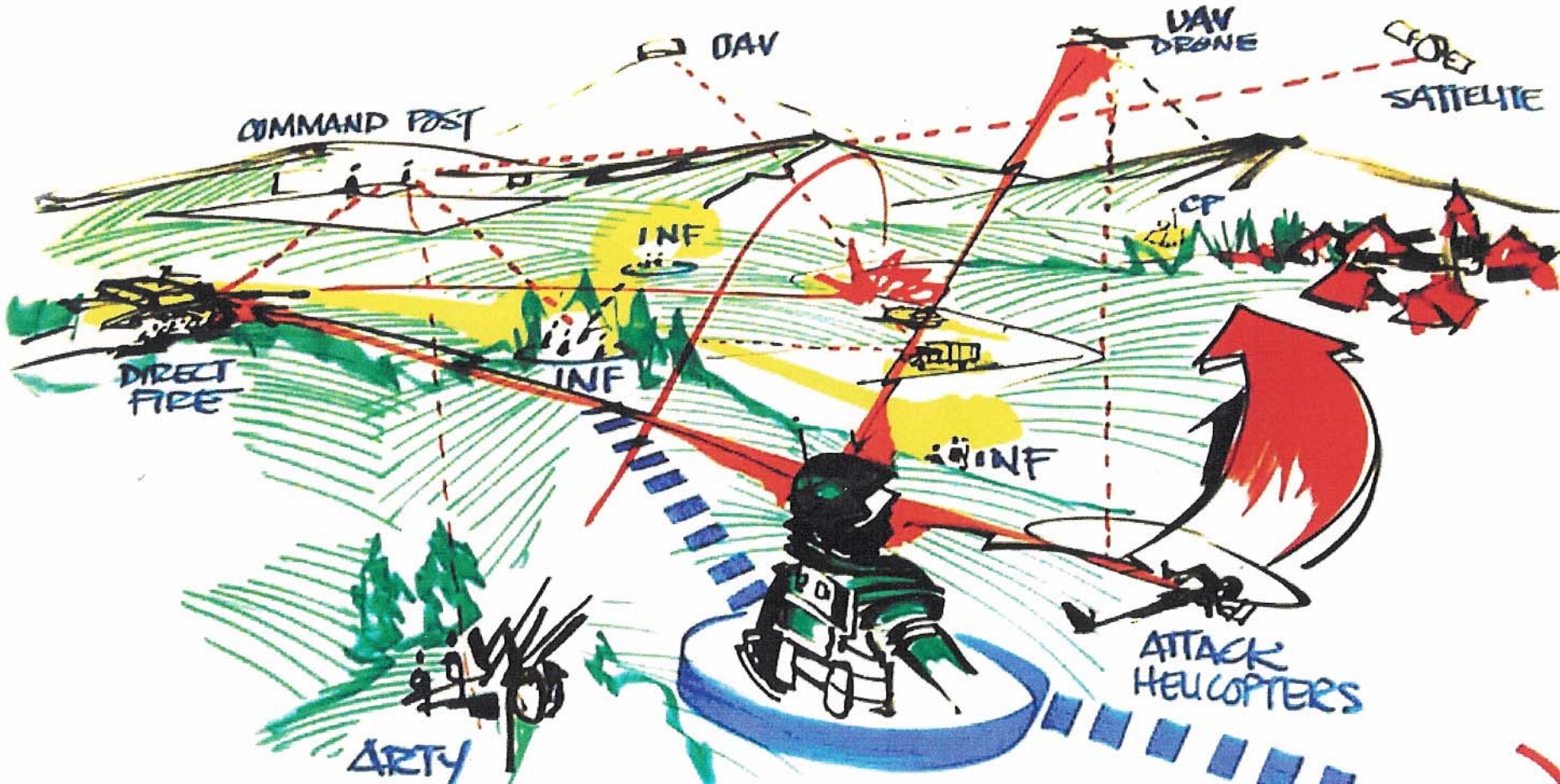
**The Brigade
Combat Team of
2015 can expect
3,178,800 sensor
reports per hour
in its area of
operations**

~~Manual~~

**In 2006, the
amount of
digital
information
created was 3
million times
all the books
ever written**

~~Client
Server~~

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



What do we have?

Organize the Information

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

What are the connections?

Connect the Information



What are they planning?

Find the Threats



How credible is the threat?

