BA04MSB010

Next Generation Chem Bio Battle Management System

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Outline

- Overview of CBRN Battle Management
  - Battle Management Decision Loop
  - CBRN Data Model
  - NGCBBM Decision Loop
- Examples of CBRN Information Management
  - Sensor / Actuator interaction
  - Analysis and assessment
  - Status
  - Response plans
- Examples of Operational Environment System Configuration
  - Data Acquisition
  - Operation Across Guards
  - Multi-level Data Processing
- Conclusions

CBRN Battle Management

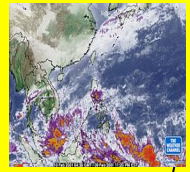
- Create an sufficiently accurate and understandable representation of the real world to provide actionable information which the warfighter can use to effectively influence the real world in real time.

- Build a tool the warfighter recognizes
  - Improve acceptance
  - Make use of centuries of evolution
  - Play CONOPS/technology leapfrog

Battle Space

Force Protection

Met Data



Hazard Models

NBC Recon

Battlefield Situational Awareness

Attack Events

Sensor Data

Operational Status

LG, SF, TRANS,
OPS, FD, EOD, ETC…

CBRN
Battle Management Questions

- What is it?
- Where is it?
- What is the impact on missions?
- How long will impact last?
- What will change the extent, degree or length of impact?
- What confirms/contradicts a change in impact?

Battle Management Spectrum

Fixed Site (RestOps)	Expeditionary Site (CASPOD)	Mobile Site	Incident Response (IMCR)
Fixed Participants	Know Participants	Know Participants	Unknown Participants
Fixed Infrastructure	Portable Infrastructure	Mobile Infrastructure	Any Infrastructure
Well Defined Mission	Defined Mission	Defined Mission	Save Lives
Train Together	Coordinated CONOPS	Coordinated CONOPS	Limited or No CONOPS
Years to prepare	Weeks to Prepare	Hours to Prepare	Hours to Prepare
Single Platform	Multiple Platforms	Multiple Platforms	Any Platform

Chem/Bio Battle Management

Remote Client

Local SME Analysis

Local NBC Modeling

Remote NBC Modeling (JEM)

Portal Shield Detector Network

One-Way Link

Survival Recovery Center

Potential Comm Link

Remote C2 System

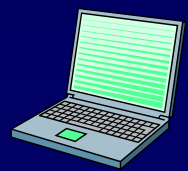
One-Way Link

Remote Data Relay Detector Network

One-Way Link

Remote Data Relay Warning Network

Rapid Manual Data Extraction



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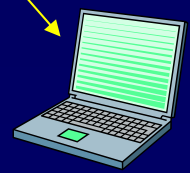
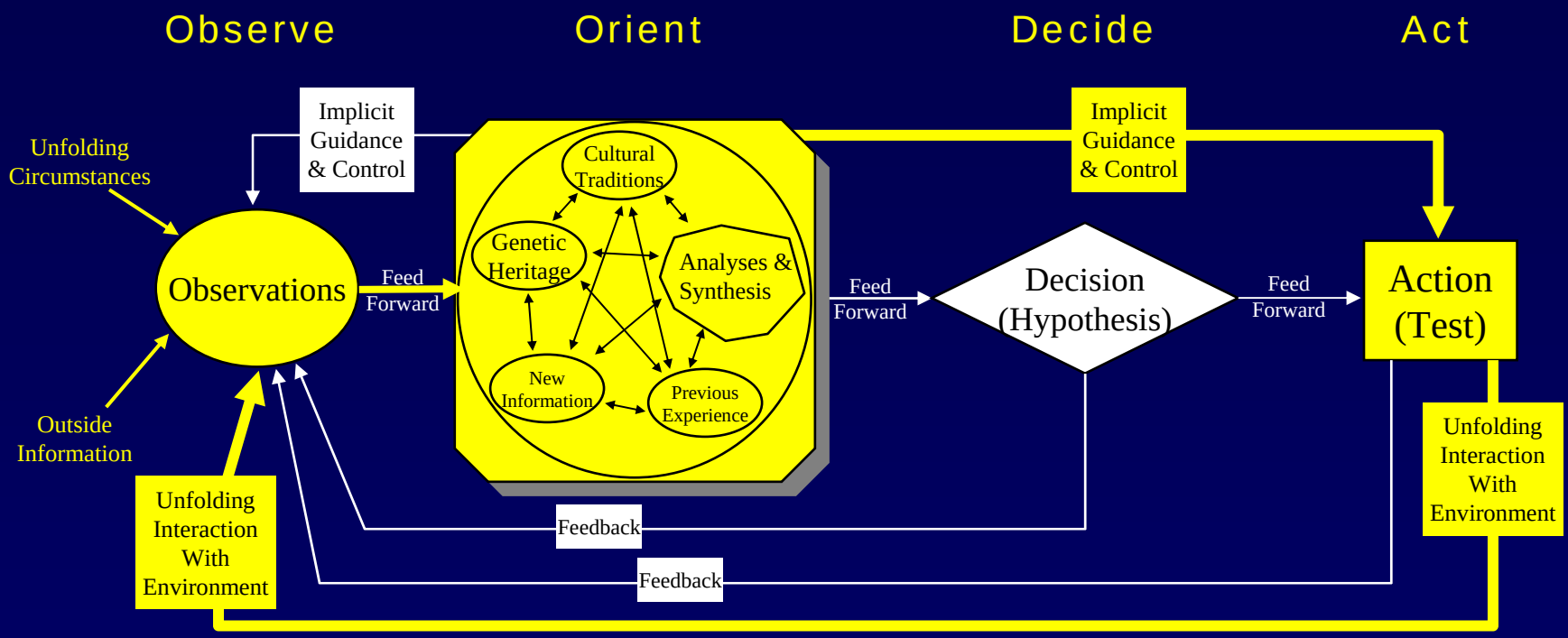


Manual Data Entry

Remote SME Analysis (JWARN / JOEF)

Boyd's OODA Loops



From "The Essence of Winning and Losing," Col John R. Boyd, January 1996.
Defense and the National Interest, http://www.d-n-i.net, 2001

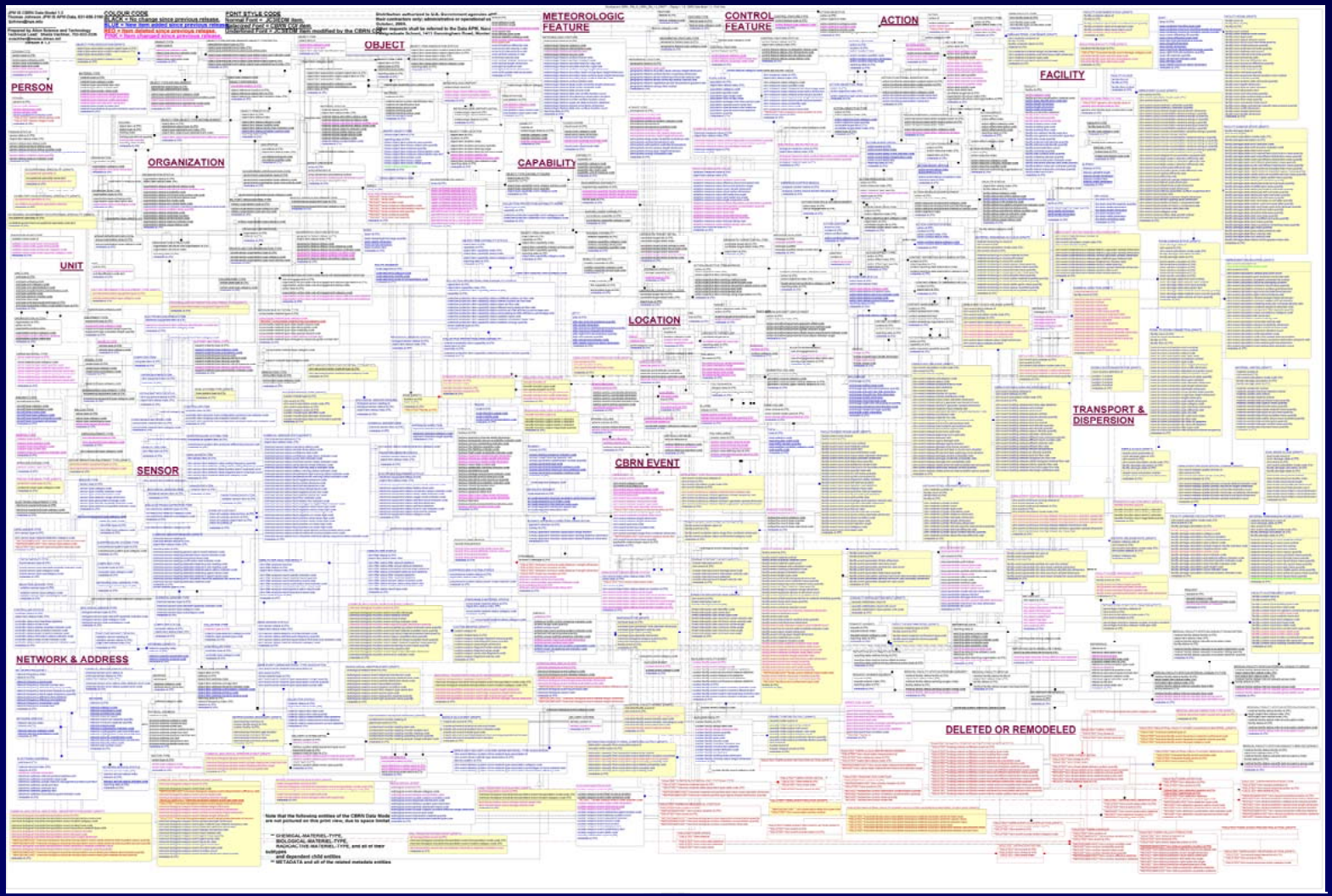
OODA Use Day to Day

- Humans process OODA loops continuously
  - Poor decisions are failures in the OODA loop
  - Katrina response was a failure in the OODA loop of individuals and organizations
  - A good employee is one that can process the OODA loop at their level
    - Vehicle maintenance checklists
      - Refuel the vehicle
    - Provide the status report
    - Provide course of action to address inadequate status for mission

- Sensors/Detectors process OODA loops according to a static or dynamic plan
  - Detector Processing - Sampling time, detection limit, alarm type
  - RDR Communication Node Processing -
  - RDR Command Post Processing -
  - IIMS Processing –

- In practice, OODA Loops need to address:
  - Bandwidth management
  - Processor management
  - Storage management

CBRN Data Model



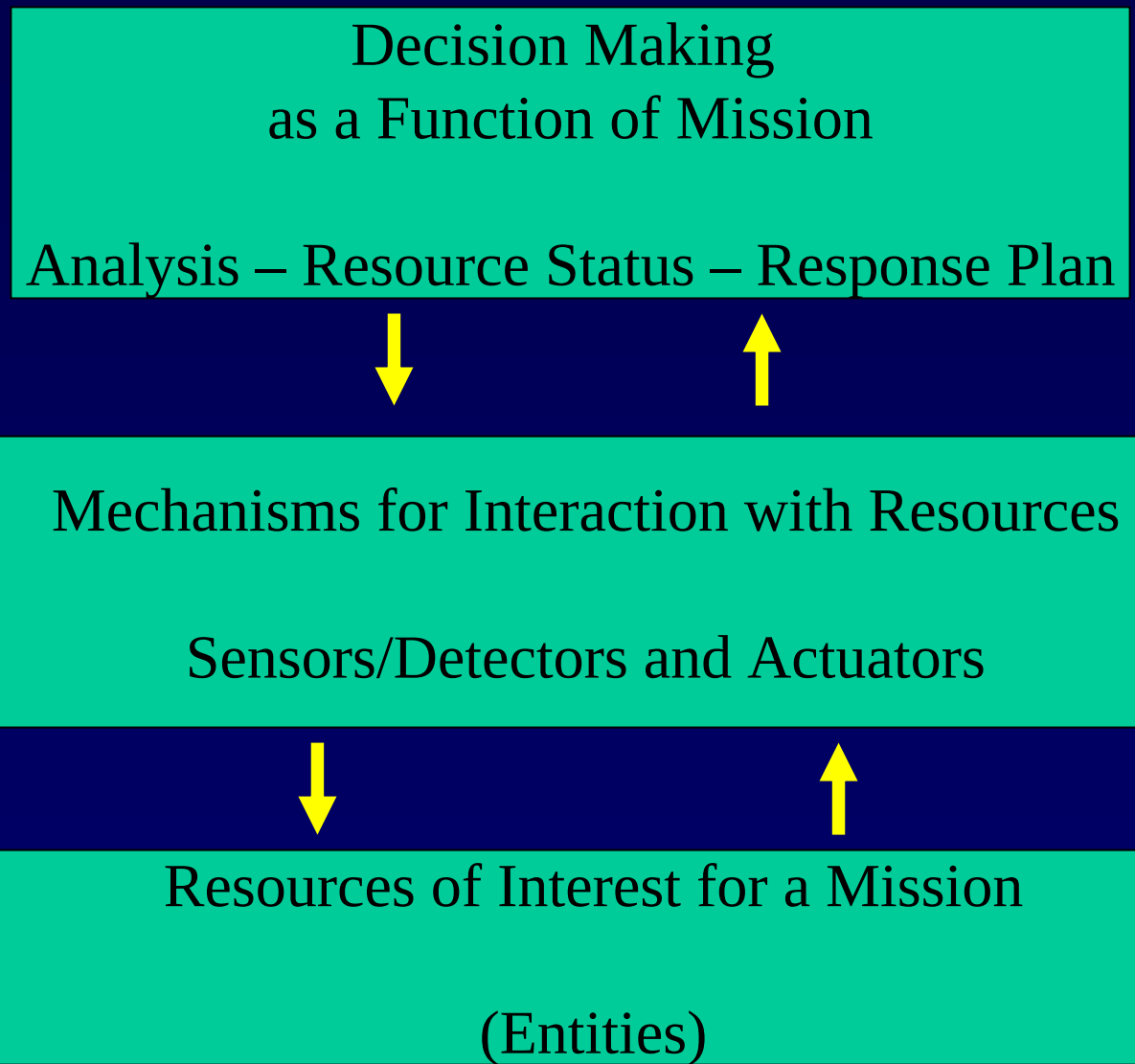
What types of information management does this enable?

