

BP25: Situational Awareness: The Elusive Common Operating Picture

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"Your Friendly Neighborhood Emergency Manager"





Overview

- **Common Operating Picture**
- **Situational Awareness**
- **Integrated Communications/Interoperability**
- **Plans And Procedures**
- **Critical Information Processing**
- **Decision Making/Sensemaking**
- **Information Sharing and Management**
- **Lessons Learned/Case Studies**
- **Summary/Questions**

NIMS: What is COP?

Q. What is a Common Operating Picture?

A: A common operating picture (COP) offers a *standard overview of an incident*, thereby providing incident information that enables the Incident Commander/Unified Command and any supporting agencies and organizations to make *effective, consistent, and timely decisions*. Compiling data from multiple sources and disseminating the collaborative information COP ensures that all responding entities have the *same understanding and awareness* of incident status and information when conducting operations. (*NIMS Resource Center*)

NIMS: Definition of COP

“An overview of an incident created by collating and gathering information—such as traffic, weather, actual damage, resource availability—of any type (voice, data, etc.) from agencies/organizations in order to ***support decision making***.” (NIMS 2008 Chapter 2)

NIMS Compliance Objectives for States, Territories, Tribal Nations, and Local Governments

Communications and Information Management

2008: Utilize systems, tools, and processes to present **consistent and accurate information** (e.g., common operating picture) during an incident/planned event.

2009: Institute multidisciplinary and/or multi-jurisdictional procedures and protocols for **standardization** of data collection and analysis to utilize or share information during an incident/planned event.

2009: Develop procedures and protocols for communications (to include voice, data, access to geospatial information, Internet/Web use, and data encryption), where applicable, to **utilize or share information** during an incident/planned event.

Common Operating Picture

- Develop and maintain **overall awareness** and understanding of the incident **within and across** jurisdictions and/or organizations.
- Incident managers at all levels make **effective, consistent and timely decisions**.
- **Consistency at all levels** of incident management across and between governmental jurisdictions, private sector and non-governmental entities.

Common Operating Picture

- **Integrated systems** for communication, information management, and intelligence and information sharing to continuously update data during incident.
 - Time (Chronological Log)
 - List (Resources)
 - Place/Location (Spatial)



Situational Awareness

- Situational Awareness is the perception of:
 - ✓ What the incident is doing
 - ✓ What you are doing in relation to the incident and your objectives
- Situational Awareness involves the ability to predict:
 - ✓ Changes to the incident
 - ✓ Your future actions

Situation Awareness

Being aware of what is happening around you to understand how information, events, and your own actions will impact your goals and objectives, both now and in the near future

