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Abstract:

## **“Common Operation Picture for Support with COTS enabling Coalition Interoperability”**

Common operating pictures ( COP) for operations are state of the art but lack any predictive element concerning support in a coalition environment. COP for support with COTS will enable Coalition Interoperability delivering on the promise of horizontal integration on the battlefield to help coalition forces transform in a world of change while enabling actionable knowledge. Coalition Operations consistently have the challenge of changing the organization, technology or concept of operations in response to terrorism, joint & combined operations, transnational threat, covert operations, and rapid technology diffusion

The Adoption of Internet Standards enables Interoperability within a coalition environment. The barriers to providing a common operating picture for support in a coalition environment are: Limited Combat Service Support (CSS) visibility, Legacy stovepipe information environments of coalition partners, Passive Interaction and Historical based data.

The Objective of a COP for support in a coalition environment is to decrease the Decision Cycle Time (aqua OODA loop -Observe, Orient, Decide, Act) of the Force and to develop the Coalition Forces into a knowledge based learning organization.

The building blocks of a COP are a Geospacial Information System (GIS), a Central User Interface (Defense Portal) with additional. layers that combine friendly & enemy forces with environmental data with continuous refreshment of real-time data from information systems as well as RFID & Sensors. This should be based on a Net-Centric environment which depends on an Open architecture based on web-services ( e.g. Internet Standards ), full Process visibility with automated event notification, a Collaborative platform, Military Message exchange, Ad-Hoc Workflow, and use of Collaboration rooms.

The benefits are the creation of real-time situational awareness, compression of the Coalition OODA Loop, increased responsiveness to Commander’s intent and creation of predictive assessments of courses of action.

# 1 Introduction

The US DoD has defined an information environment that uses emerging standards and technologies to optimize assured information sharing among all users. It results from implementing Global Information Grid (GIG) component architectures in accordance with the NCOW RM. A Net-centric Information Environment is inclusive of Core and COI enterprise services, and a data sharing strategy that emphasizes metadata concepts, shared information spaces, and the task, post, process, use (TPPU) paradigm.<sup>1</sup> In short, Net-Centricity connects the decision maker with the war fighter.

An Enterprise Services Architecture provides a blueprint for services-based, enterprise-scale business solutions -- solutions that are adaptable, flexible, and open, for lower total cost of ownership. Applications can be created on top of existing enterprise applications and served by an Enterprise Services Architecture to increase the value of those systems and extend automation to new processes. By using the Enterprise Services Architecture blueprint, the Coalition Partner will be better able to determine the speed at which it creates or adopts innovations, make outsourcing more manageable, extend business processes to include partners, and more easily offer solutions to its constituents. An Enterprise Services Architecture extends Web services to enterprise services. Enterprise services borrow the syntax and standards of Web services to implement business-level requirements, such as scalability, robustness, security, and manageability, to fulfill all enterprise requirements.

## 1.1 Basic Principles – Towards an Enterprise Services Architecture

An Enterprise Services Architecture provides a new blueprint for services-based, enterprise-scale business solutions. It offers the increased levels of adaptability, flexibility, and openness that are needed to meet Coalition Interoperability needs. The main driver behind an Enterprise Services Architecture is the growing need for new cross-functional business processes in a Net-Centric strategy. To protect existing investments, IT systems must be reused, rather than replaced. The first enterprise systems were built on mainframe architecture. These applications are now steadily replaced by Client/Server systems that provided integrated business processes. Coalition Forces can now extend these applications with the help of Web Services into an Enterprise Service Architecture.

### 1.1.1 Benefits of an Enterprise Services Architecture

An Enterprise Services Architecture provides extensive benefits for Interoperability in a Coalition Environment. It helps drive more value from existing IT investments. An Enterprise Services Architecture provides a war fighter-focused infrastructure that supports continuous business process evolution and change.

### 1.1.2 Composite Application Framework

Based on the SAP NetWeaver technology platform, the Composite Application Framework (CAF) provides a strong environment for an efficient and consistent development and

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<sup>1</sup> NCOW-RM, 1.0, September 30, 2003

deployment of new composite applications (xApps) by SAP and external partners. SAP xApps are the new breed of Packaged Composite Applications that enable continuous improvement and innovation by combining existing, heterogeneous applications into cross-functional, end-to-end processes. Within the CAF elements of all SAP NetWeaver integration layers - Portal, Collaboration, Business Intelligence, Knowledge Management, Master Data Management, Business Process Management, Exchange Infrastructure (XI) and Web-Application Server (WAS) - are brought into a unified environment, to create new business solutions across people, information, processes and application object repositories.