What kinds of field configurations does this enable?

NGCBBM System Approach

- Tie OODA Loop to common military functions
  - Data analysis
  - Asset status for a mission
  - Response checklists
- Generalize military functions
  - Generalize service specific functions
    - “The Army doesn’t do split MOPP”
  - Generalize event/status/entity functions
    - Runway / pier / shipping channel / road
- Use CBRN Data model as basis for the battle management system

NGCBBM Data Base and Code Structure



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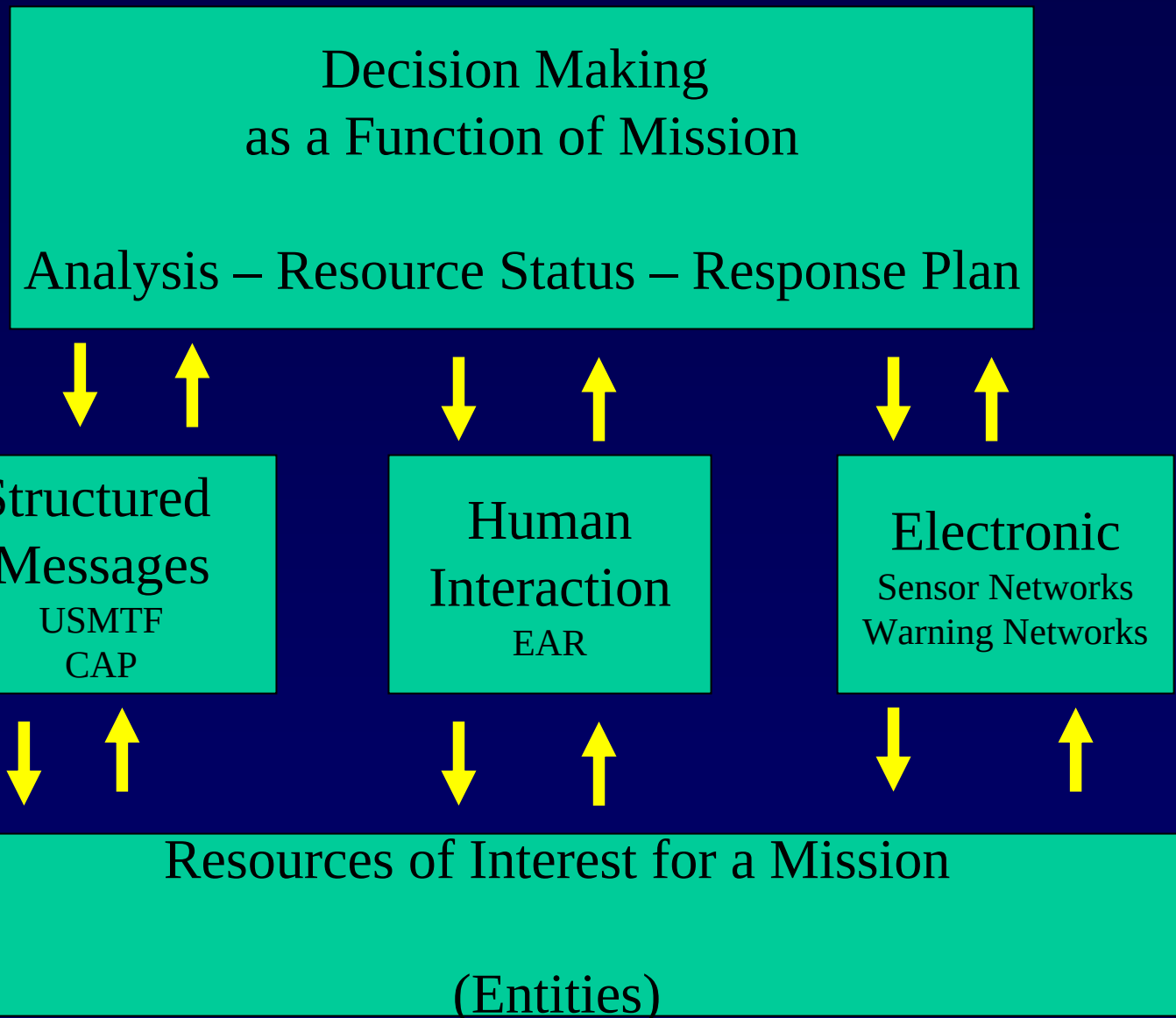

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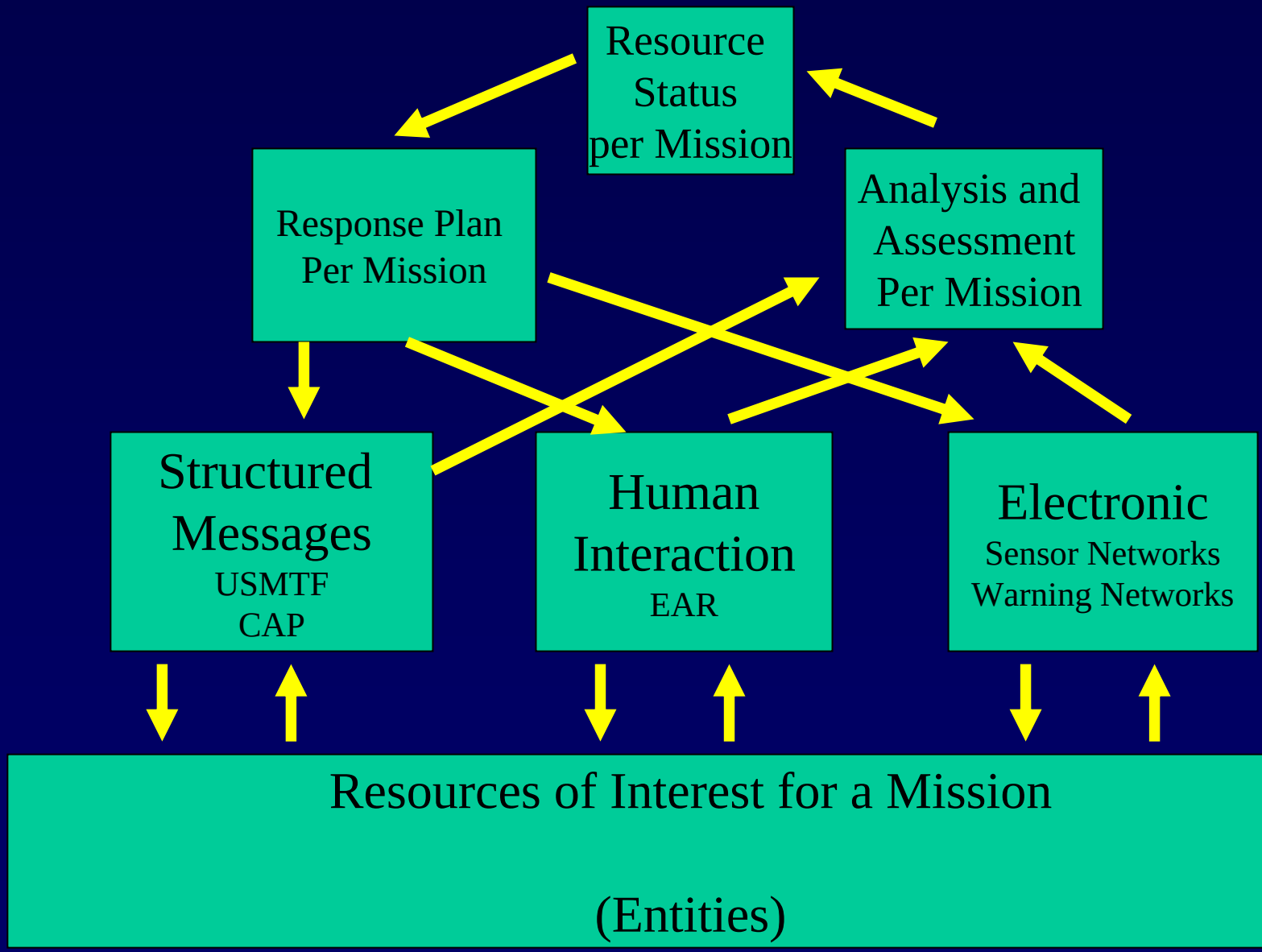

NGCBBM Data Base and Code Structure

Entity_Status
- Mission Capability
- ThreatCON
- FPCON

Status of our resources for a specific mission

Action Event / Mission Plan / Support Plan
- Sweep — Assets w/ Consumables
- Warn
- Checklist
- Battle Plan
- Dynamic SME Response
- Refuel
- Eat/rest
- Organizational Structure

Dynamic or planned events (act or sense) in response to status for a specific mission

Event_Entity Analysis and Assessment
- Data Point
- SME Analysis
  - Tag
- Automated Analysis
  - Model

Analyze events to determine entity status for a specific mission

Event_Remote
- USMTF
- OTH Gold
- CAP
- EDXL

Reference data
Two-way interaction

Event_Human
- Sensor
- Detector
- Actuator

Action Request
Attack or Activity Report
Local event through
Human interface

Event_Electronic
- Sensor
- Detector
- Actuator

Local event through
Electro-mechanical interface

Entity / Entity_ Properties Features / Entity_ Allegiance
- Region
- Transportation Infrastructure
- Utility Infrastructure
- Platform
- Facility
- Equipment
- Consumable
- Individual