Situation Awareness

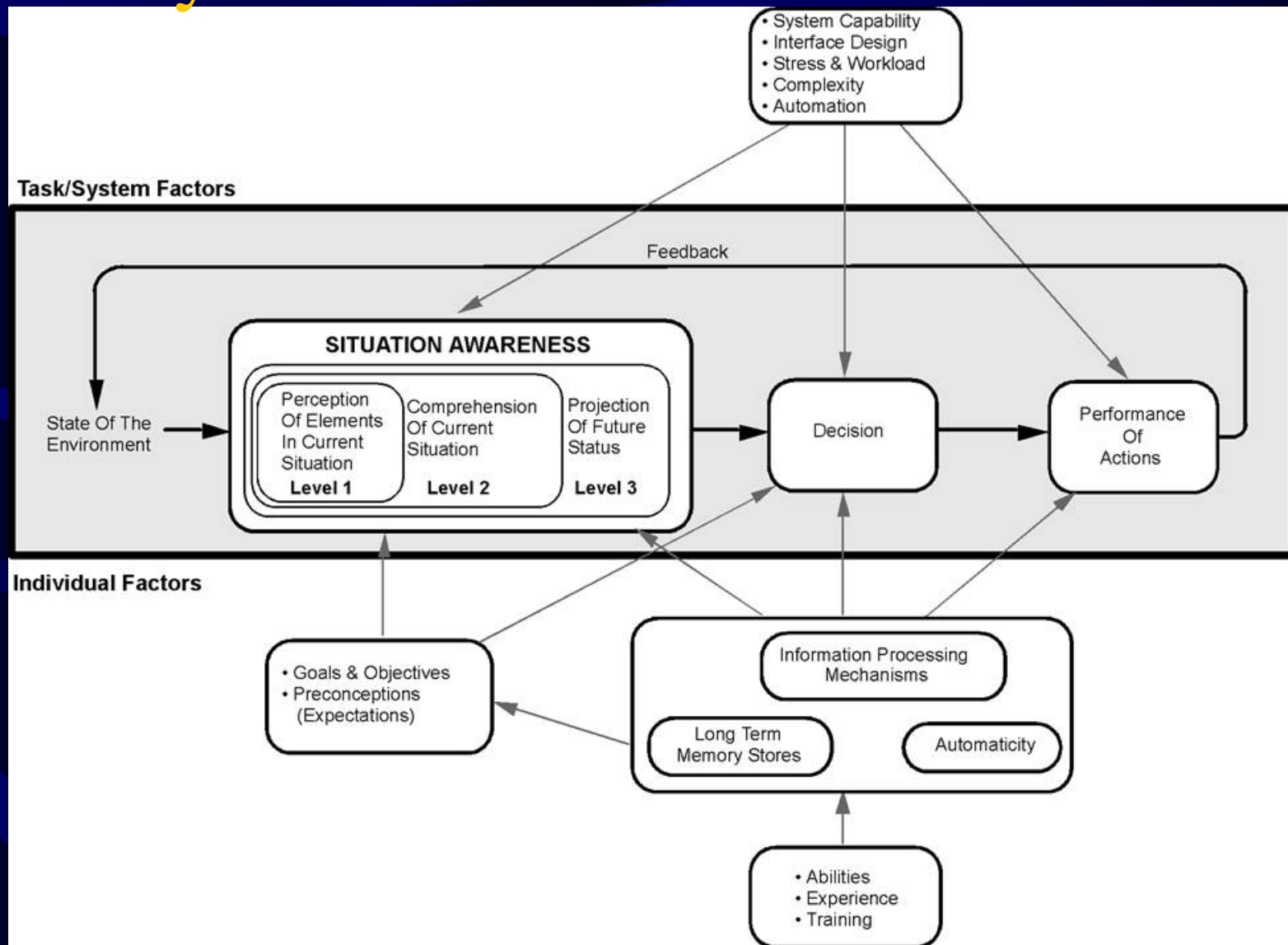
Situation awareness has been formally defined as "the *perception* of elements in the environment within a volume of time and space, the *comprehension* of their meaning, and the *projection* of their status in the near future." (Endsley, 1988, 1995b, 2000)