## 2 Net-centric Information Environment

### 2.1 Data

In a Net-centric Information Environment, the objective is to effectively share authoritative data to enable effective decision making through actionable knowledge. In the US DoD, the goal<sup>2</sup> is to provide data that is: **Visible, Accessible, Institutionalized, Understandable, Trusted, Interoperable and Responsive to Warfighter Needs**

#### 2.1.1 Structured Data

To exploit the large amounts of data moving through the Net-Centric network data warehouses are used to expose structured data. These warehouses are designed to pull together data from disparate systems and platforms so that users can get a “single version of the truth” – that is, a unified, consistent view of the situation.

#### 2.1.2 Unstructured Data & Collaboration Framework

The Knowledge Management (KM) platform is an integral component of SAP NetWeaver™ and is delivered as part of SAP Enterprise Portal. The KM platform provides access to unstructured information which resides in a distributed repository landscape in a Net-centric Information Environment (for example, on file servers, Web servers, and document management systems). Powerful retrieval & classification mechanisms and document services such as rating, feedback, and discussions allow warfighters to create and access unstructured data they need for their daily work. The collaboration capabilities of SAP NetWeaver™ can offer the Warfighter additional ways of dealing with unstructured data to improve interoperability in a Coalition Environment.

##### 2.1.2.1 SAP NetWeaver Collaboration

SAP NetWeaver Collaboration comprises the following:

**Collaboration rooms** are virtual workspaces which can be set up for any topic or purpose. They are especially convenient for teams or work groups, since the rooms ensure that all required tools, services and information sources are available from a single point of access. Collaboration rooms are based on room templates define the room's structure, content, and access authorizations. They also offer full integration to 3rd-party groupware systems and real-time collaboration services.

**Real-time collaboration** services are designed to help people resolve problems quickly online. These services include instant messaging/chat and application sharing. Instant messaging allows individual users to quickly contact other users who are online. When multiple users are involved, the service instantly transforms itself into a chat-like event. This service can be used in combination with application

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<sup>2</sup> Department of Defense Net-Centric Data Strategy, April 30, 2003

sharing. Application sharing is an interactive collaboration service allowing portal users to share their desktop or running applications with other portal users regardless of their physical location. It can be used for demonstrating software, conducting presentations, helpdesk support, and so on.

The **collaboration launch pad** is an intuitive tool providing centralized access to contacts and collaborative services such as sending an e-mail, creating an appointment, and sharing a document. The launch pad is started from the portal header and can therefore be used regardless of the user's current location in the portal. The collaboration launch pad also shows the online availability (known as 'awareness') of a contact. Employees can define their current online availability status individually or have their status detected automatically.

**3rd-party integration** helps protect customers' existing investments and lets users' work with tools they are familiar with. SAP NetWeaver Collaboration offers the following two types of 3rd-party integration: 1) Integration with groupware solutions such as MS Exchange and Lotus Domino, for sending e-mails or making meeting requests. 2) and integration with real-time service providers such as WebEx.

### 3 Composite Applications

#### 3.1 The Challenges of Net-Centricity

The challenge around the Net-centric Information Environment is to provide warfighters with coherent, easy to change, end-to-end business processes. There is a need to gather the information from all the applications and data sources of the Net-centric Information Environment into a unified, homogenous form, and then use the information to build new, focused process based on a comprehensive view of the enterprise.

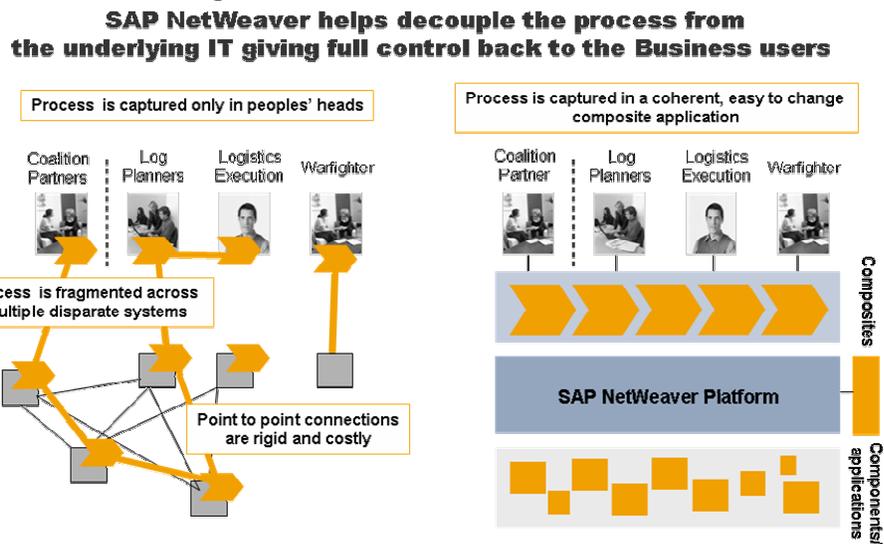


Figure 2.