Entity is any resource that can be used to change the real world

Country / Base

Organization

Resources combined for a mission form a higher level entity

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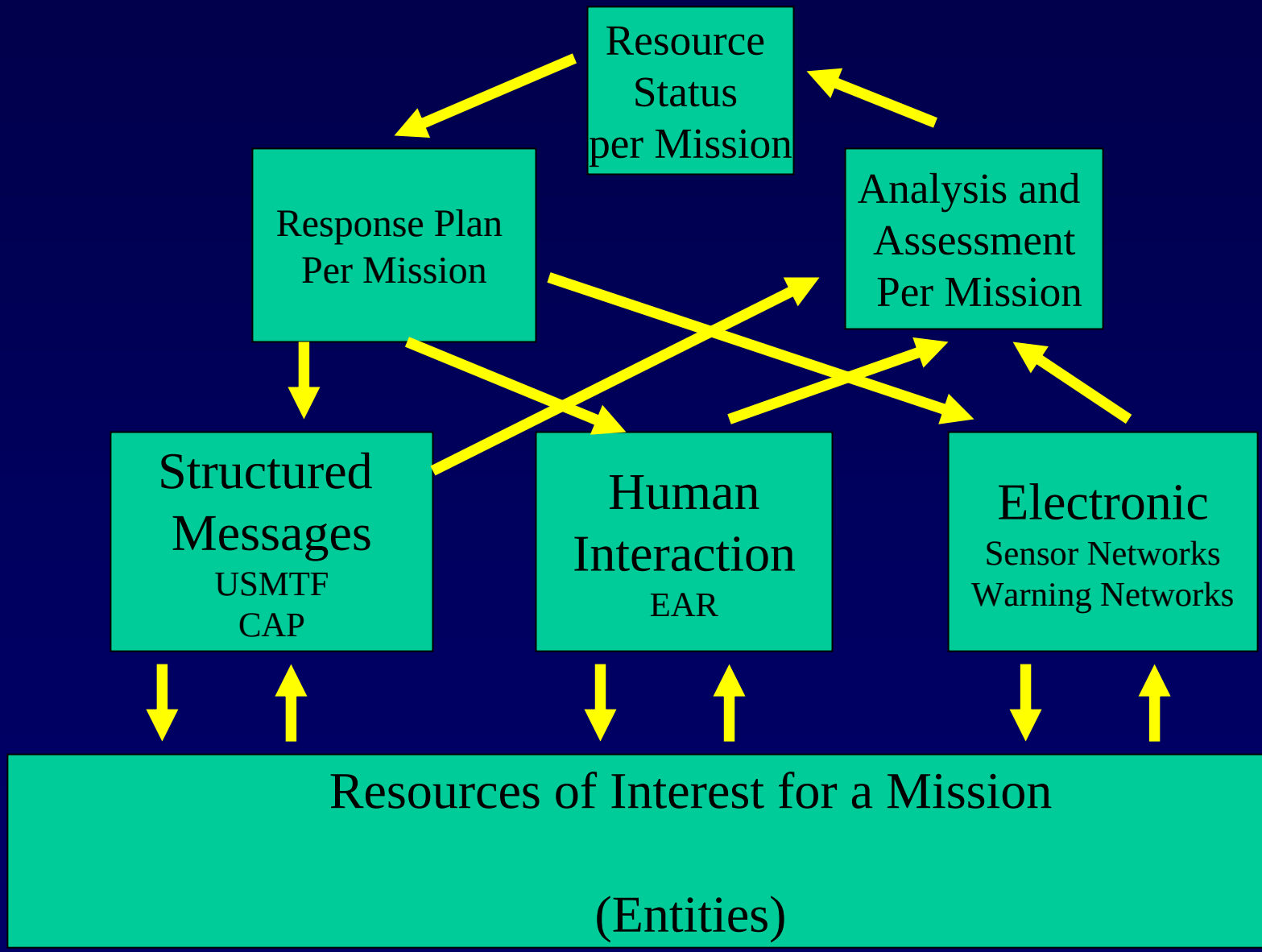
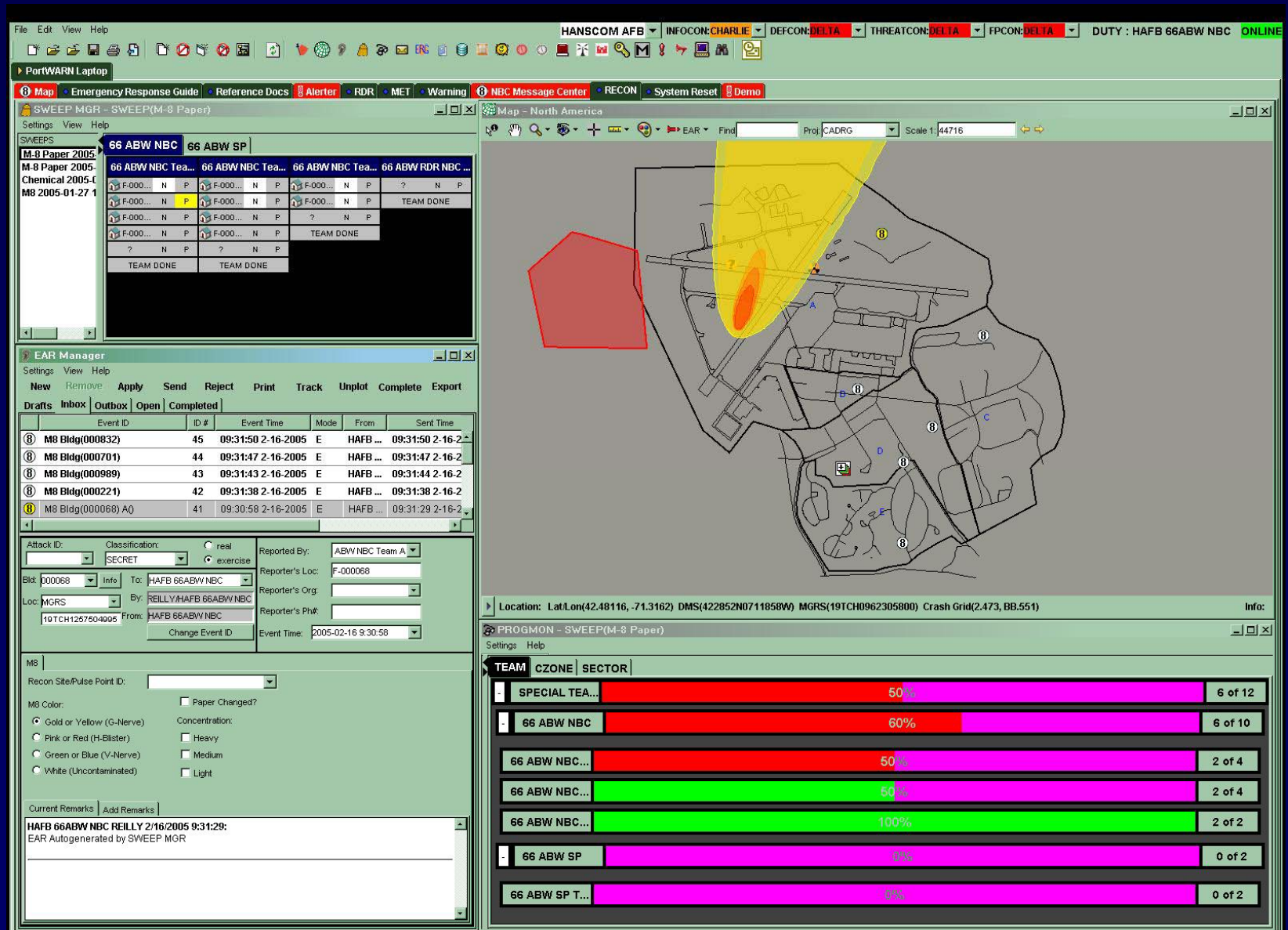


Data Acquisition

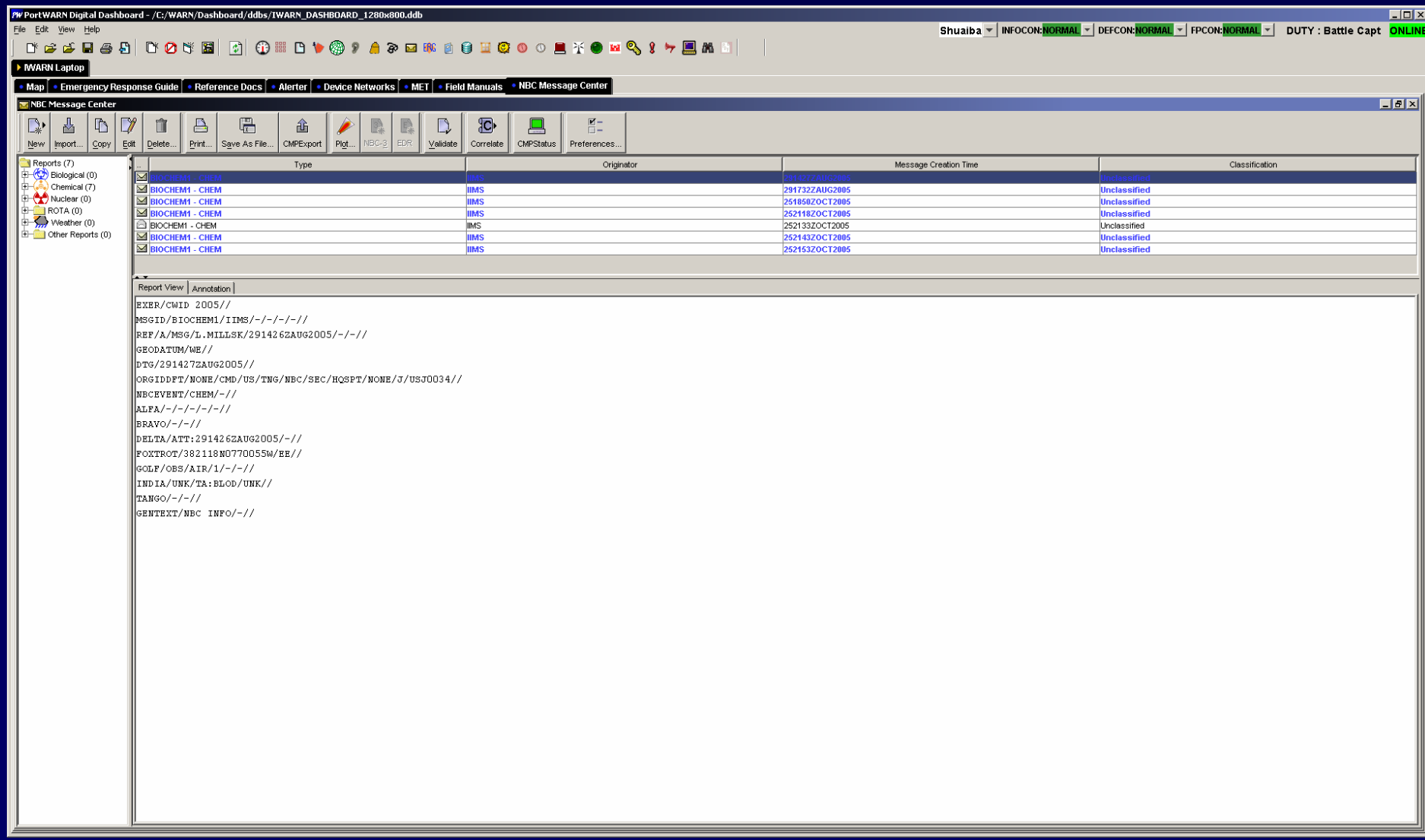
- Reference
  - Map Data
    - NGA
    - GeoBase
    - Commercial
  - Hot Links
  - Reference Databases
  - Reference Documents
  - Emergency Response Guidebook
- Manual
  - EAR
  - StatRep
  - Region or ThreatCON Status
  - Drawing Map Layers
- Rapid Manual
  - Sweeps
- Information Extraction
  - Patrol Debriefing Tool
  - Turbo Tax type interface
- Streaming Electronic
  - Portal Shield
  - Remote Data Relay
  - JCID
  - Force Protection Sensors
  - Met
  - GCCS Track Data
  - JWARN and JEM