In other words, how well the perception matches the reality

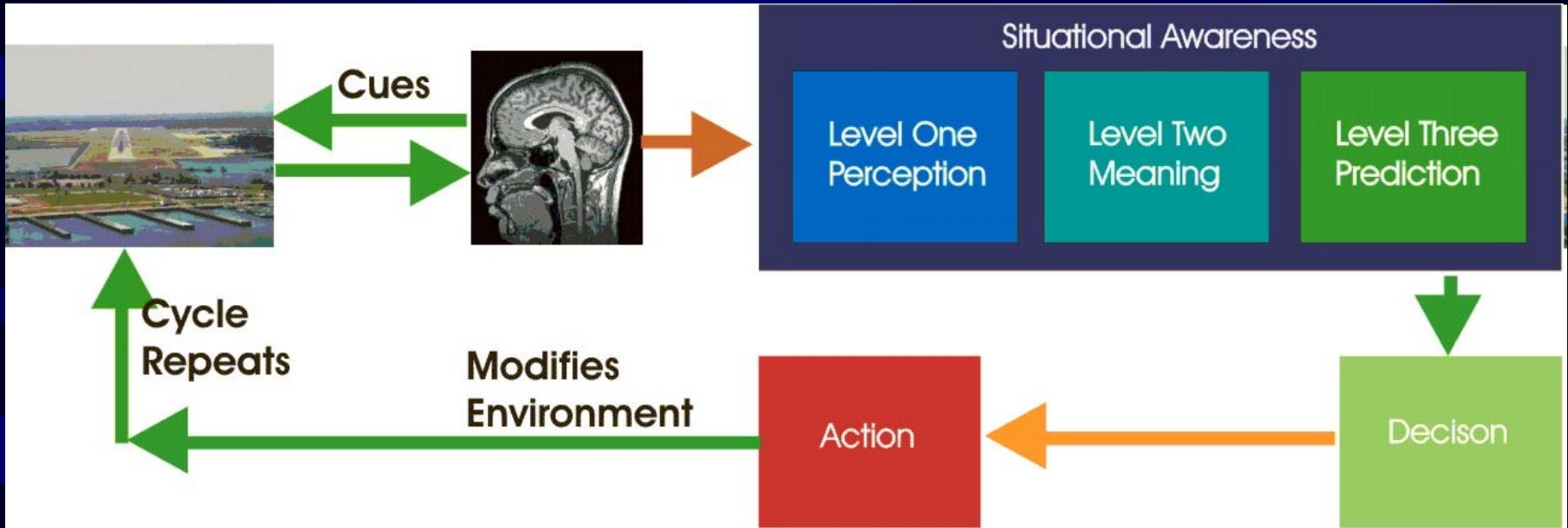
Three Levels of Situation Awareness

- Perceiving critical factors in the environment (Level 1)
- Understanding what those factors mean, particularly when integrated together in relation to the operator's goals (Level 2)
- At the highest level, an understanding of what will happen with the system in the near future (Level 3)

Endsley's Model of Situation Awareness



Another view of situation awareness



Awareness vs. Assessment

Situation awareness is viewed as "a state of knowledge."

Situation assessment is "the processes" used to achieve that knowledge.

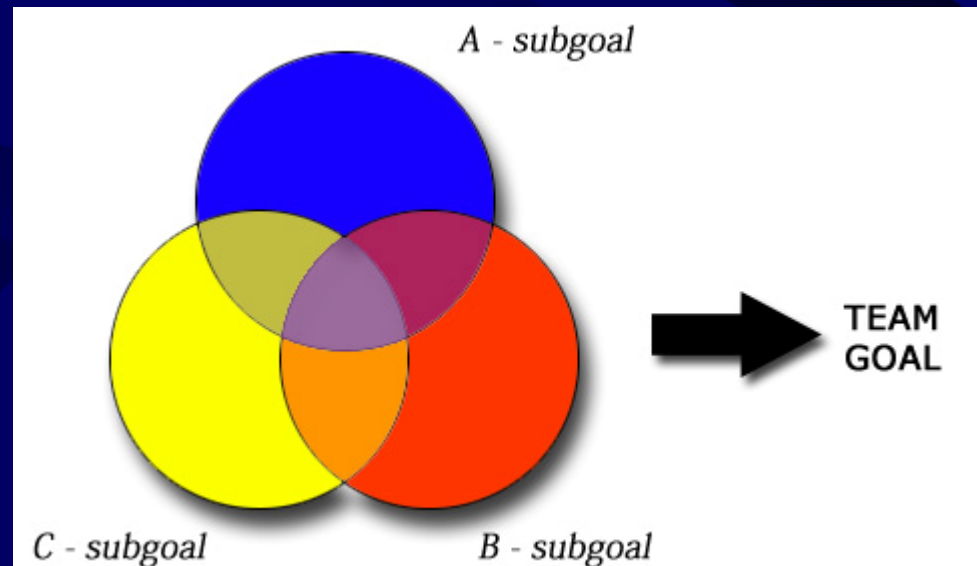
Note that awareness is not only produced by the processes of assessment, it also drives those same processes in a recurrent fashion.

Team Awareness

“An accurate mental model of a complex incident that is shared among team members can allow individuals the capacity to anticipate the actions and needs of fellow team members.” *All Hazards Incident Management Team*