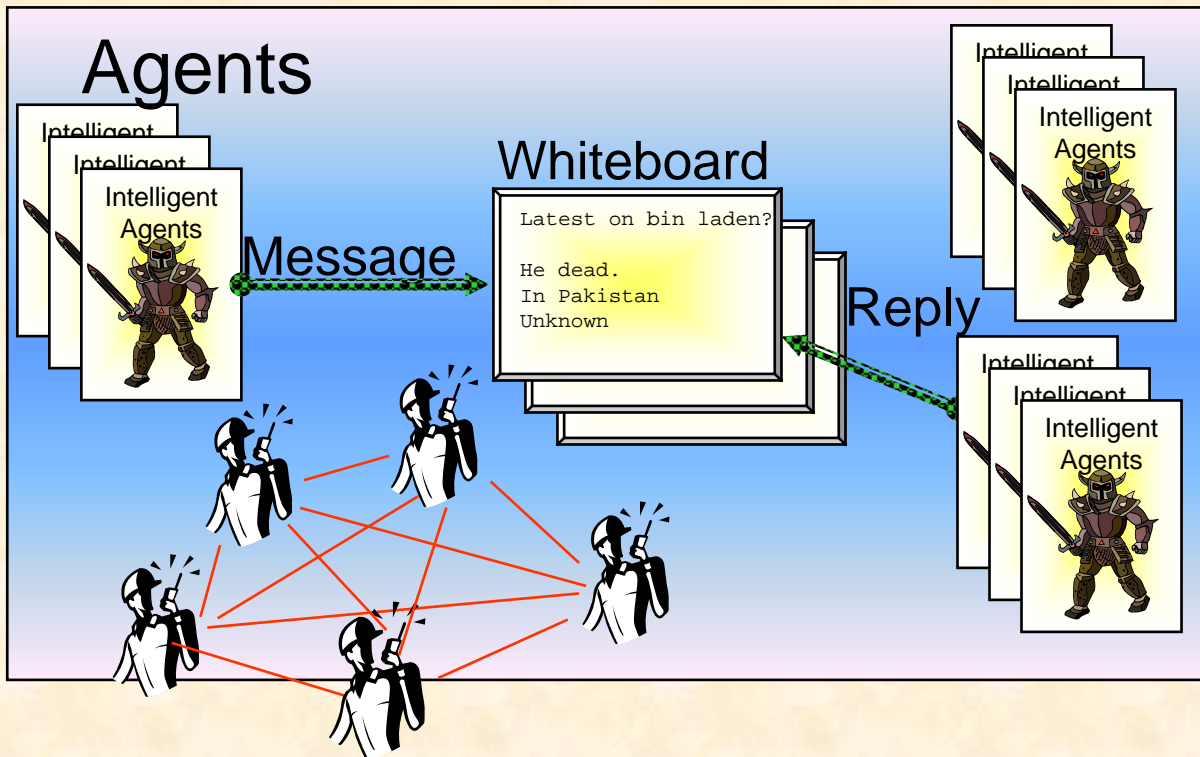
Take Action



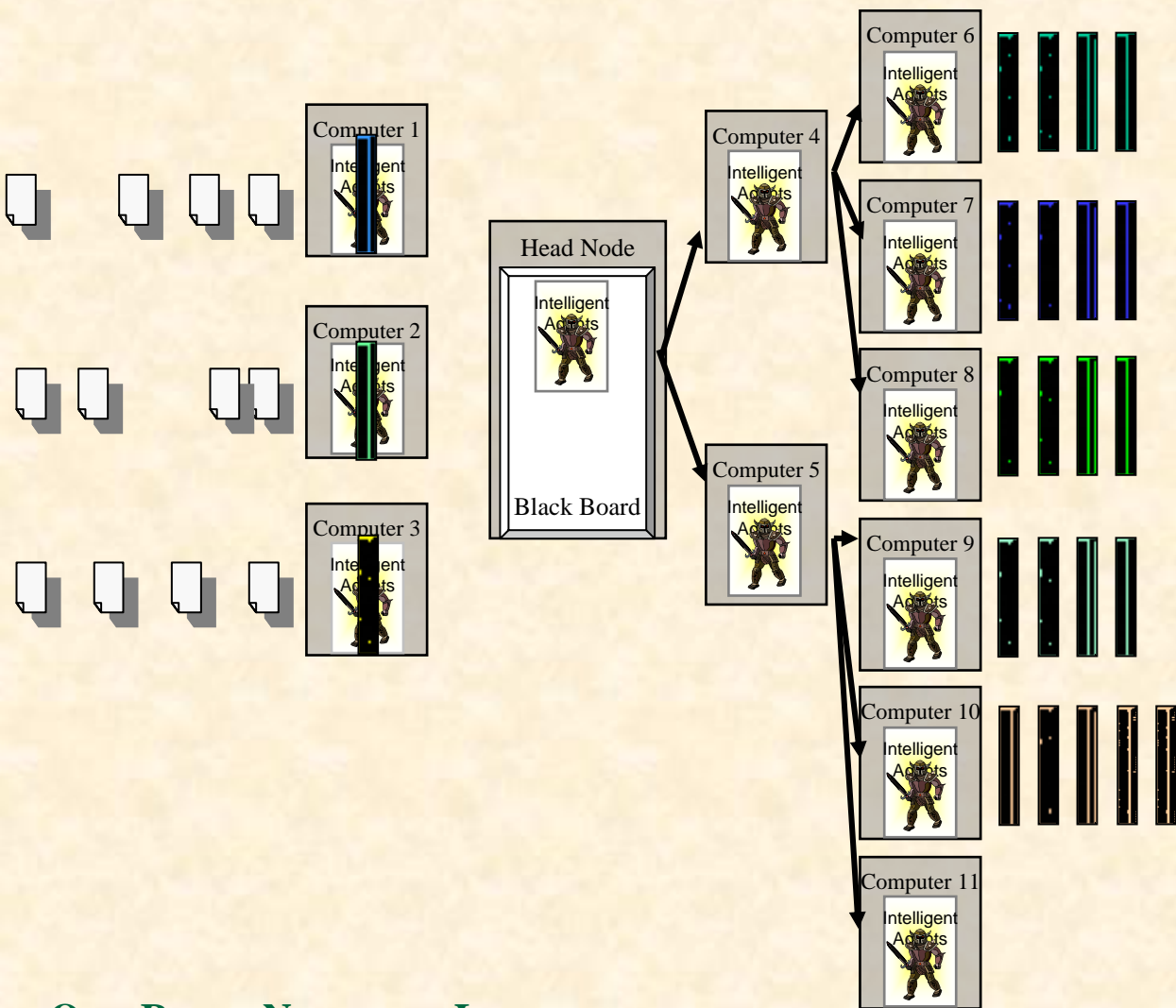
Intelligent Software

• Intelligent Agents

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



Agent Approach



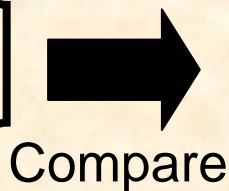
- **Standard Approach**
11.5 Days

- **Agent approach**
8 minutes 24 Seconds!