Sweep Interface

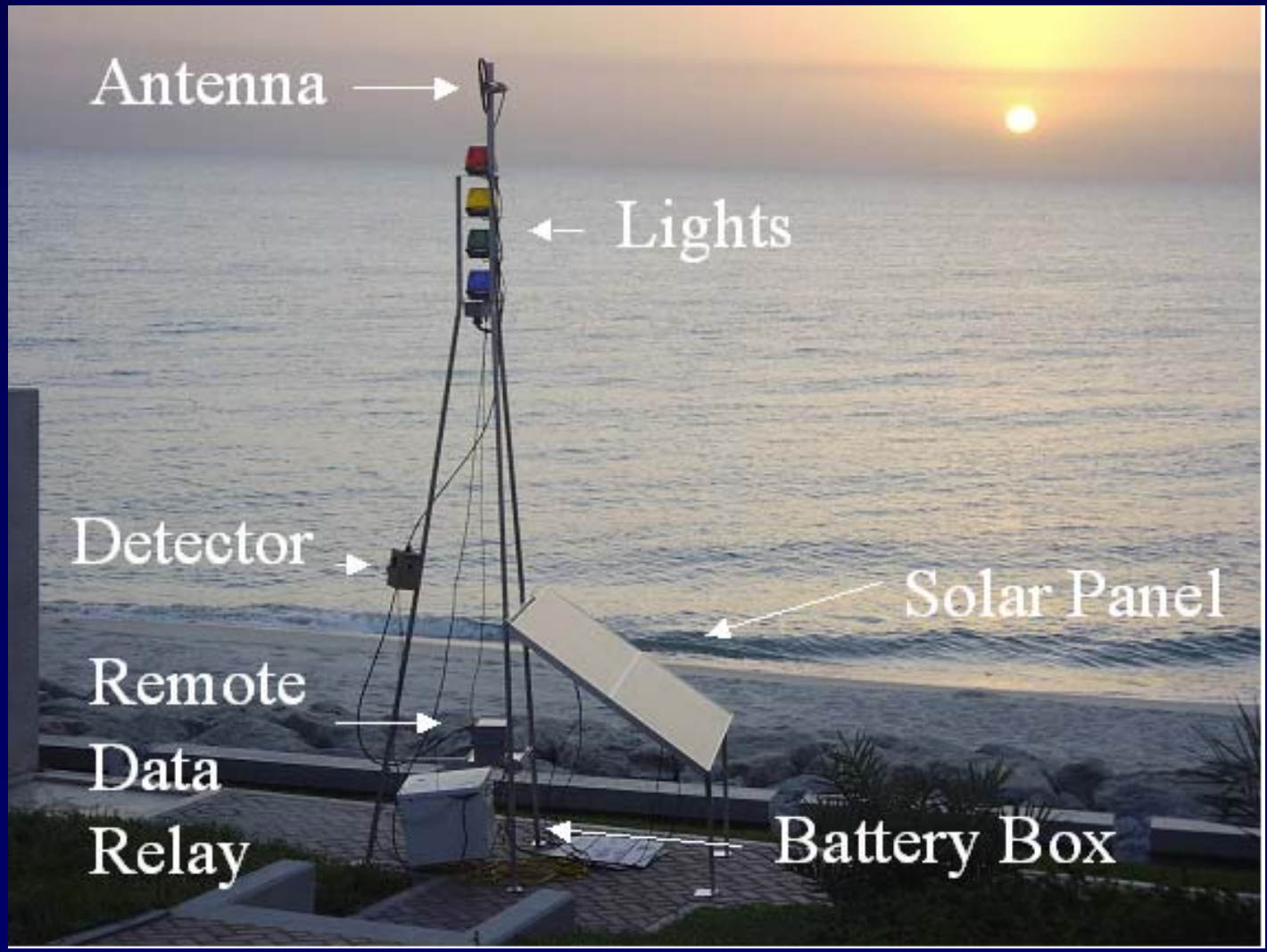


Information Extraction

CBRN Messaging



CBRN Warning



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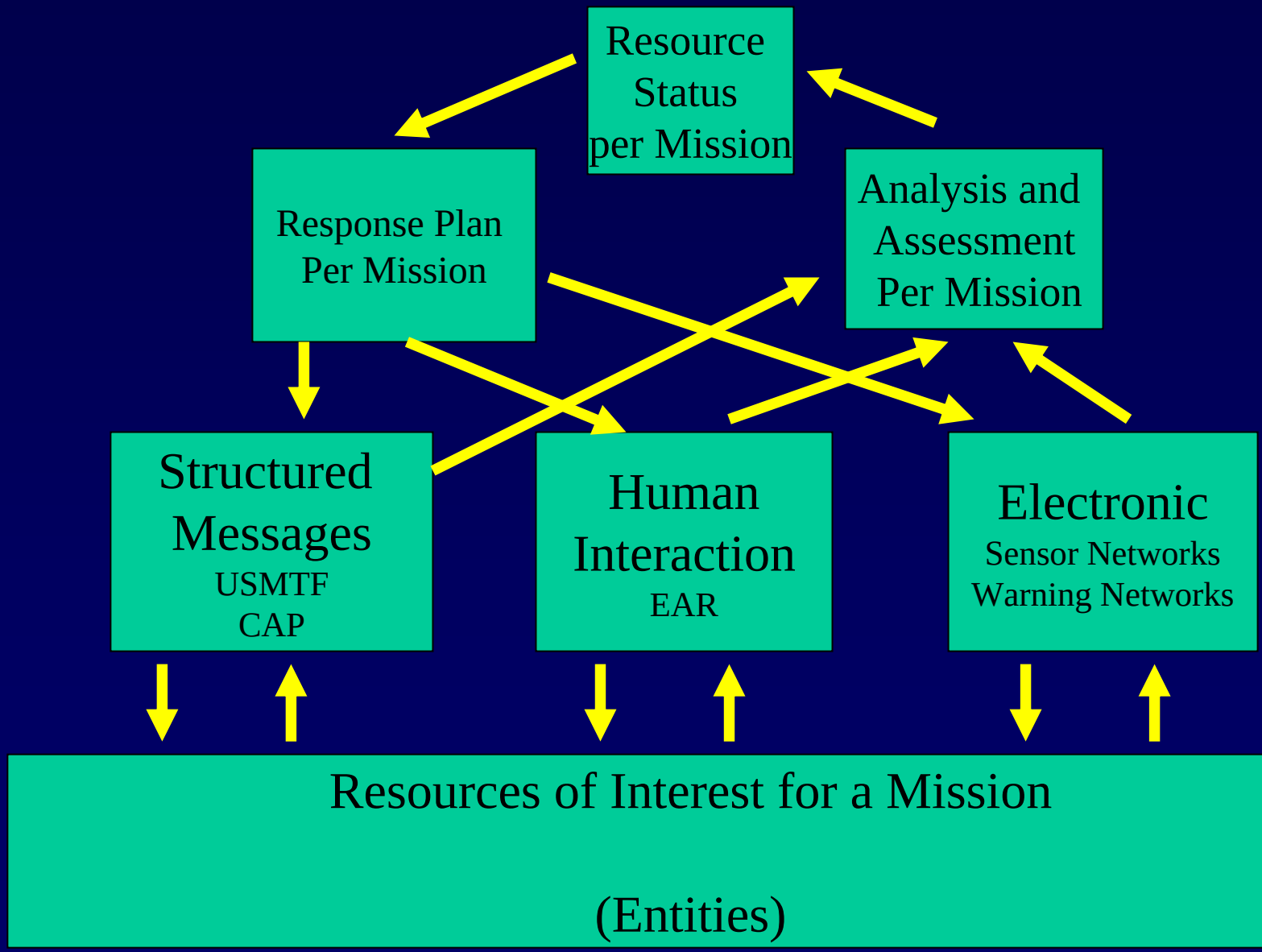


Information Cataloging and Aging

- I saw the cloud two hours ago
- I detected residue 30 min ago
- I saw the effects one hour ago
- I detected the cloud 115 min ago
- I modeled the cloud 90 min ago
- The CONOPS are ….
- Intel says the cloud would most likely have been ….
- Local newspaper reported in Oct_03 …..
- DECON had this impact ….

Information Tagging and Filtering

- Manual Tagging and Filtering
  - Plot on COP and Major Event List
  - Plot on Local COP and Major Event List
  - Region of Interest
  - Organization of Interest
  - Information Type of Interest
  - Information Topic of Interest
  - Classification

- Automated Tagging and Filtering

Sensor Data

- When is sensor data significant enough to detect, record and report?
- Rules are built into the detector and the detector network
  - Do you know what the rules are and how they impact your high level data interpretation?
- How do you combine data collected under different rules?
  - Sampling bias

Models

- Impact Regions (NBC 4-5-6) - Impact level on Region and Assets
  - Actual hazard on the ground
  - Hand drawn region

- Impact Region Models (predictive models) - Impact level on Region and Assets
- Transport and Diffusion
  - JEM
  - ATP-45
  - HPAC
  - ALOHA
  - VLSTrack
  - Met (e.g. precipitation)
  - Flooding
  - smoke
  - Other than attack
    - CAMEO
    - ALOHA
    - ERG
    - D2PC

- Operational Impact Models – Impact on Operations – Effect Models
  - Manual Status
  - JEM
  - JOEF
  - Heat Stress
  - Cold Stress
  - Smoke
  - STAFFS
  - Casualty Rates
  - NBC CREST

- Effects Calculators
  - NBC Planner

- Recovery Models
  - Resources required for Protection and Recovery

- Protection Effectiveness Models
  - None
  - Vulnerability Assessment Table (VAT)
  - Flooding data
  - Snow/Ice Storms
  - Stability Category Wizard
  - ITRANS
  - Urban Dispersion Model
  - MINT – Missle Intercept

- Passive and Active DECON Models
  - Is DECON needed or not?
  - What type of DECON is needed – Hasty vs deliberate, assets needed
  - Snowplow
  - Manual Measurement

- Course of Action Analysis
  - JOEF
  - Effects Based Operations
  - DECON Site Design
  - NCBR – show contamination of assets – ITT force decon.
  - Acquisition Analysis

- Probability Analysis

Can You Run Your Model?

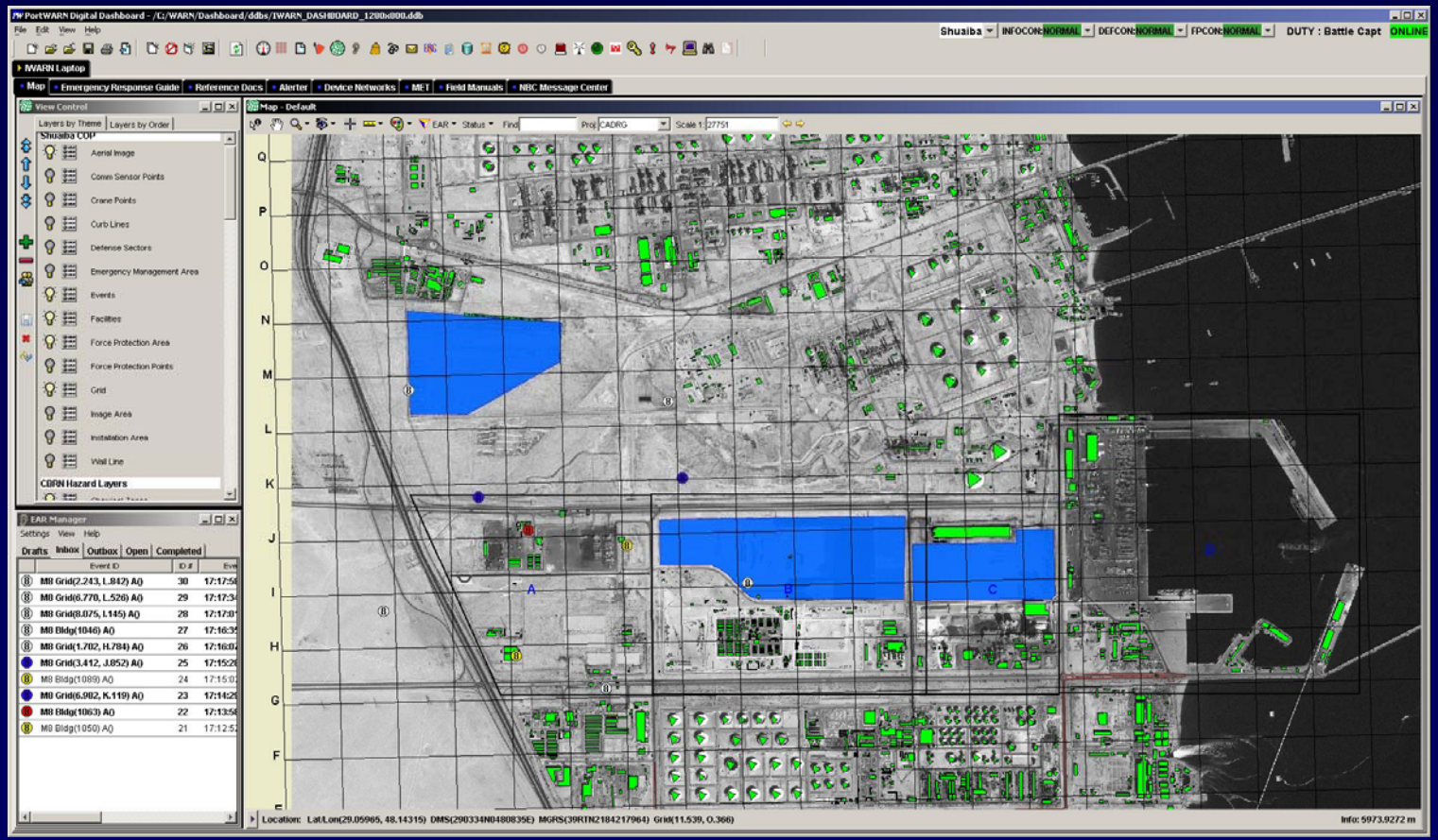
- CBRN Modeling Message is Needed
  - Ground contamination vs vapor
  - Sensor vs field observation
  - Vapor hazard vs liquid hazard
  - Sensors you don't own?
  - Models you don't own?