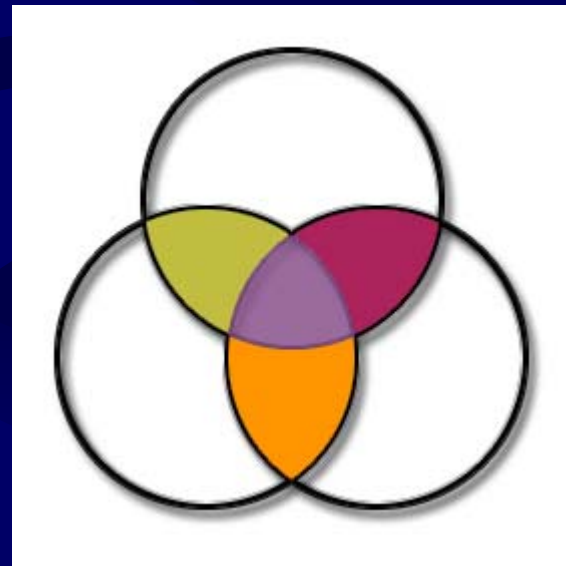
Team Situation Awareness

Defined as “*the degree to which every team member possesses the SA required for his or her responsibilities.*”



Shared Situation Awareness

Defined as "*the degree to which team members possess the same SA on shared SA requirements.*"



Teamwork Elements

- Leadership
- Interaction
- Behavior
- Collaboration
- Communications
- Commitment
- Trust

Situation Awareness Skills

- Identify potential/actual problems
- Recognize the need for action
- Do NOT ignore information discrepancies
- Analyze discrepancies before proceeding
- Seek and provide information before acting

Situation Awareness Skills

- Continue collecting information about the incident and assignments made
- Identify deviations from the expected
- Communicate to all team members
- Assess your own task performance
- Avoid tunnel vision



Spencer Platt / Getty Images



United Airlines Flight 173

- December 28, 1978
- Final approach to Portland International
- Nose gear light problem
- Ran out of fuel, crashed into wooded residential area six miles from airport

United Airlines Flight 232

- July 19, 1989
- Catastrophic engine failure in flight
- Complete loss of normal flight control, maintain flight using only engine control
- Crash landed at Sioux City, IA airport
- Leadership of Capt. Al Haynes and crew

Crew Resource Management (CRM)

The term cockpit resource management (now crew resource management) was first used in 1977 by American aviation psychologist John Lauber, who defined it as “using all the available resources – information, equipment, and people – to achieve safe and efficient flight operations”.

CRM: Human Factors Based

CRM involves enhancing team members' understanding of human performance, in particular the social and cognitive aspects of effective teamwork and good decision making.

CRM Elements

- Understanding of team roles
- Group decision making/problem solving
- Assertiveness
- Team attitudes
- Stress management
- Shared mental models
- Communications

Communications Exercise

TELEPHONE/WHISPER

- Divide into groups
- First person gets message
- Send to next person as accurate as possible
- Speak the phrase one time
- Verbal (whisper)
- Last person in each group wait until all are finished



Emergency Communications Systems

- Telephone (hard line)
- Fax
- Cellular Phone
- Wireless/PDA
- Pager
- Email
- Radio (2 way)
- Radio (Amateur)
- Computer
- Internet
- Data
- Television (Cable)
- Satellite TV
- Satellite Internet
- Satellite Phone
- Runner/Personal

Integrated Communications (ICS/NIMS FUNDAMENTALS)

- Common communications plan
- Standard Operating Procedures (SOPs)
- Common frequencies
- Established communication nets
- Clear text
- Common terminology