2000 times faster
With no loss of accuracy

Software Agent Applications

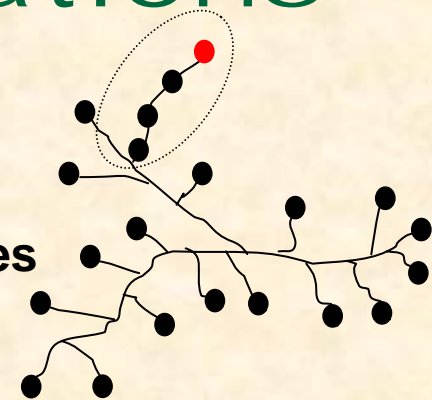
CCIR



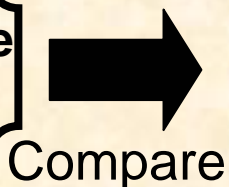
10,000 Documents



Best matches to CCIR



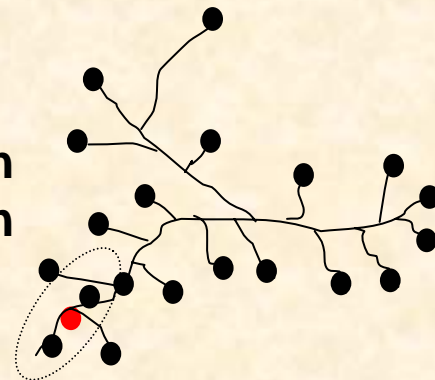
Formulate Question



Data Base



Best match to question



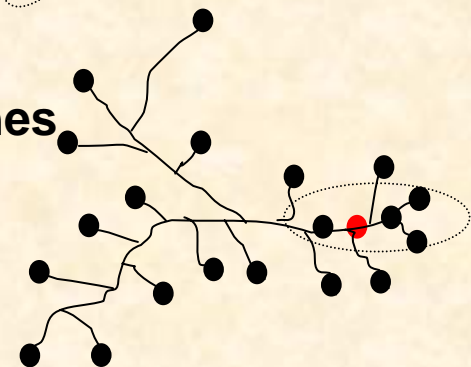
Pattern Metrics



Data Bases

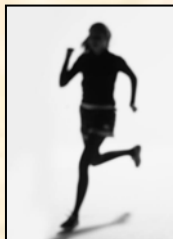
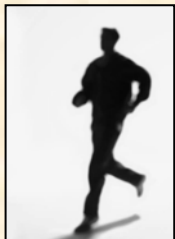


Best matches to pattern



Next Step: Adding DNA to Agents

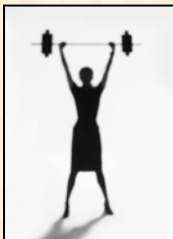
Endurance Speed



Agility



Strength



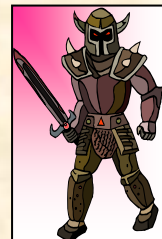
Group



Method



Target



Location



Speed/Strength



Group/Method



Target/Location



A large red rounded rectangle containing four images: a man in a turban, a soldier with a rifle, the Statue of Liberty, and a line graph.

Group/Method/Target/Location



Connecting the Dots

Threats

6 Indonesians Barred From U.S.
Current and Former Military Officers



Slevin
Waters

US naturalized citizen indicted for hiding
Cold war leaves a deadly anthrax legacy



Miller

supported in part by
EarthLink
NEWS



Pl
By
Wa
Fri
The
dozen current
officers, includ
on a watch list
barring them from entering the United States,
according to U.S. government officials.



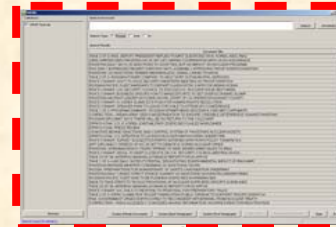
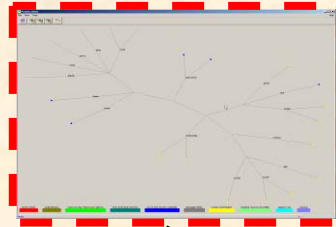
VOZROZHDENIYA ISLAND, Uzbekistan -- In the spring of 1988, germ scientists 850 miles east of Moscow were ordered to undertake their most critical mission.

Agents

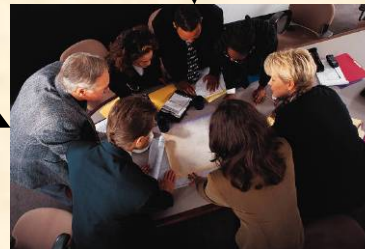
OSCAR High Performance Computer Cluster



Analysis



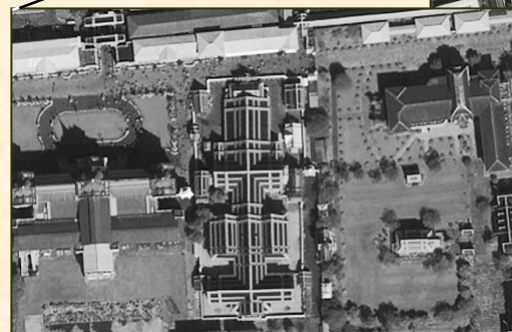
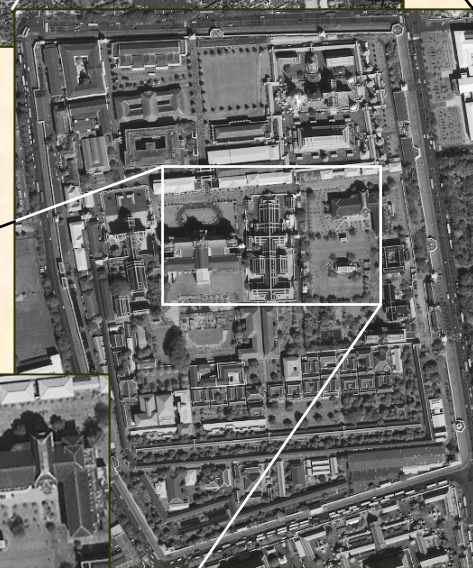
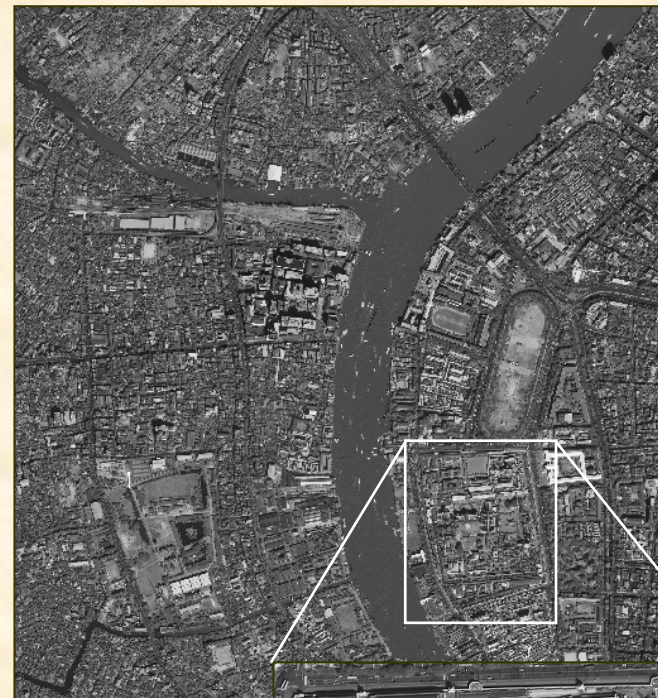
Decision