- Common Modeling Parameters which can be filtered based on Classification

Data Aging

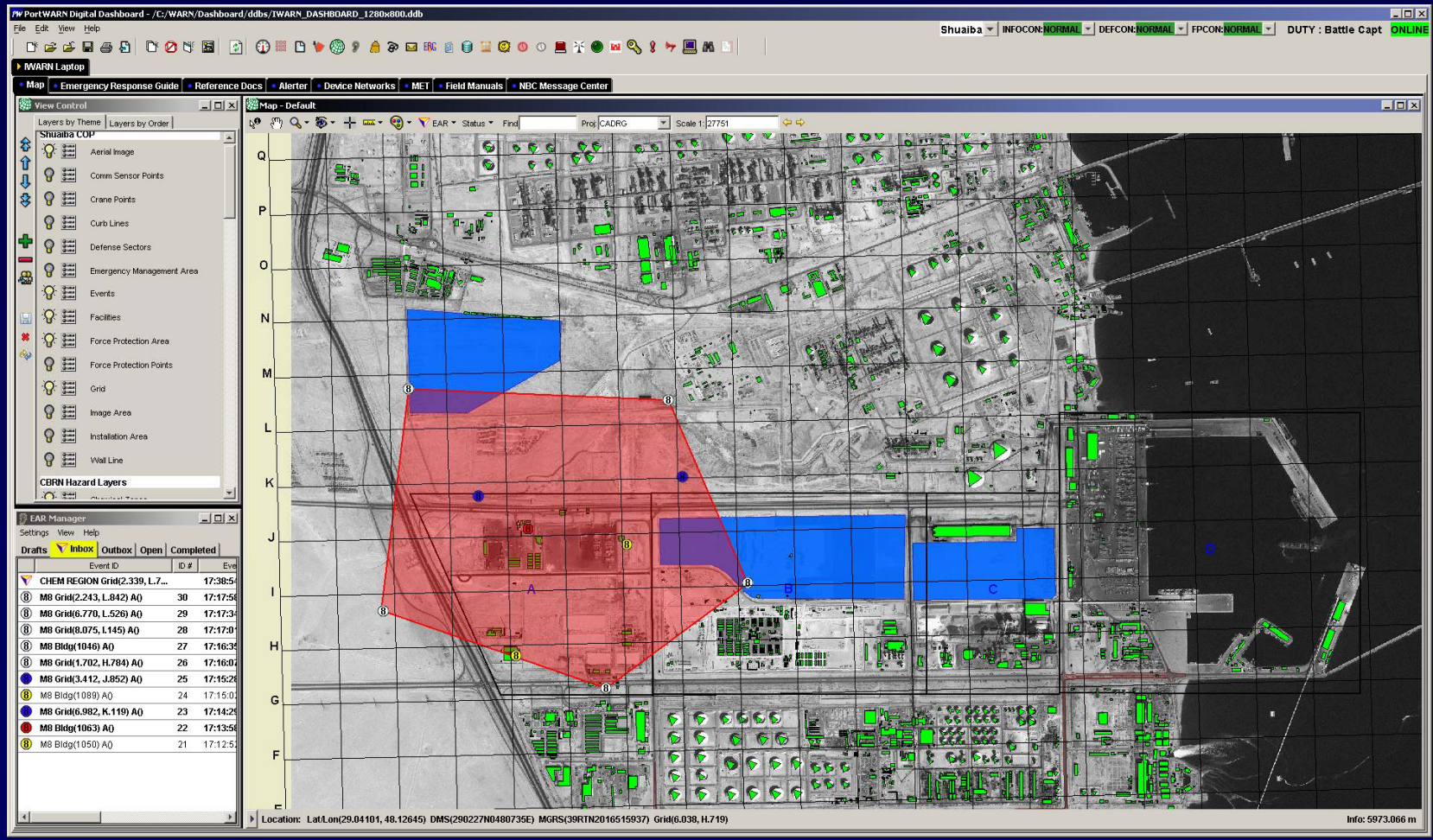
- How do you convey the currency of detection?
- MCAD Passive IR Absorption detection lines can overwhelm the user
- Aging of detection lines based on:
  - Time
  - Wind
  - Other environmental parameters?
  - CHEMRAT
- Automated Chem Region Polygon generation and aging of the chem regions
  - Time
  - Wind
  - Other environmental parameters?
  - CHEMRAT
  - Decon
    - Falcon or GL1800
    - Water
    - Bulldozer

M8 Detection



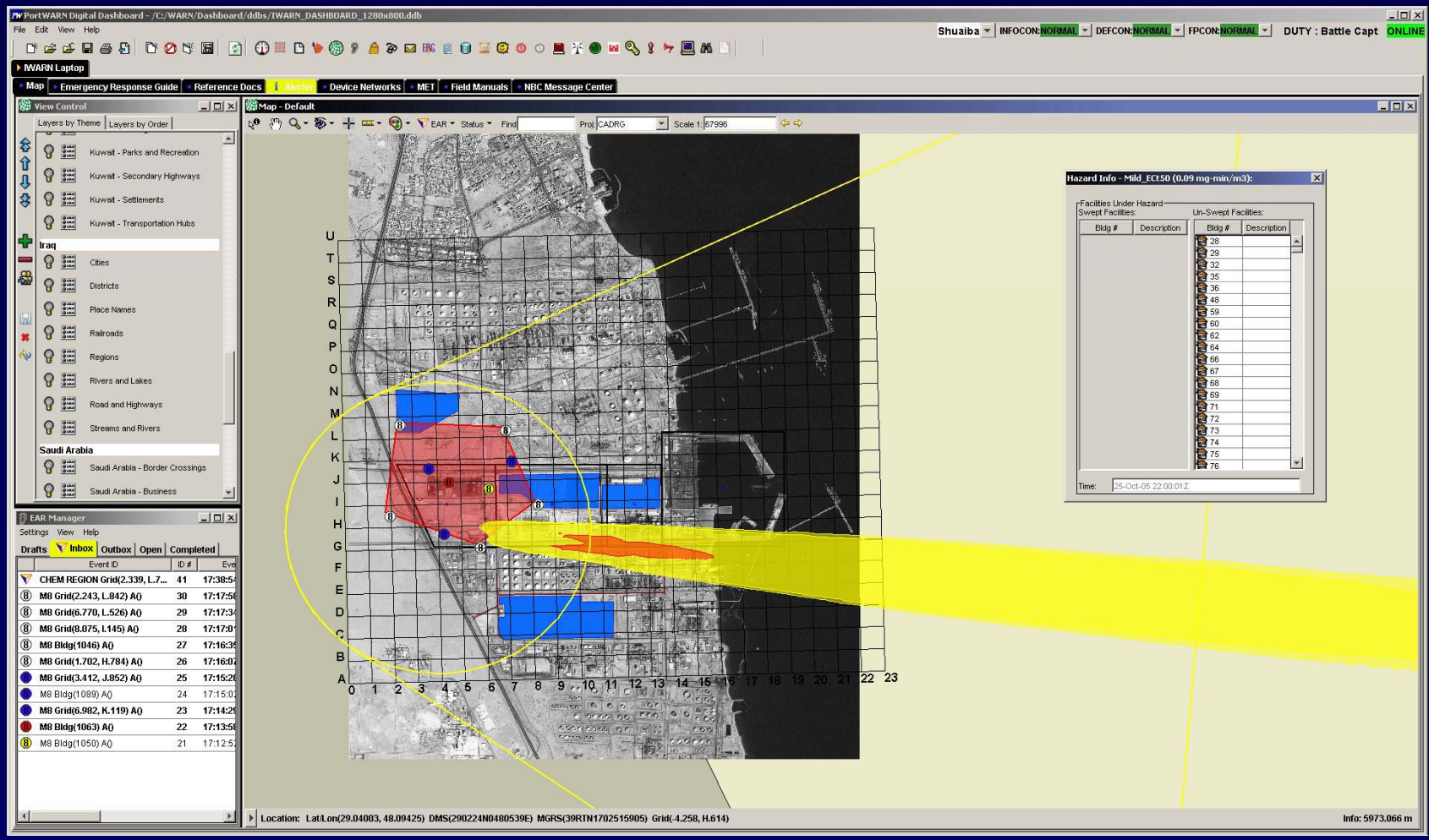
- Detections analyzed and believed to be real
  - SME evaluated the data points

Chem Region Drawn by SME



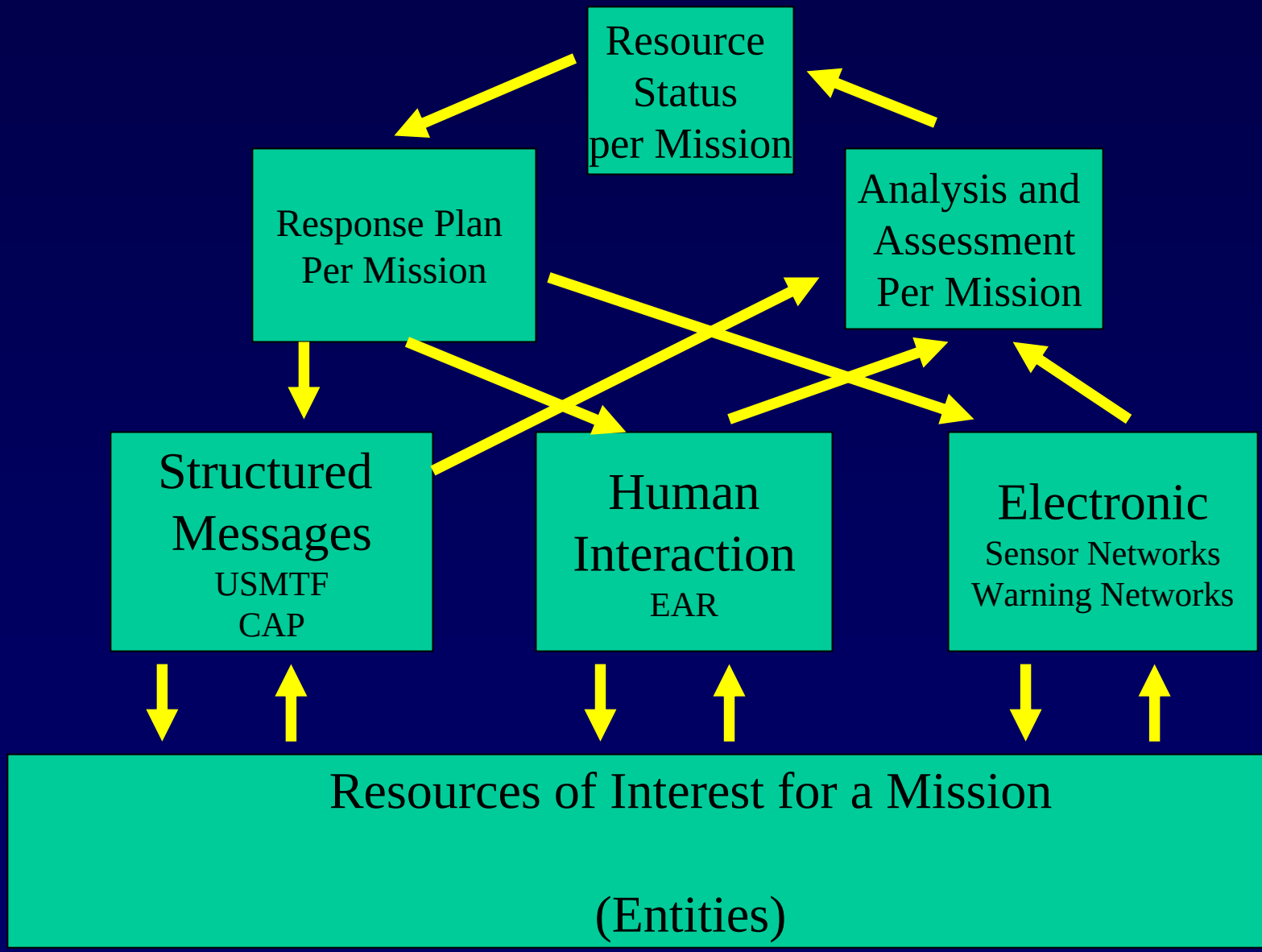
- SME determines region contaminated at level of detections
  - Manually tag data points to region and resources in it according to SME