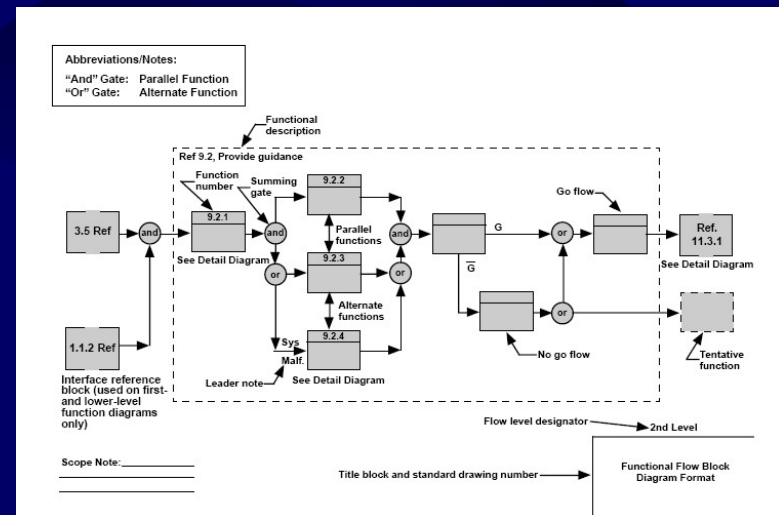
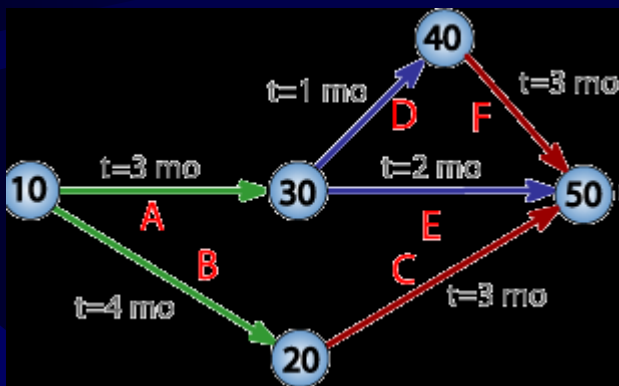


Plans and Procedures

- Communications Plan
 - How to Operate and Maintain the System
- Communications Protocol
 - How to Communicate the Information
- Information Management
 - How to Do Something with the Information

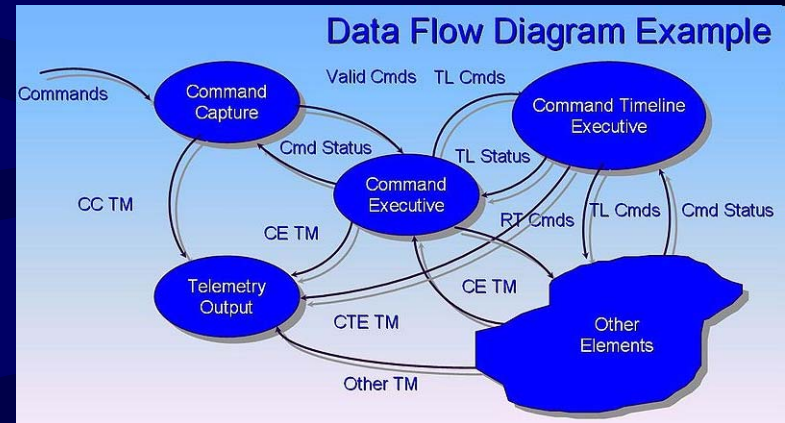
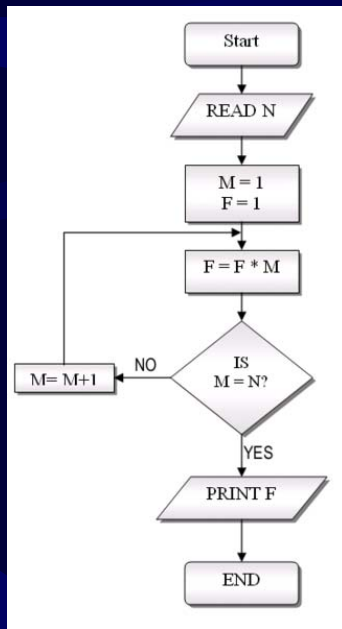
Information Flow Requirements

- Information Needs
- Quantity (Need to Know vs. Nice to Know)



Information Flow Requirements

- Internal vs. External
- Vertical vs. Horizontal



- Gathering and Processing
- Use and Distribution

Information Examples: Operations

- Affected People
- Affected Property
- Emergency Responder Status
- Situation Assessment
- Disaster Assessment
- IAP (Incident Action Plan)

Information Examples: Planning

- SitRep (Situation Report)
 - Present Situation
 - Predicted Situation
- Incident Action Plan (IAP)
- Legal/Regulatory
- Political

Information Examples: Logistics/Finance & Admin

- Financial accounting
- Inventory control
- Scheduling
- Personnel Tracking
- Resources (material, financial and human)

Informatics

Research on, development of, and use of technological, sociological, and organizational **tools and approaches** for the dynamic acquisition, indexing, dissemination, storage, querying, retrieval, visualization, integration, analysis, synthesis, **sharing** (which includes electronic means of collaboration), and publication of data such that economic and other **benefits may be derived from the information** by users from all sectors of society. *President's Committee of Advisors on Science and Technology*