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..."

Define Query Region...




Query Lon-Lat Boundaries

North	35.9303306961255
West	-84.428265862448
South	35.9231430947257
East	-84.4204371135055

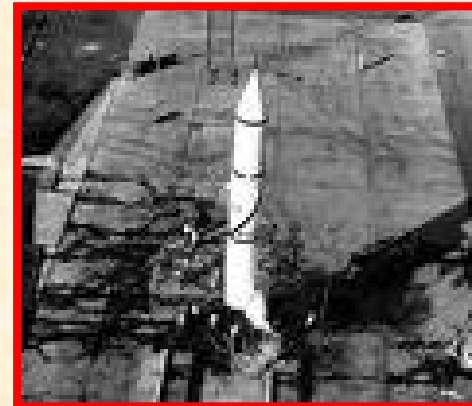
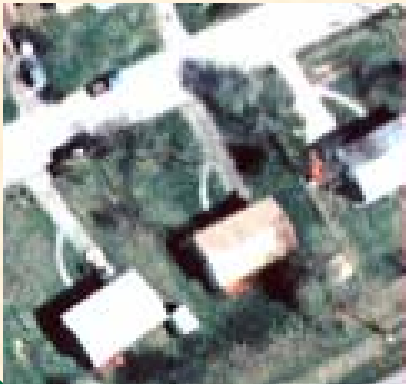
Load Query Image Create Query File for query results: c:\queryoutput.txt Retriever display

Unique Output Code: 13 Generate Unique Code

Define Query Region...



21006.2816-0040.W	20951.2569-0768.W	20699.1408-0768.W	31261.3072-1536.W	29722.3200-1664.W	22025.0256-2048.W
21097.3072-0000.W	20919.2432-0256.W	22080.0912-1920.W	22953.0384-2048.W	29668.2944-1920.W	20640.1152-0384.W
12417.2944-1536.W	20384.0000-1152.W	20805.1920-0000.W	21721.2432-2560.W	12251.2176-1792.W	13990.2944-2176.W
21032.2944-0384.W	20750.1664-0128.W	17296.0128-2432.W	20877.2688-0512.W	21839.2944-3328.W	20478.0384-1280.W
21761.2688-0512.W	22616.2944-2688.W	13802.2432-2688.W	14074.3328-2176.W	31337.3456-0512.W	20724.1536-0304.W



Where is the missile ?

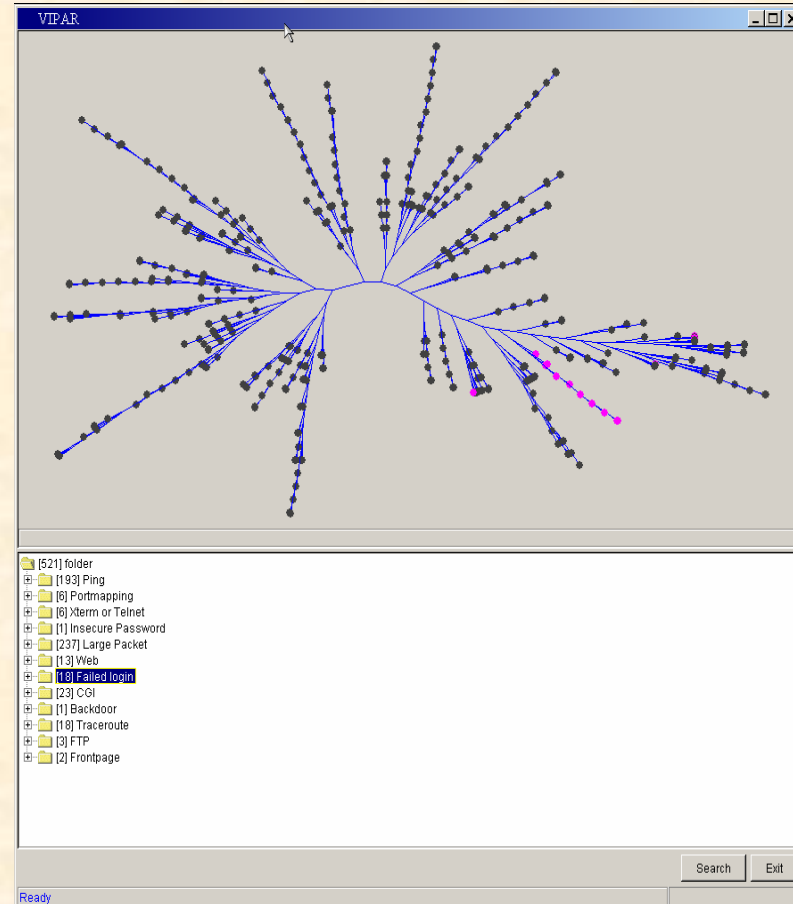
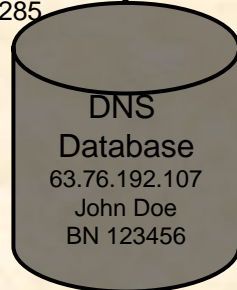
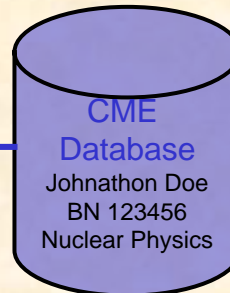
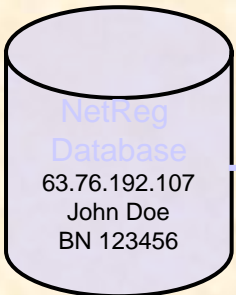
Cyber Security

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?