Contaminated Region from Model

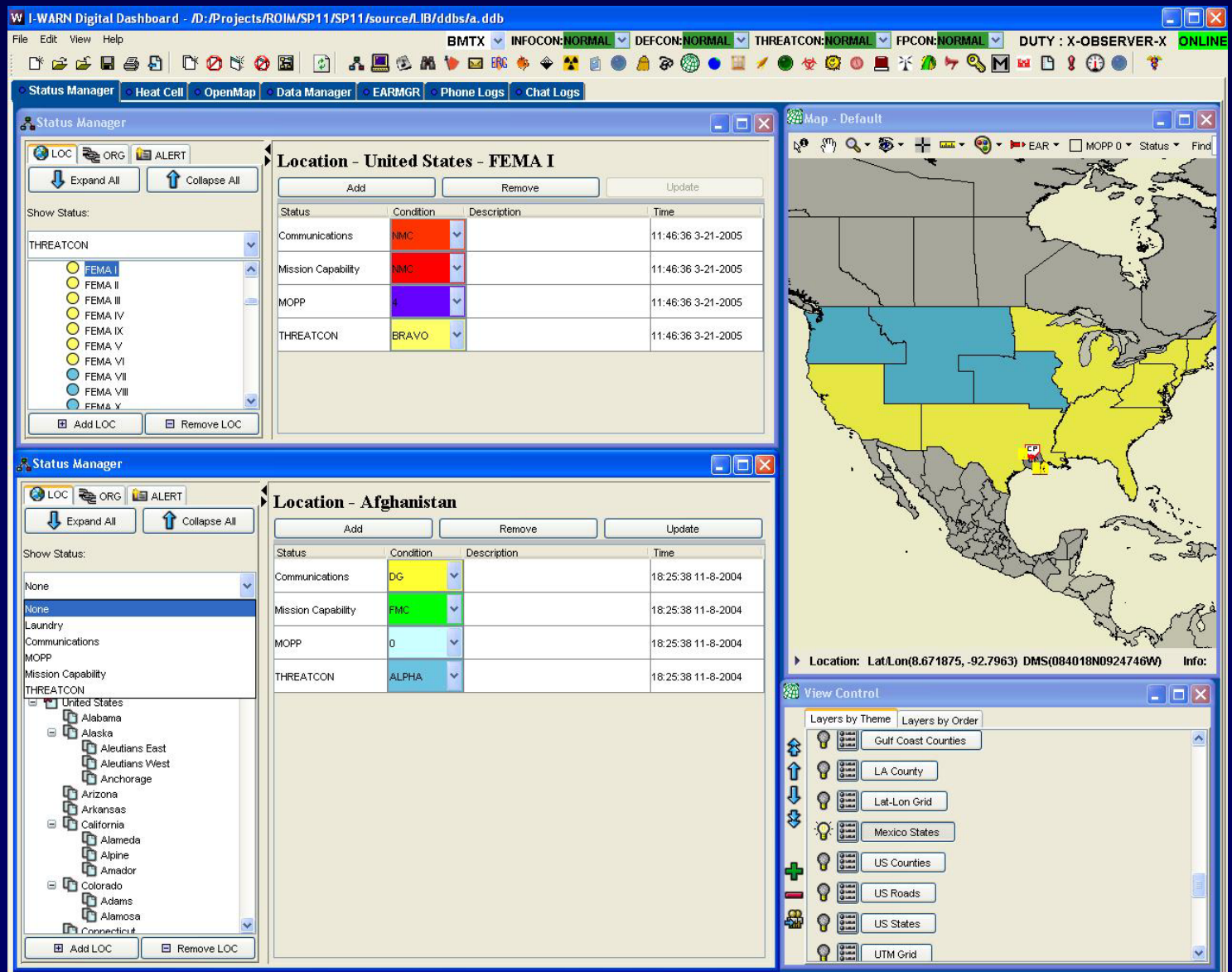


- Model predicts contamination levels based on detections and formalized SME
  - Automated tagging of data points to region and resources in it

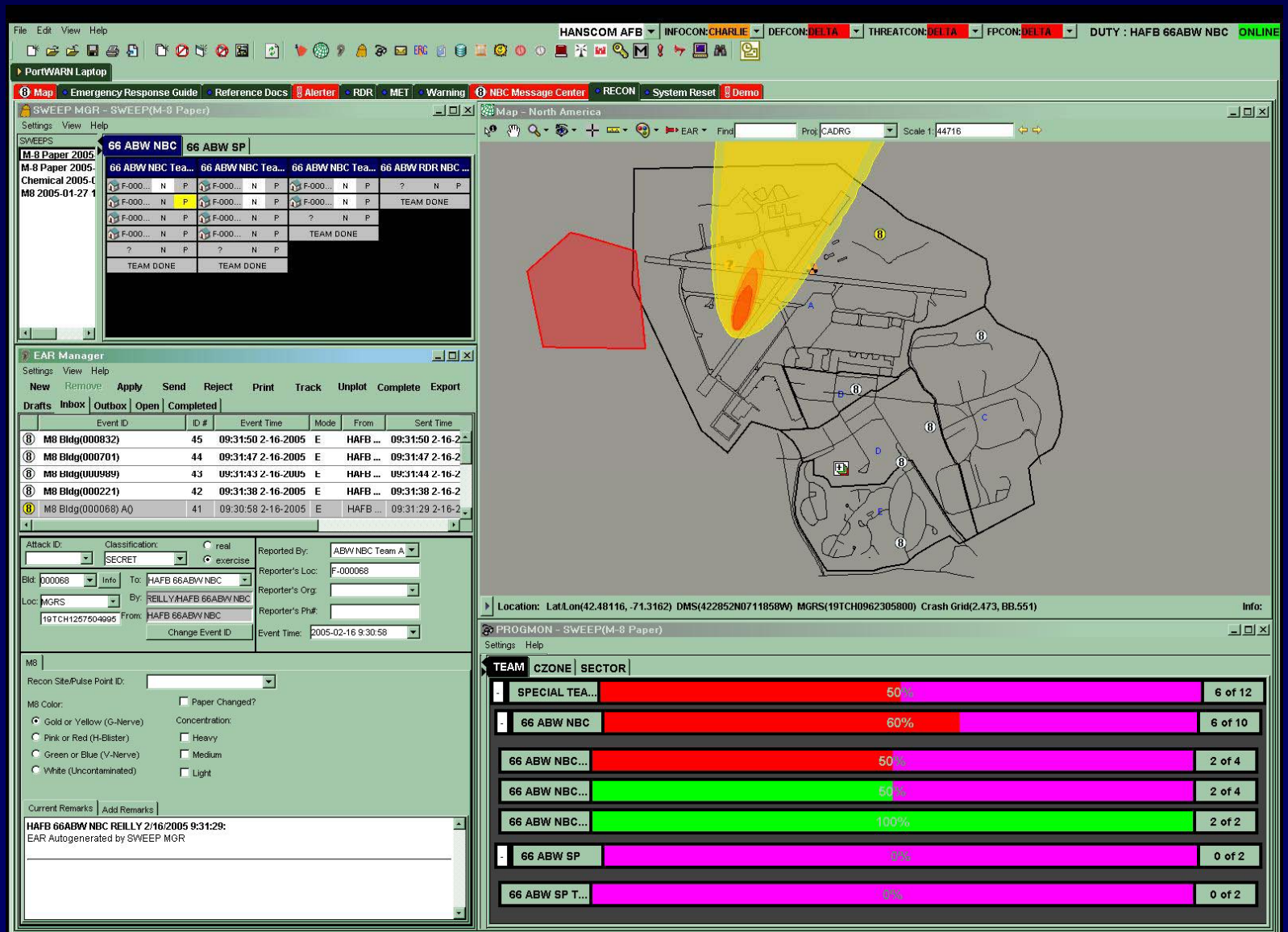
NGCBBM Data Base and Code Structure



Status Summary and CON Toolbar



Sweep Manager and Progress Monitor



Status of Which Resource?

- "Detector Faulted" is the status of the detector
  - May imply unknown status for region
- "Detector Clear" is the status of the point
  - May imply known status for region
- "Detector Alarm" is the status of the point
  - May imply known status for region
- "Comms Down" is the status of the network
  - May imply unknown status for region
- "MOPP None" is the status of the region
  - Implies MOPP status for all resources in the region

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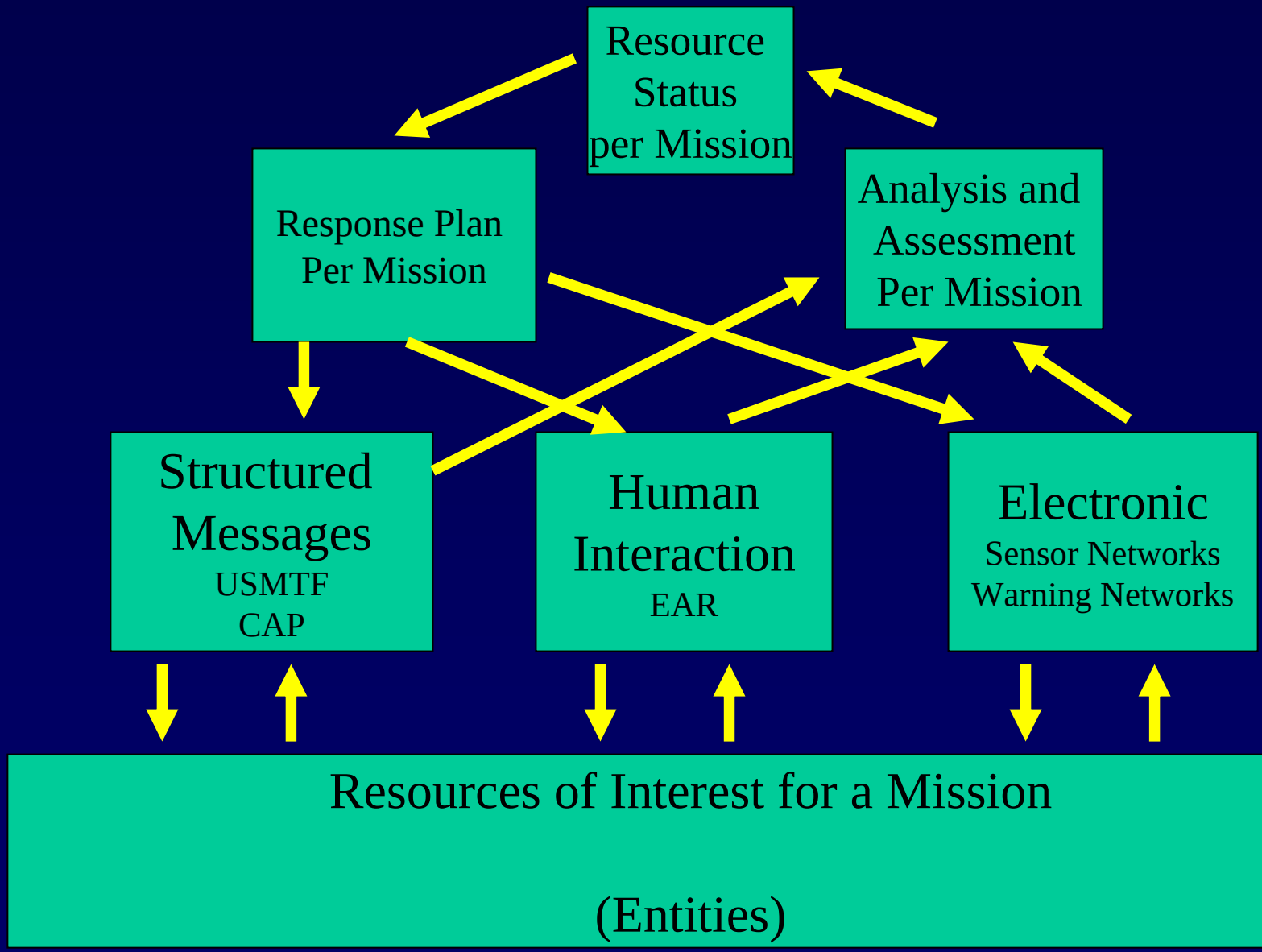

Response Plans

- No Timeline
  - Simple checklist
- Static PowerPoint with Timeline
- Electronic Timeline
- Electronic Timeline with Resource Conflict Notification
- Electronic Timeline with Suggested Courses of Action