Critical Information Processing

- Information/Intelligence Collection
- Management/Consolidation/Evaluation
- Decision-Making (Process)
- Implementation/Dissemination

GOOD INFORMATION + GOOD
SYSTEMS = INFORMED DECISIONS

Complexity Analysis in Decision Making

- Impacts to life, property, critical infrastructure, and the economy
- Community and responder safety
- Potential hazards and threats
- Weather and environmental threats

Complexity Analysis in Decision Making

- Likelihood of cascading events
- Potential crime scene (terrorism)
- Political sensitivity, external influences, media relations
- Area involved, jurisdictional boundaries
- Availability of resources

Decision Making Theories

- Crew Resource Management (CRM)
- Naturalistic Decision Making (NDM)
- Recognition-Primed Decision Making (RPD)
- Control Model of Operational Command
- Situational/Resource Model
- Method of Tactical Reasoning (MTR)

Decision Making

- GOAL: The right information in the right amount to the right person at the right time
- Information requirements may vary
 - Level in the organization
 - Type of decision being made
- Vital that appropriate information be directed to the proper decision maker

Decision Making

- Intuitive (reactive): Pattern reaction based on previous experience
- Analytical (planned): Calculated selection of alternatives

Remaining calm is important to using analytical process vs. reactionary process

Decision Making

- Intuitive
 - Automatic
 - Fast
 - Emotional
 - Swayed by experiences and images
- Analytical
 - Logical
 - Contemplative
 - Pragmatic

Decision Making

Example: A coffee and a donut cost \$1.10 total. The coffee costs \$1 more than the donut. How much does the donut cost?

Intuitive answer: 10 cents

Analytical answer: 5 cents

Sensemaking

- Sensemaking is both an individual and a collective process where “*reality is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs.*” (Weick, 1995)
- In contrast to decision making where the key question is: *what shall we do?*, in sensemaking the key question is: *what is going on?*

Sensemaking

- At the heart of sensemaking is the lack of fit between what is expected and what is encountered. (Weick & Meader, 1992)
- Organization emerges through sensemaking, and not that sensemaking is a product of organization. (Weick, Sutcliffe & Obstfeld, 2005)

Related Cognitive Processes

	<i>Process</i>	<i>Outcome</i>
<i>Tactical Level</i>	Situation Assessment	Situation Awareness
<i>Strategic Level</i>	Sensemaking	Understanding

Facilities/Information Sharing

- Operations/Coordination
 - EOC
 - MAC
 - Fusion Center
- Information Sharing
 - Electronic
 - Paper
 - Visual
- Visual Displays (Info at a Glance)
 - TV, monitors, dry erase boards, wall boards, clocks
 - Maps, GIS (geospatial)



Geospatial Tools

- ***Geographic information systems (GIS)***: software systems used to capture, store, manage, analyze, and display geospatial data resources
- ***Computer-assisted design (CAD) systems***: widely used to create and manage three-dimensional digital models of buildings and other engineering structures

Geospatial Tools

- ***Remote sensing:*** collection of data from a wide range of automated systems, including satellites and aircraft, and ground-based sensors and surveillance cameras
- ***Clearinghouses, geolibraries, archives, geoportals, and geobrowsers:*** Web sites that provide access to large collections of geospatial data sets

Geospatial Tools

- *Spatial decision-support systems (SDSS)*: provide decision-makers information when decisions involve location, makes comparisons between many possible alternatives

Open Geospatial Data Standards

- Open Geospatial Consortium (OGC) and ISO standards allow open systems that integrate with multiple vendors
- OGC has close relationship with ISO/TC 211 (Geographic Information/Geomatics)
- OGC works with other international standards bodies (including W3C, OASIS, WfMC, IETF)

Open Geospatial Data Standards

- August 2007: OGC approves XML-based standard
 - Share diverse data sources while maintaining individual map styles for specific applications (i.e., different response team needs)
 - Styling information can be applied to digital feature data (vectors) and coverage data (gridded data), while users determine colors/symbols for specific features/layers