Activity Log Entry

Filter: misc-000264 IDS247 - MISC - Large UDP Packet
Date: 07/20
TOD: 00:05:03.171193
Source IP: 63.76.192.107
User: John Doe
Research Area Nuclear Physics
Source Port: 23882
Target IP: 160.91.64.211
Target Name: smith.aol.com
Target Port: 6970
Length: 1285

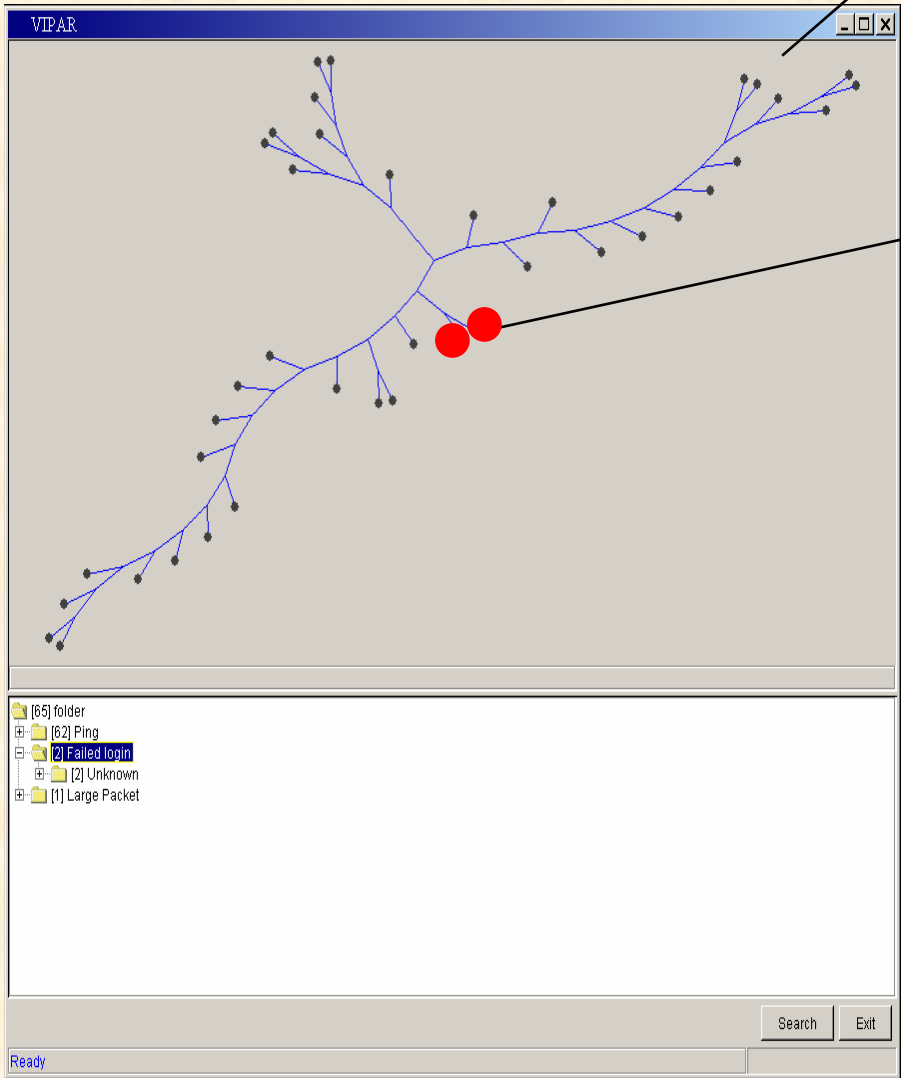


Caught in 30 Minutes!

45 "low and slow" pings from:

- Country X
- Country Y
- Country Z

2 attacks on nanotechnology scientists



Source IP: 200.10.225.87 ncache07.terra.cl

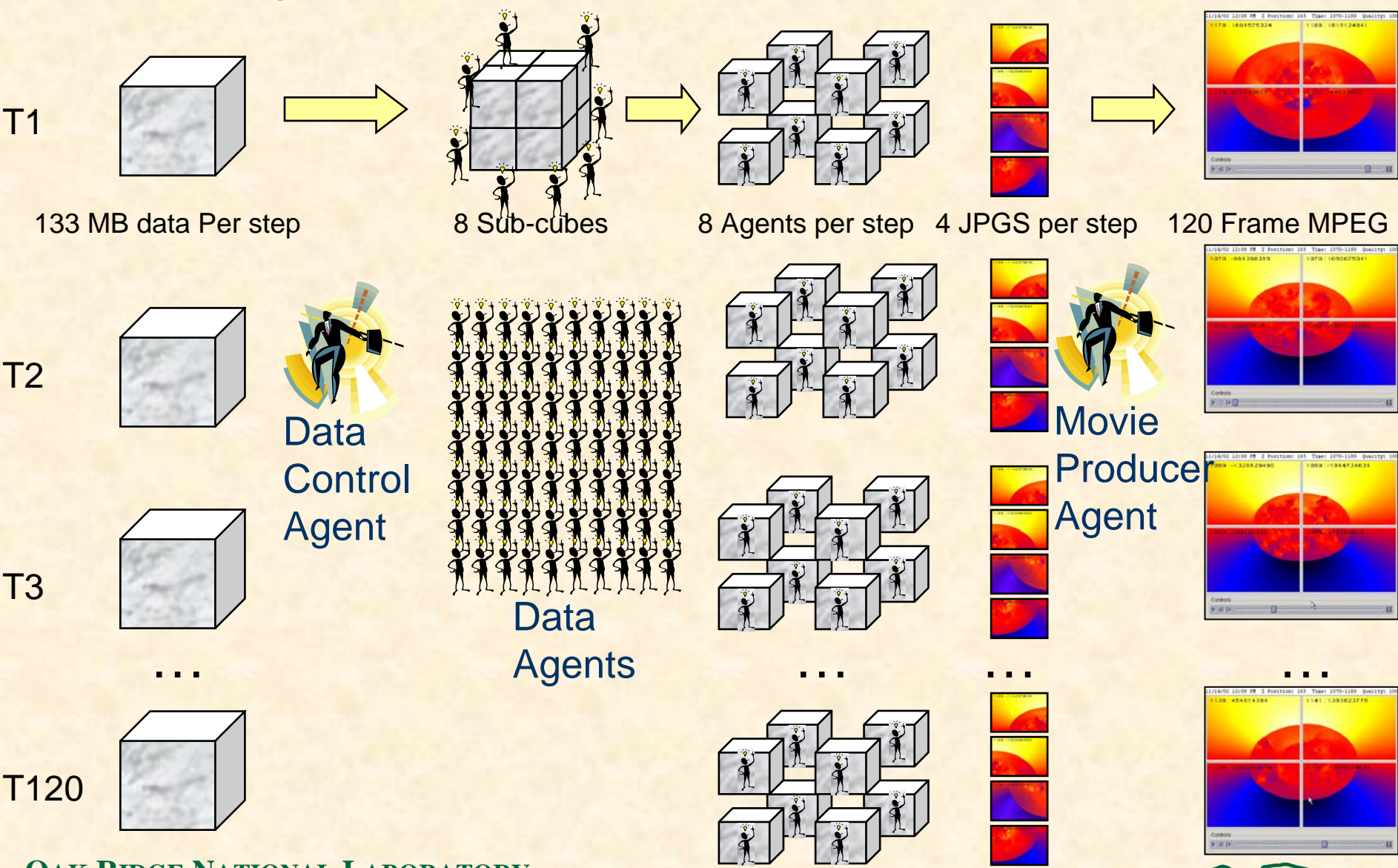
Date	Time	Source Port	Destination IP	Destination Hostname	PI Name	Research Area	Destination Port	Length	Filter
07/23	14:14	80	128.219.49.130	LQ32.CT.ORN.LGOV	Hidden	Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	4145	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	14:29	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	4302	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	14:58	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	4654	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	15:11	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	4768	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	15:31	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	4934	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	16:17	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	1789	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	16:41	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	2130	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	17:00	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	2285	455	beta-000014 BETA - WEB - 403 Forbidden
07/23	17:27	80	128.219.49.130	LQ32.CT.ORN.LGOV		Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym	2575	455	beta-000014 BETA - WEB - 403 Forbidden
							Chemical and Material Science on Nanostructured Surfaces: Biomimetic Photozym		

Patent Pending

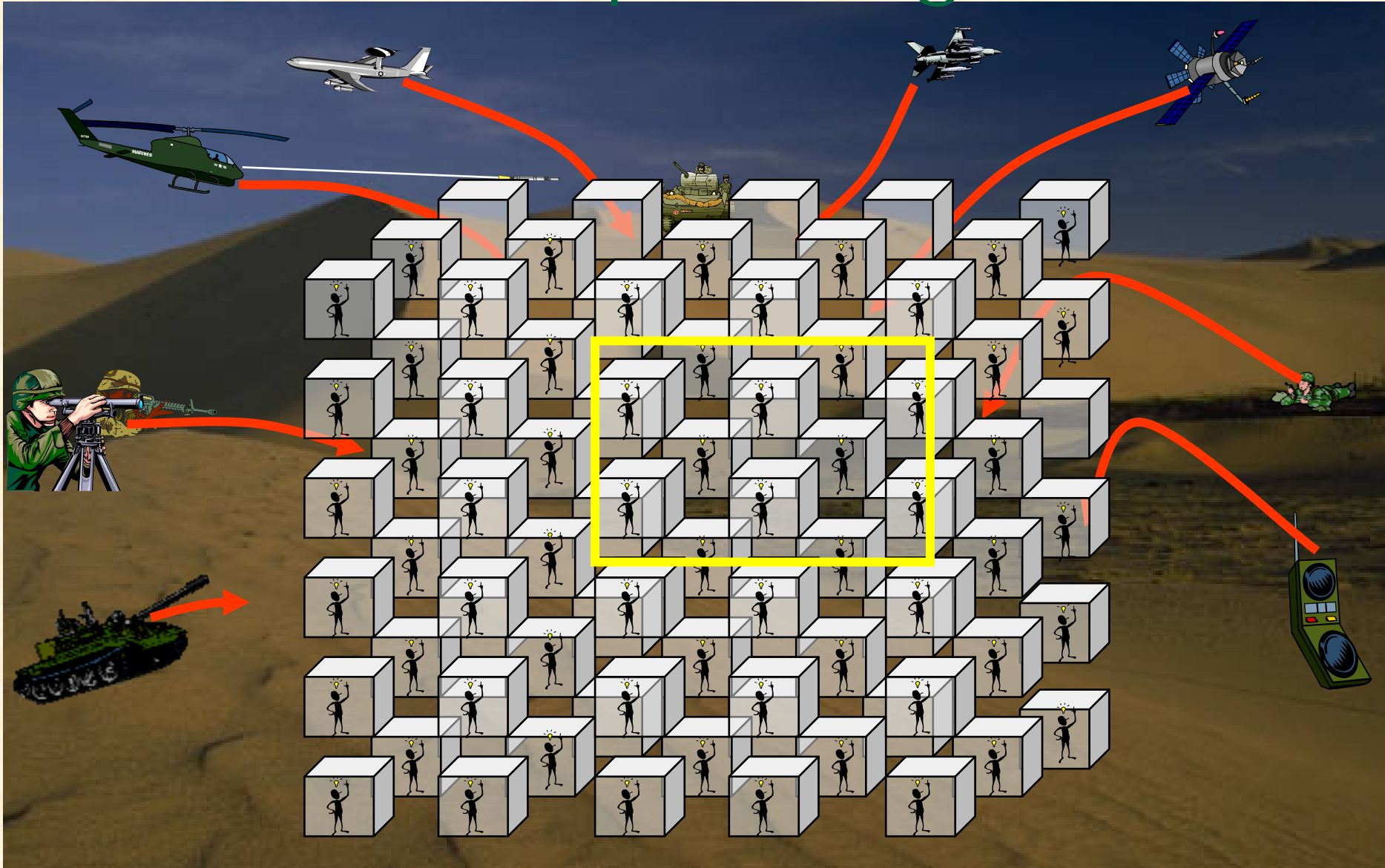
Agent Example "Pictures from Data"