#### 3.2 xApps

xApps are composite applications based on the Enterprise Services Architecture that drive business process innovation and execution in a Net-centric Information Environment. Instead of starting from scratch, xApps start with existing data and functionality and then coordinate the functionality in different ways to solve new problems. As illustrated in the following figure, xApps add new functions for specialized purposes sit on top of existing platform. The Enterprise Services Architecture platform is what makes the reuse of existing applications possible.

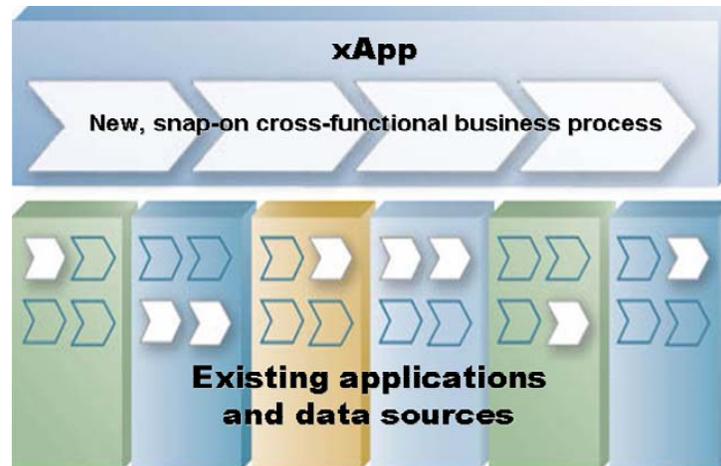


Figure 3.

xApps in general solve problems and are smaller in scope than the previous generations of enterprise applications. The processes are automated, more collaborative and fluid. In addition to data stored in databases, unstructured information generally must also be managed by the application. While in the previous generation of applications, most user interfaces felt like a paper-based form in which the main task was entering data, xApps are much more like a dashboard, showing the relevant information for each different part of a process a user is monitoring or participating in. In general, xApps will have the following characteristics:

xApps aggregate information from existing layers. All of the information needed from underlying enterprise applications are unified in a xApps.

xApps create new relationships among pieces of information from existing layers. The unified information from different underlying systems can be connected. Skills information from the HR system can be related to project information from project management software.

xApps aggregate and generalize services from existing layers. All of the operations that can be performed on a customer, for example, appear as a unified set of services, even though they may be performed by a variety of different systems. All of the operations from platform component systems, like creating a process or searching for documents, are generalized for the xApps and apply to all objects in the Enterprise Services Architecture. The scope of a search, for example, would include objects from all enterprise applications.

xApps aggregate processes from existing layers. Processes that may be granular in underlying enterprise applications are unified in a xApps.

xApps have discrete functionality. xApps are not monolithic, with a huge collection of related functionality, but rather are targeted to a specific function or process.

### 3.3 Example of an xAPP: Common Operation Picture for Support with COTS enabling Coalition Interoperability

Common operating pictures ( COP ) for operations are state of the art but lack any predictive element concerning support in a coalition environment. COP for support with COTS will enable Coalition Interoperability delivering on the promise of horizontal integration on the battle field to help coalition forces transform in a world of change and enabling actionable knowledge.

Coalition Operations have the challenge that during operations the organization, technology or concept of operations is changing as they have to adapt to terrorism, joint & combined operations, transnational threat, covert operations, and rapid technology diffusion. This way

Coalition Forces are constantly changing as a result of adjustments in organization, technology or concept of operations.

In their 1999 work on Network Centric Warfare Albert, Garska & Stein laid the foundation of a common operating picture for support with Commercial Off the Shelf Software ( COTS ) enabling Coalition Interoperability.