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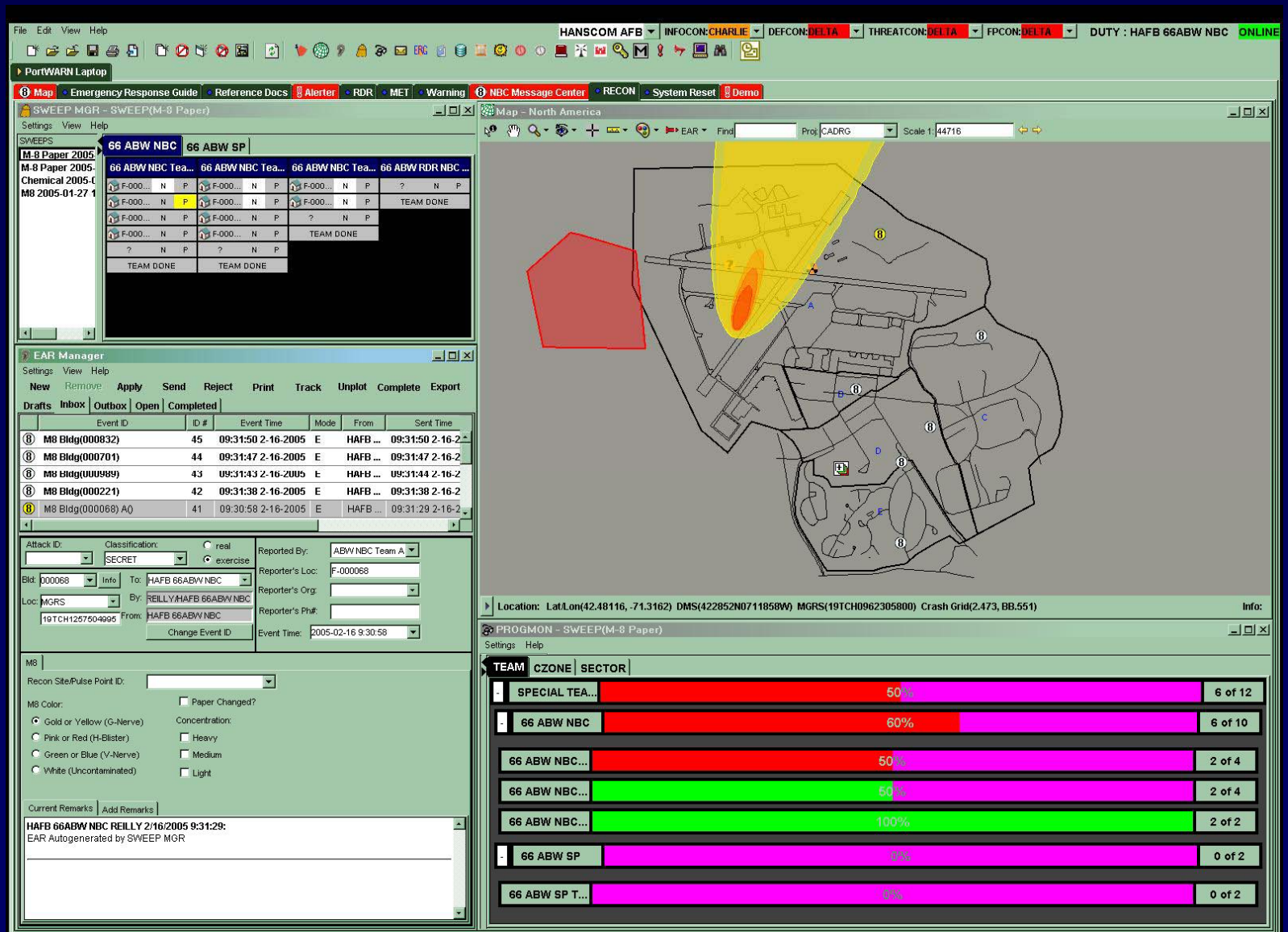


Guidance

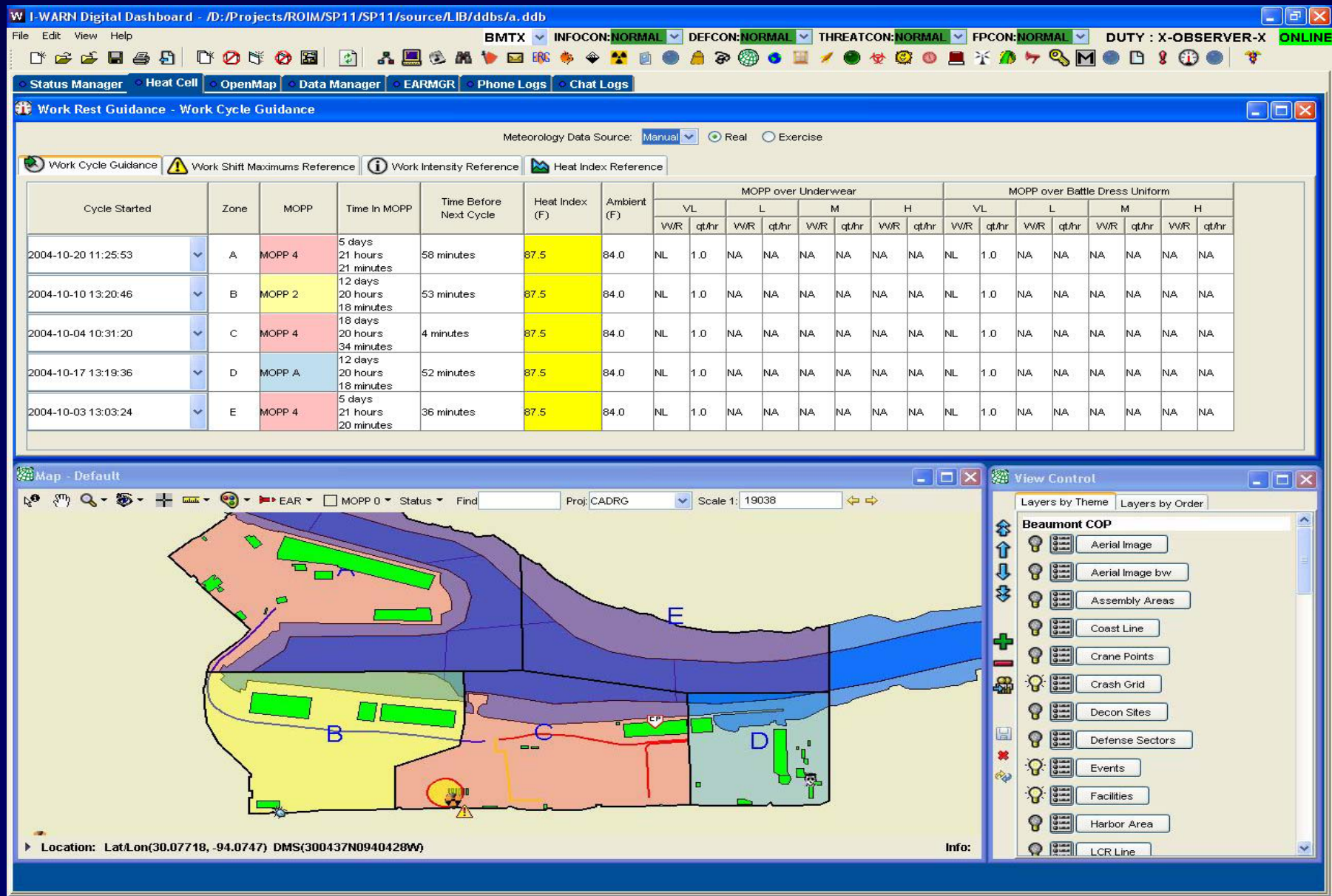
- Passive Guidance
  - Display of Contaminated Regions
  - Reference Documents (CONOPS, ATSO Guide)
  - Static Response Plan (PowerPoint)
  - Databases (Emergency Response Guide)

- Active Guidance
  - What do I need to be reminded of?
  - What information do I need to run a different model?
  - Sensitivity Analysis – How critical are the different parameters in a model?
  - Sensor Placement
  - What information would change my understanding of the situation around me?
  - Asset conflicts in response plans
  - Suggested Course of Action

Active Guidance

- Given:
  - Assets in a Region
  - Asset work load
  - MOPP Condition
  - Weather
- Provide Guidance on:
  - Time assets in MOPP
  - H2O Consumption
  - Work Rest Cycle
  - Total work time per shift
- Provide Inputs for Operational Throughput Models

Heat Index Guidance



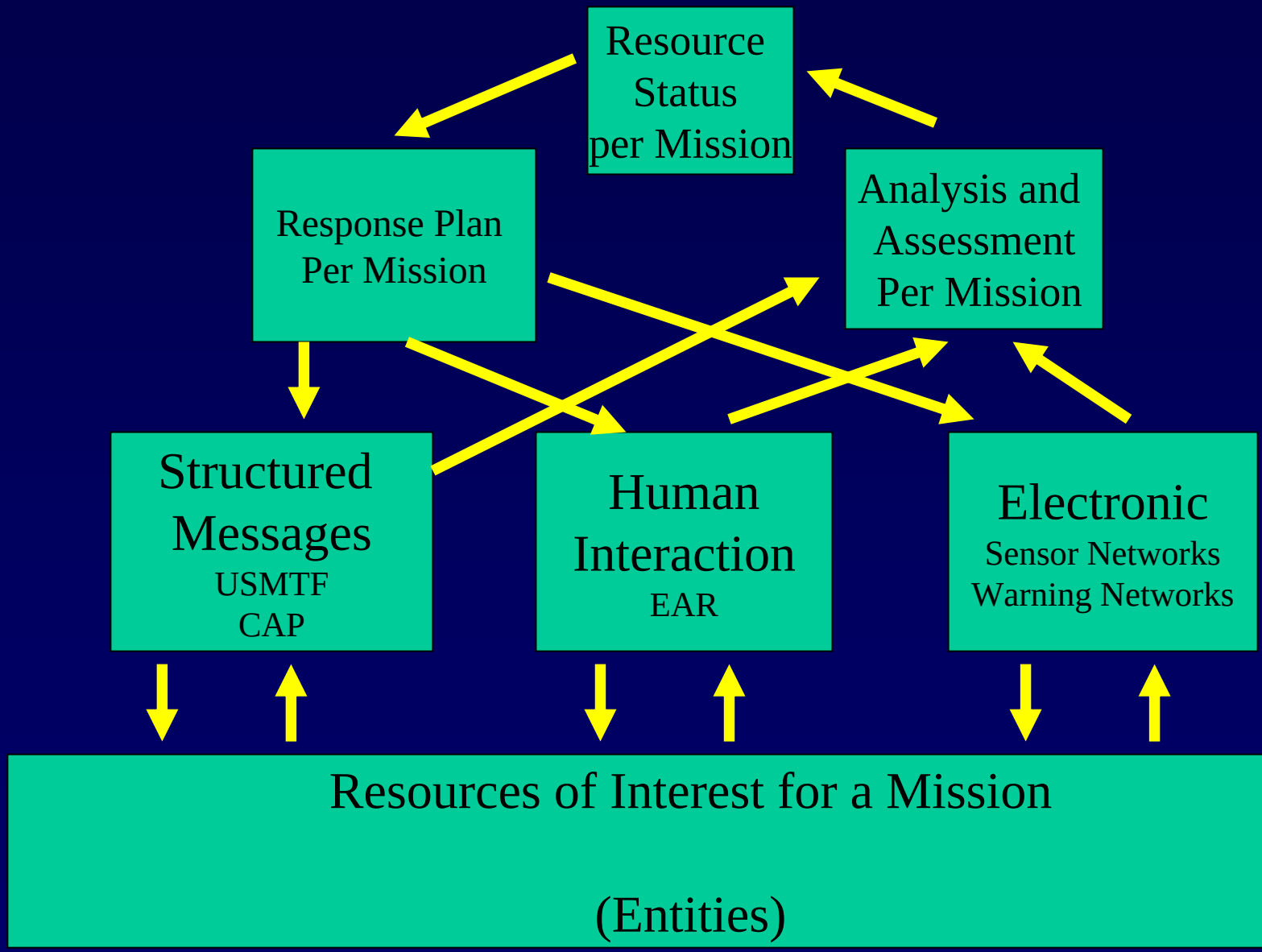
Example 1

- Detect or observe chemical incident
- Analyze data by SME or model to determine impact on entities
- Set status of entities for specific missions
  - Flying mission
  - Water table protection
- Determine response by SME or according to preset plan
- Act as required by response
- Monitor resources and re-calculate status

Example 2

- VIP visit reported
- SME confirms it will happen and determines impact
- Change FPCON status
- FPCON change triggers new response plan
  - Change detector sampling rate and deployed forces
- Analyze data for indication of incident
- ….
- VIP visit reported over

NGCBBM Data Base and Code Structure



CBRN Information Management

- Capture the information in a format you can process
- Experienced humans appear to assume or skip steps – but the steps are accomplished
  - Build all the steps into your Battle Management System
- Automated systems tend to have hard coded steps – system can't adapt
  - Design automated systems to be adaptive
- Regardless of how the change in state is initiated, change must be in a standard format and subject to a standard process
- Non-CBRN Information Management is the same
  - Intel

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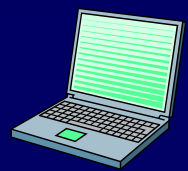

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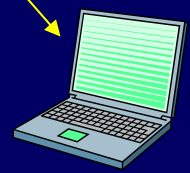

Manual Data Entry

Remote SME Analysis (JWARN / JOEF)

Multiple Level Security Networks

- Multiple Networks
  - Detector
  - Local C2
  - Higher Level C2
- Network Links
  - Detector to Local C2
    - Fat Finger
    - Sneaker Net
    - One-way Fiber
  - LAN C2 to WAN C2
    - Fat Finger
    - Sneaker Net
    - Database replication through ISSE and other Guards
      - Classification rules?