- 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

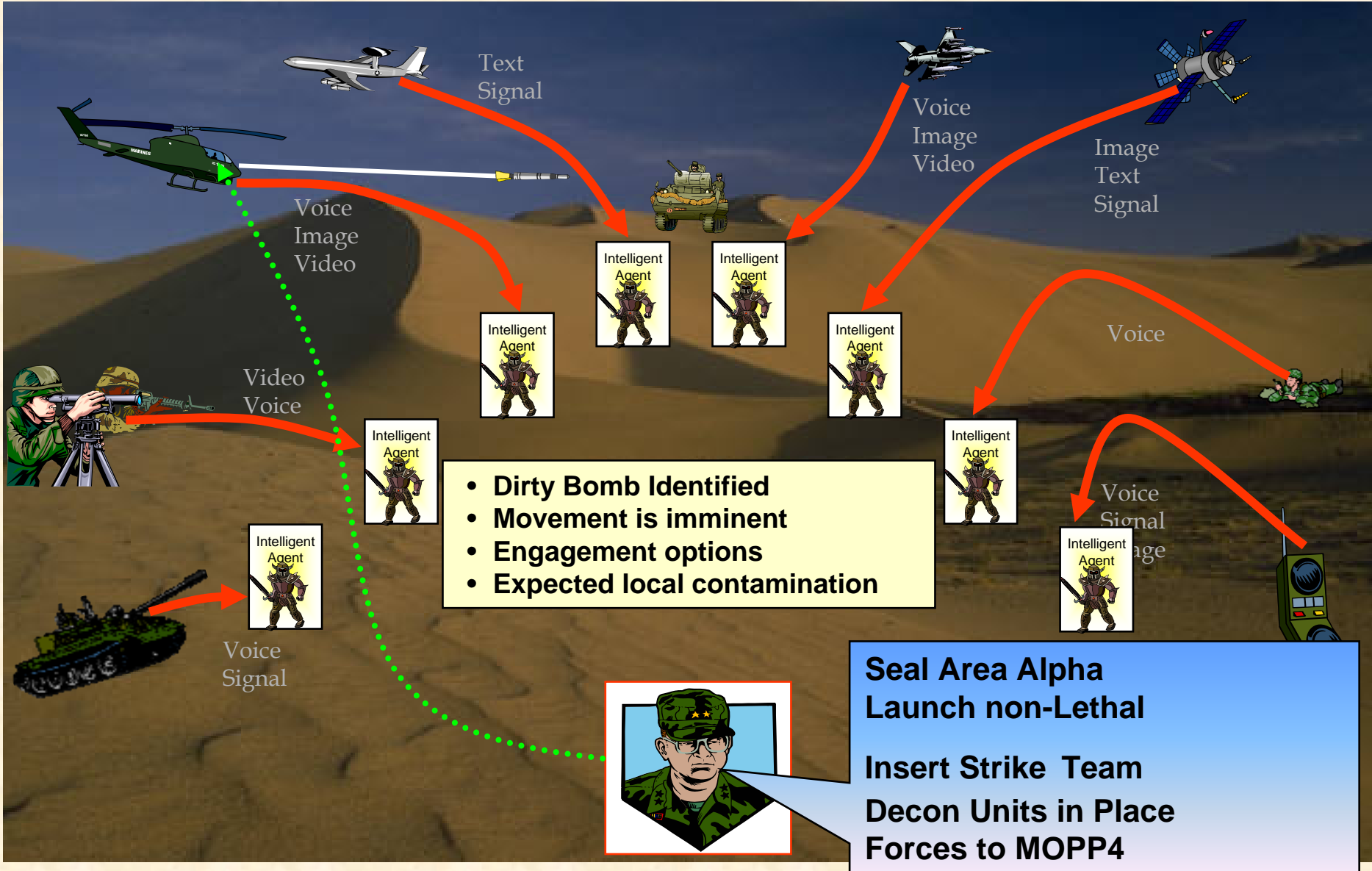
Astrophysics Common Operational Picture



Common Operating Picture



Future Battlespace - Forward Analysis



Knowledge Discovery

"The Art of the Possible"