Mapping/GIS Systems

- Street Address
- Local grid reference
- Call box alarm location
- Public Land Survey System (PLSS)
- State Plane Coordinate System (SPCS)
- Lat/Long (three types)
- USNG (US National Grid)

Mapping: The Problem

- Growing need for better geospatial information capabilities, but no standard, nationally consistent map grid
- Example: Washington, D.C. consumer maps
 - 35 maps, 30 different atlas grids
 - Same street names, different grids
 - None work with GPS
 - No universal map index

Mapping: The Solution

USNG (US National Grid)

- Established nationally consistent grid reference system standard (e.g., all street maps using common set of street names)
- Provides seamless plane coordinate system across jurisdictional boundaries and map scales
- Enables precise position referencing with GPS, web map portals and hardcopy maps

Mapping: The Solution

- Unlike latitude and longitude, USNG simple enough to teach and effectively use at 5th grade reading/learning level
- Enables practical system of geoinfo addresses and universal map index
- Similar to Military Grid Reference System (MGRS)

USNG and COP

- Foundation of Common Operational Picture is geospatial information
- ICS for catastrophic events become nearly impossible to implement effectively without a common frame of spatial reference
- The reward for using the USNG will be large
- Cost of implementation is small and risk low

(James Lee Witt)

USGS Geospatial Information Response Team (GIRT)

Primary purpose: rapid coordination and availability of geospatial information for effective response by emergency responders, and land and resource managers, and for scientific analysis

<http://www.usgs.gov/emergency/>

Geospatial Example – Florida 2007

- 2004-2005 Atlantic hurricane seasons
 - Better statewide coordination of geospatial information could have saved lives and enhanced emergency managers' efforts
 - Florida Division of Emergency Management (FDEM) takes lead in formulating statewide GIS strategic plan
- Using federal grant, FDEM hires contractor for statewide geospatial data coordination strategic plan, final version published April 2008
- Needs sustained funding from Florida Legislature

Geospatial Example – California 2008

- Geospatial Information Systems (GIS) Task Force
- Led by California CIO Teri Takai and Chief Deputy Christy Quinlan
- Goal: strategic plan for statewide coordination (enhance technology for environmental protection, natural resource management, traffic flow, emergency preparedness and response, land use planning, health and human services)

"Virtual USA" Meeting 2009

- Federal/state collaboration to allow interoperable state/local geospatial data for emergency response
- Goal: local/state-owned geospatial data interoperable and usable across jurisdictions, with non-federal authorities maintaining control over the data
- Inspired by Virtual Alabama success using Google Earth Enterprise software
- DHS Science and Technology Directorate sponsored first meeting
 - Attendees: DHS, Florida, Alabama, Mississippi, Louisiana, Texas, Virginia, Tennessee, Georgia

DHS Initiatives

- HSIN (Homeland Security Information Network)
- COP (Common Operating Picture) Application
- GDM (Geospatial Data Model)
- NIEM (National Information Exchange Model)

HSIN (Homeland Security Information Network)

- Common network platform for gathering, fusing, analyzing and reporting information related to potential terrorist and other threats (2004)
- DHS network for operational information sharing and collaboration to maintain situational awareness, as well as monitoring response and recovery efforts resulting from terrorist, natural and human-caused disasters

COP (Common Operating Picture) Application

- Real time, web-based application enables HSIN users to collect, capture, and publish data including graphic imagery
- Critical decision makers define and prioritize information required for operational activities, and display data to best facilitate mission

COP (Common Operating Picture) Application

- Integrated Common Analytical Viewer (iCAV)
- Used in National Operations Center (NOC)
- Post-Katrina After Action Report requirement

GDM (Geospatial Data Model)

- DHS Geospatial Management Office (GMO) develops GDM to support geospatial interoperability and information sharing (2005)
- Open, standards-based model
- Geospatial information sharing between organizations/agencies with primary responsibility to plan/respond to natural disasters/hostile events
- Initial design/revisions incorporate existing, openly-accessible Federal and industry standards and practices

National Information Exchange Model (NIEM)

- Federal, State, Local and Tribal interagency initiative
- DOJ-DHS partnership agreement launched February 2005
- Leverages data exchange standards efforts implemented by Global Justice Information Sharing Initiative (Global) and extends Global Justice XML Data Model (GJXDM)
- Facilitate timely, secure information sharing across justice, public safety, emergency and disaster management, intelligence, and homeland security
- NIEM complies with HSPD-5