Network Centric Operations

- Stand Alone Client
- LAN
  - EARs
  - Shared Map Layers
  - Shared Database
- Multiple WANs
  - Common Message Parser and Email
  - CBRN Messages
  - Common Alerting Protocol
  - USMTF
  - XML

Network Dependency of Mission Critical Systems

- Network Centric is Great
- Network Dependent is Network Vulnerable
- A local system must continue to operate when the network doesn't
- Information must be processed on different security level networks
  - Information Objects must include a WWID with a MAC address and history of changes

UST 2.05 Network Schema
RDRs at O'Neill Fed Building and Fleet Center
4May04

OGA Networks
FEMA, MEMA, BEMA, O'Neill

IIMS Thin Clients

IP Addresses:
O'Neill Fed Building - 159.142.10.250
Maynard ROC - 166.112.210.188
Boston FEMA - 166.112.74.62

O'Neill Fed Building Network

Data Distributor:
- One way fiber receive from RDR CP
-Ethernet link to MACA
-@ O'Neill Building
-Gateway Desktop
-Win2K
-IP: 159.142.10.250

Access Control List @DISA/Eagle through Port 80

Access Control List @DISA/Eagle through Oracle Ports

One-way fiber guard @O'Neill

Detector Network @ Fleet

RDR Comm Node:
-Two way RF and/or Ethernet link to RDR CP
-Hardwire link to sensors/detectors

RDR Command Post:
-Two way RF and/or Ethernet link to RDR Nodes
-Access Database
- One way fiber send to MACA
-Gateway Desktop
-Win2K

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MACA Network

IIMS Thin Client

IIMS Thin Client

MACA Database and Server
-Oracle 9i
-NGA Data
-@DISA/Eagle
-Apache

IIMS Thick Client
1 @ NORTHCOM

IIMS Thick Clients
5 @ Hanscom

IIMS Thick Client
1 @ Dahlgren

IIMS Thick Client
1 @ DISA/Eagle

IIMS Thick Client
1 @ SPAWAR

SneakerNet

ISSE guard - Email UST 1.10 @ NORTHCOM

ISSE guard – Database Replication UST 1.10 @ NORTHCOM

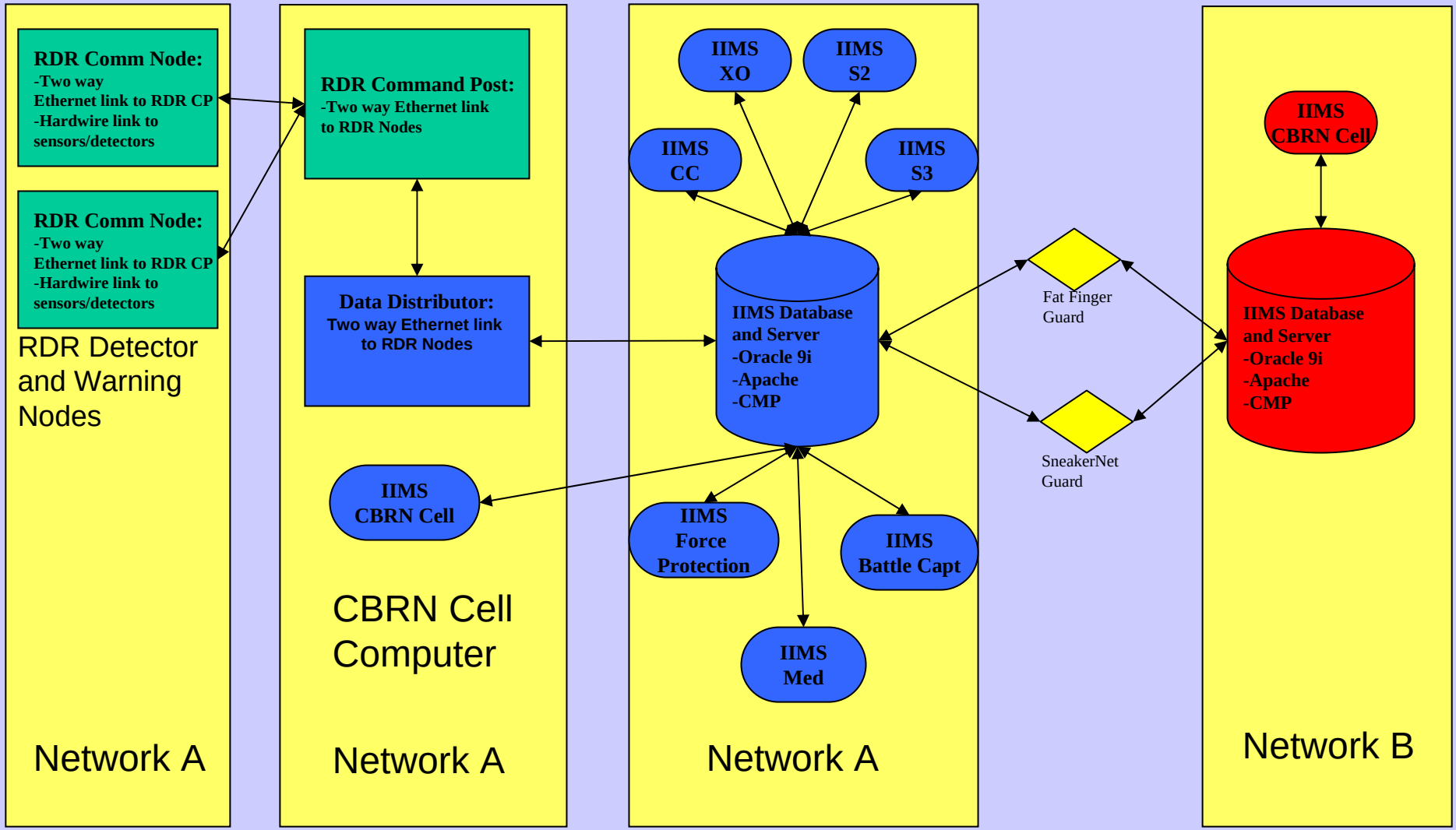
US National Network

IIMS Thin Client

IIMS Thin Client

US National Database and Server
-Oracle 9i
-NGA Data
-@ DISA/Eagle
-Apache

IWARN Test Schema A
24 Oct 2005



IWARN Test Schema B
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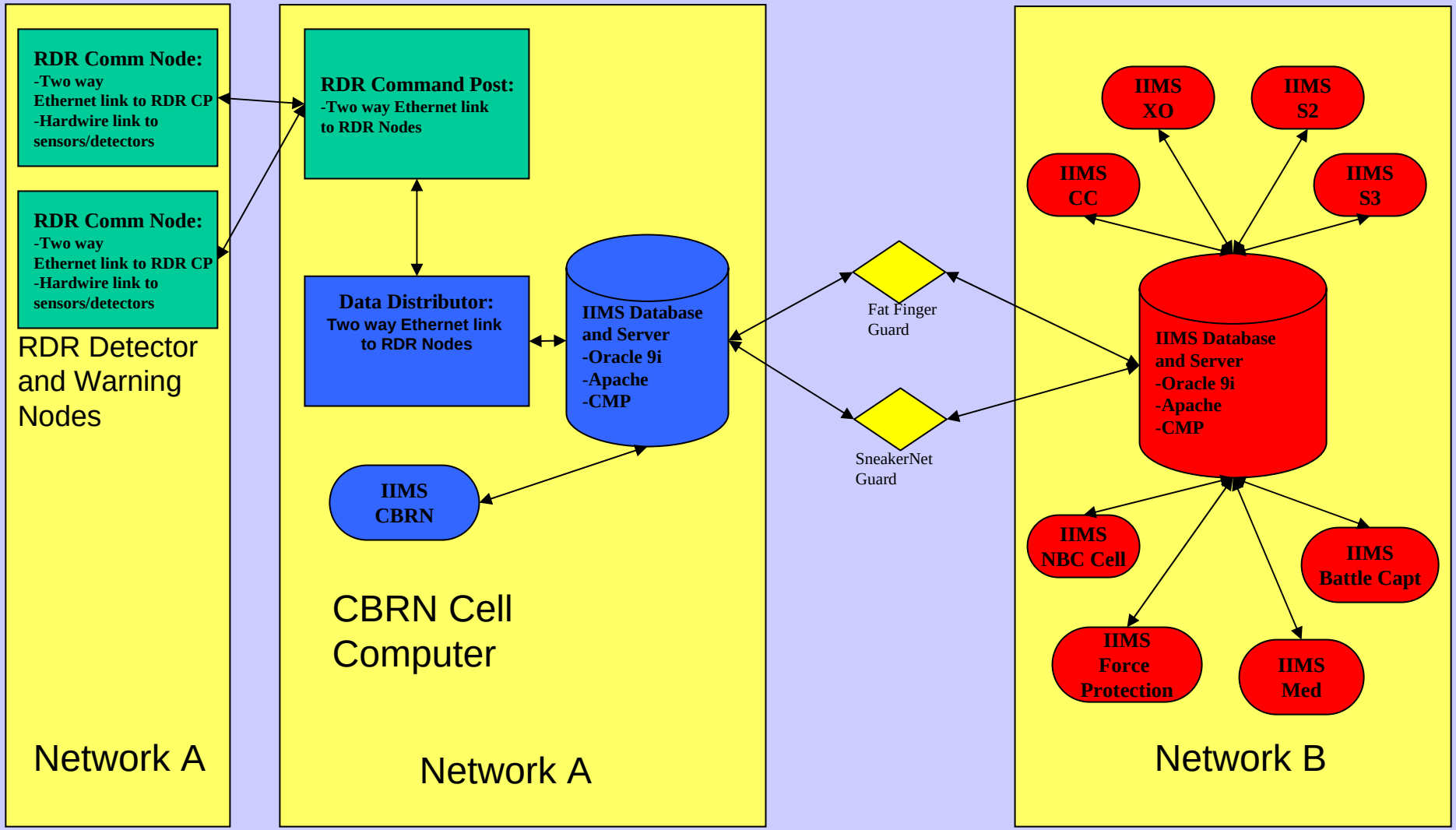

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- Examples of Operational Environment System Configuration
  - Data Acquisition
  - Operation Across Guards
  - Multi-level Data Processing
- Conclusions

Adoption of the CBRN Data Model

- Does it support all CBRN information management steps?
  - What types of information management can the applications using the C2IEDM data model do now?
- Does it support all CBRN network configurations?
  - What network configurations can the C2IEDM data model support now?
- How do we transition to the CBRN Data Model?
  - Tailor model?
  - Tailor code?
  - Both?

Transitioning Technology to the Warfighter

(Parallel Spiral Development)

- Create a Receptive host for Tech Transition
  - Provide a C2 Backbone for researchers to build against
  - Integrate mature IT products using ACTDs
  - Technically and Operationally Test concepts for Military Utility
  - Transition to either Core Programs or existing Battle Management Systems
- Field technology, solutions, and CONOPs
  - Build on success
  - Add components
  - Provide blue print for NBC Battle Management
  - Generalize the solution to address joint CONOPS
  - CONOPS and Technology leapfrog