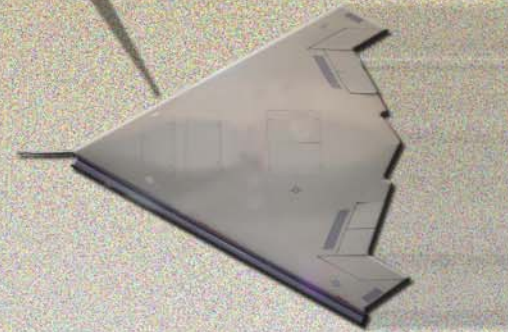


OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY





Sqdn Cdr



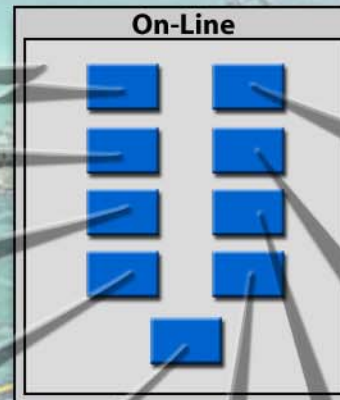
Info Transmitted

- 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

**Warning
Order
at 1200 Z**



JFC J3

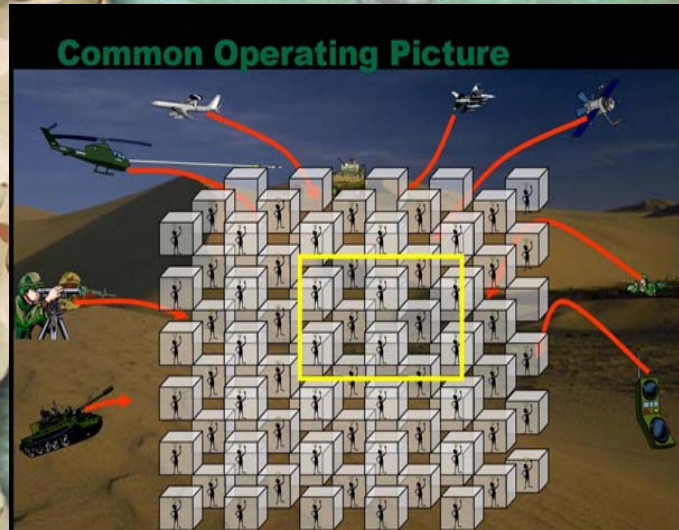
Units Available		Deployment List
		ACC
		MC
		AF
		SOC
		NAV

UID
Readiness
Load Plans
Movement Requests
Movement Plans
Support Slice
Sustainment

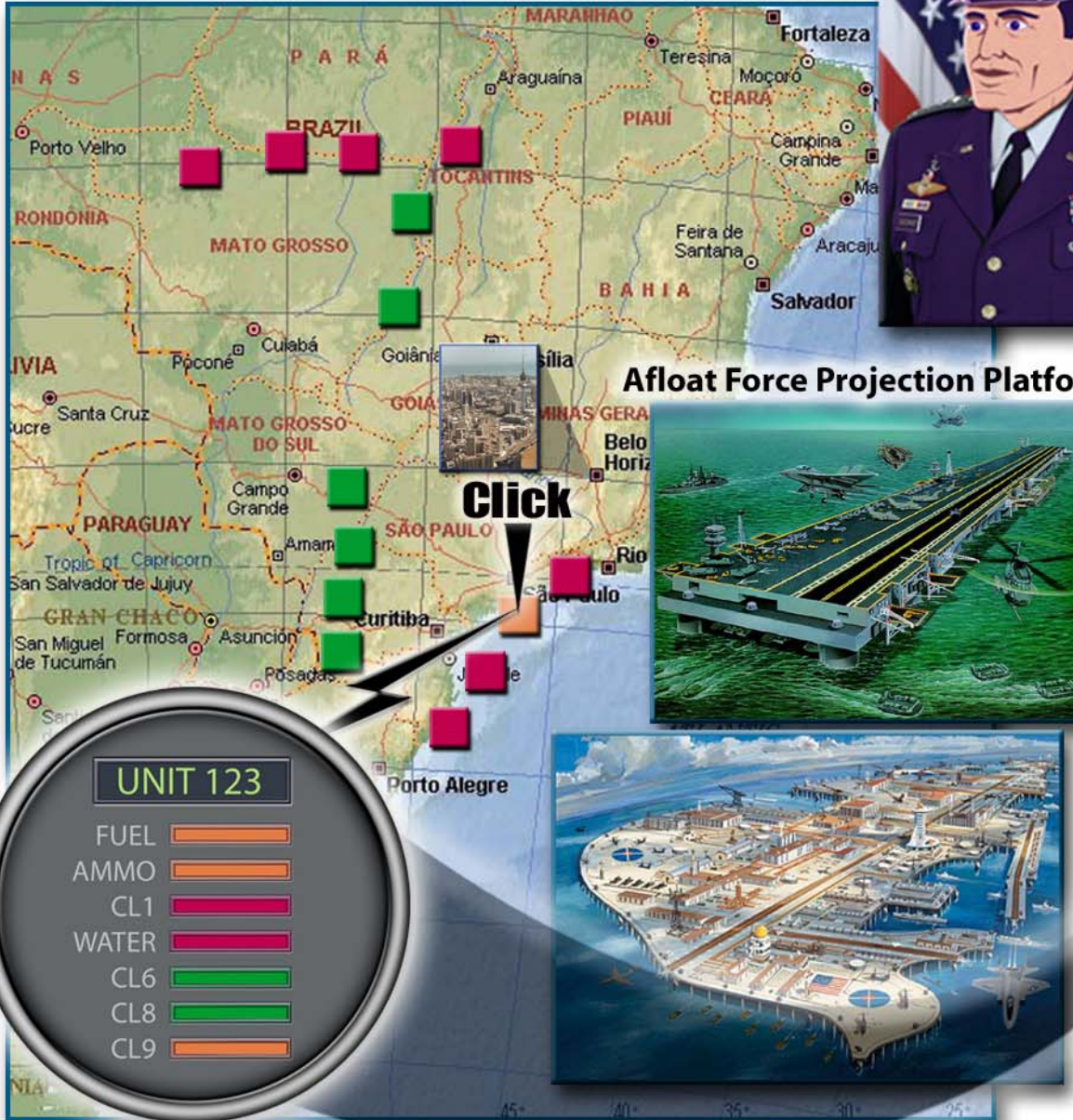
On-Line	
ACC	DLA
AFCC	NCC
USMCCC	DOD
SOCC	J5J3
TRANSCOM	UID

*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**



Day 5: Combat Power



Afloat Force Projection Platform



Path to Success

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

Knowledge Discovery 2020

A futuristic space station or orbital platform is shown in a dark, atmospheric environment. The station features a large, complex structure with a prominent antenna or probe extending from its side. The background is a dramatic sunset or sunrise, with a bright orange and yellow glow on the horizon. The overall scene conveys a sense of advanced technology and exploration.

**Know all that can be known
Apply the Power of the Force**

“The Force Is Always With You”