Effective Information Management

- Technology/Facility Infrastructure
- Information Collection and Evaluation
- Systematic Decision-Making Process
- Information Distribution
- Feedback on the reliability/quality/usefulness of the information

Coming and Going in All Directions

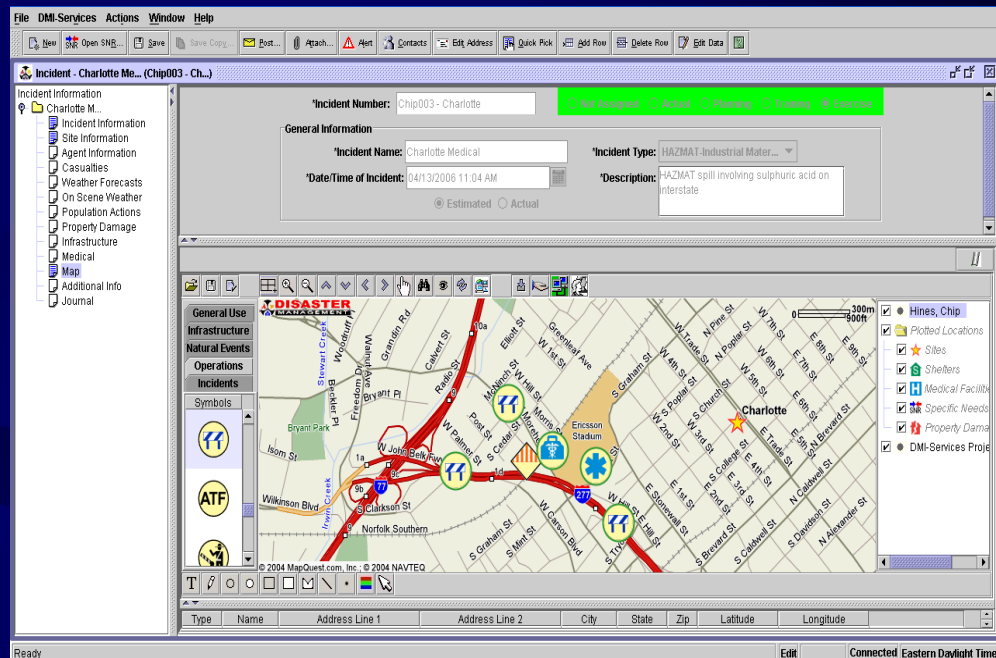
- Multiple feeds
- Multiple sources
- Sharing information (both ways)
- Street/jurisdiction/state/national levels

Information Feed/Source Examples

- 911
- NWS
- GIS/Geospatial
- Notification systems
- Government databases
- Social Networking (Twitter, Facebook, MySpace)
- RSS
- Verbal

Software Examples

- DMIS
- DM-OPEN
- Sahana
- WebEOC
- E-Team
- SoftRisk
- JPERS (Joint Emergency Planning & Response System)



Software Examples

- HSIN/COP
- CAMEO/Aloha/MARPLOT
- Google Earth
- Microsoft Virtual Earth
- MapQuest
- Google Maps
- ESRI (ArcView, ArcGIS, etc.)

Media Information Sharing

- Credible Spokesperson
- Honesty
- Do What You Say You Will Do
- Regular Briefings
- One Source of Information (JIC/JPIC)
- Integration with SA/COP
- Rumor Control/Feedback

Lessons Learned

- ✓ Communications ALWAYS listed
- ✓ Redundancy in messaging/systems
- ✓ Pre-established procedures/protocols
- ✓ Media/Risk communications (CERC)
- ✓ KISS (especially during stress situations)
- ✓ Train/Exercise for real-world use
- ✓ TRAIN, TRAIN, TRAIN

Case Studies

Situational Awareness: Maintained/Lost

- 9/11: New York
- 9/11: Arlington
- Hurricane Katrina
- Other audience specific examples

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QUESTIONS?



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Waiting For the Next Disaster: <http://waiting-for-the-next-disaster.blogspot.com/>