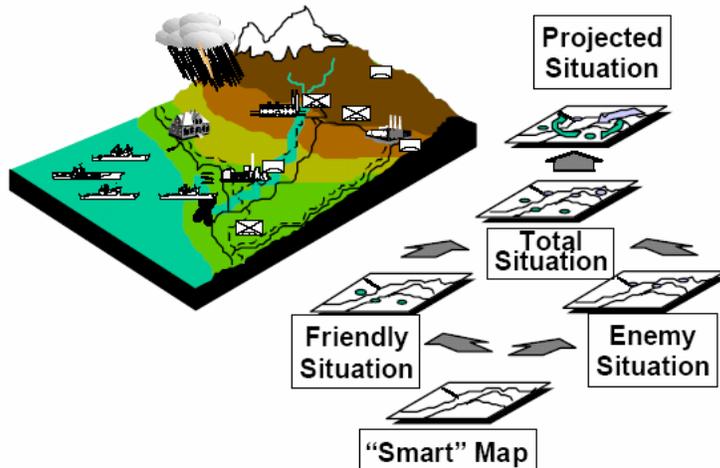
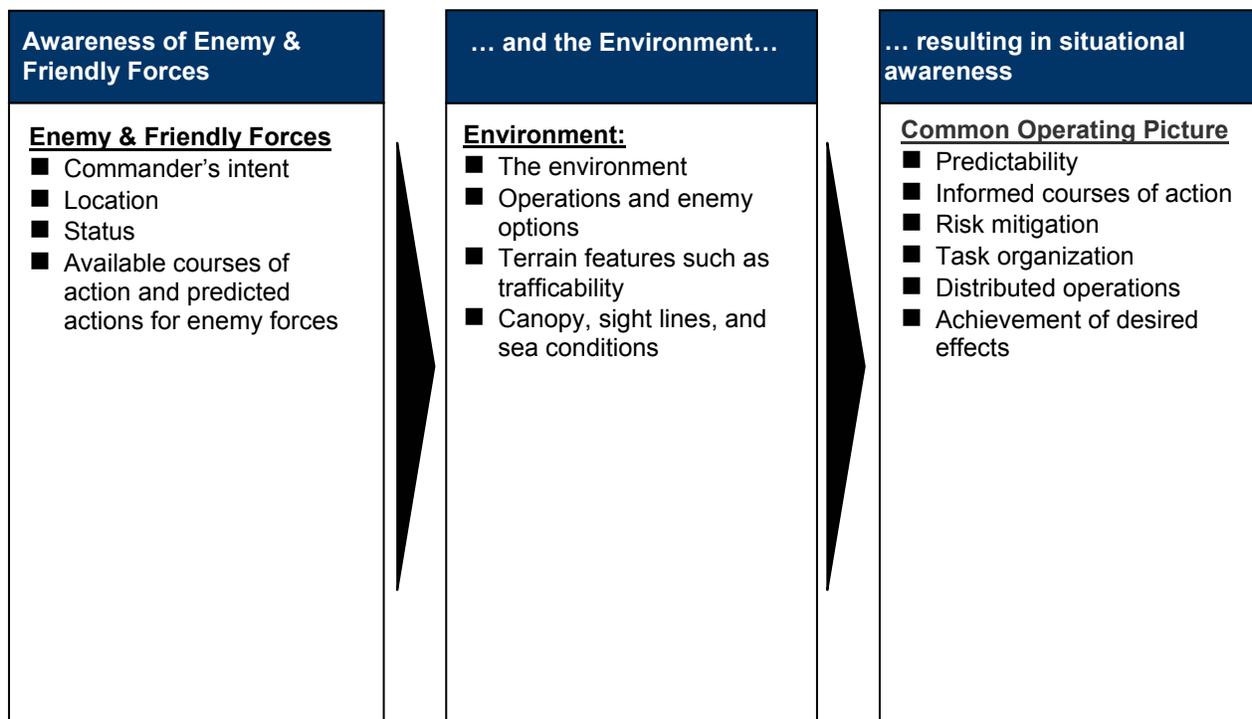


Figure 4

Creating Situational Awareness is based on a Smart Map that combines the Friendly Situation, with the Enemy Situation to form a visual representation of the total situation. The total situation is the basis of decision making and the communication of the Commander’s intent. The building blocks of a Common Operating Picture enabling Coalition Interoperability are described below:

### Achieving Situational Awareness



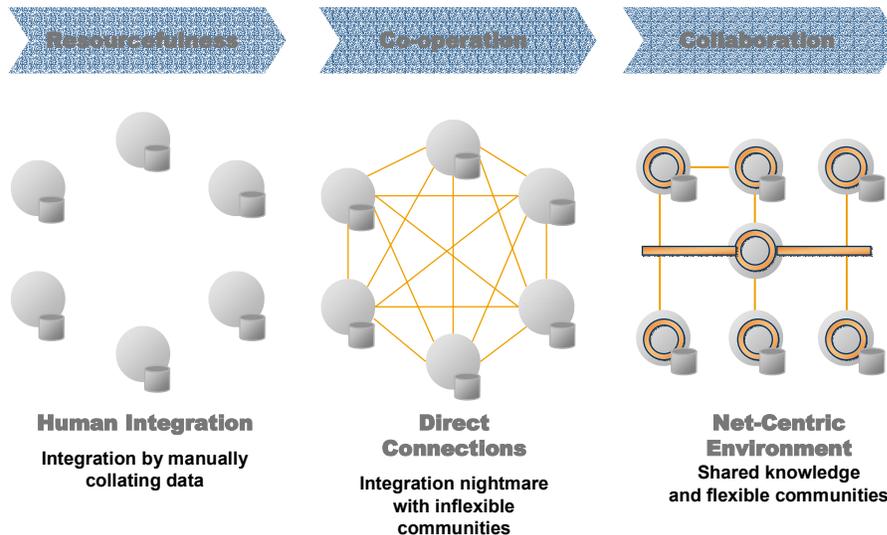
The Objective Assessment of Logistics in Iraq describes the current deficiencies in achieving a Common Operating Picture which have to be overcome in a coalition environment.

<b>Current Deficiencies</b>	<b>Key Observations</b>
<b>Limited Logistics Visibility</b>	<ul style="list-style-type: none"> <li>■ Decisions handled in separate systems</li> <li>■ Decisions based on incomplete data</li> <li>■ Difficulty on making capability based decisions</li> <li>■ Ad-Hoc and Improvised logistics</li> </ul>
<b>Legacy System Environment</b>	<ul style="list-style-type: none"> <li>■ Closed and incompatible systems</li> <li>■ Inability to upgrade individual components</li> <li>■ High Total Cost of Ownership</li> <li>■ Based on existing concepts of operations</li> </ul>
<b>Passive Interaction</b>	<ul style="list-style-type: none"> <li>■ Need to pull information</li> <li>■ Lack of drill-down, drill-across and free navigation</li> <li>■ Inability to determine impacts</li> <li>■ Inability to initiate action in real time</li> </ul>
<b>Historical Based Data</b>	<ul style="list-style-type: none"> <li>■ Uncertain future posture</li> <li>■ Actions are reactive rather than pro-active</li> <li>■ Difficult to correlate historical data to current events</li> </ul>

To achieve a COP enabling Coalition Interoperability the military organizations have to transform to a Netcentric Environment with shared knowledge and flexible communities. Cold War IT architectures still exist and are based on point to point direct connections between the coalition forces. This prevents Coalition interoperability.

## Shared Knowledge for Situational Awareness

### COP Genealogy



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Figure 5.

The Objective of a COP for support in a coalition environment is to decrease the Decision Cycle Time (OODA – Loop Observe, Orient, Decide, Act) and to develop the Coalition Forces into a learning organization.

The building blocks of a COP are a Geospatial Information System (GIS), a Central User Interface (Defense Portal) with additional layers that combine friendly & enemy forces with environmental data with continuous refreshment of real-time data from information systems as well as RFID & Sensors. This should be based on a Net-Centric environment which depends on an Open architecture based on web-services ( e.g. Internet Standards ), full Process visibility with automated event notification, a Collaborative platform, Military Message exchange, Ad-Hoc Workflow, and use of Collaboration rooms.

The Benefits are the Creation of real-time situational awareness, providing of a Compressed OODA Loop, Increased responsiveness to Commander's intent and a Creation of predictive assessment of courses of action.

The SENSE AND RESPOND LOGISTICS: CO-EVOLUTION OF AN ADAPTIVE ENTERPRISE CAPABILITY – DoD's OFFICE OF FORCE TRANSFORMATION – April 2004 describes the transformation trends around the Common Operating picture that is also applicable for the coalition environment:

- Focus logistics support towards direct correlation to a total situation awareness
- Total situation awareness requires maintenance and access to historical situation, and the entire situational context for past operations

- To anticipate and proactively support future operations, total situation awareness also requires awareness of planned operations and anticipation or prediction of future situations
- Total situation awareness consists of historical, current, future plans, and predicted views of Commander's intent, Strategic, operational, and tactical situation awareness, The military operations environment, Force capabilities status and logistics resources & capabilities statuses

Current technology trends are enabling the Vision with Predictive technology, Real time messaging, Business process management, Affordable bandwidth, Peer to peer computing, Self healing networks, RFID, Agent based solutions, Service oriented architectures, Multi Level security solutions, Grid computing / virtual data centers, Geo spatial maps / GPS, Event driven architectures and Cognitive systems. By adopting the current COTS trends in technology to the OODA Loop the building blocks are described below:

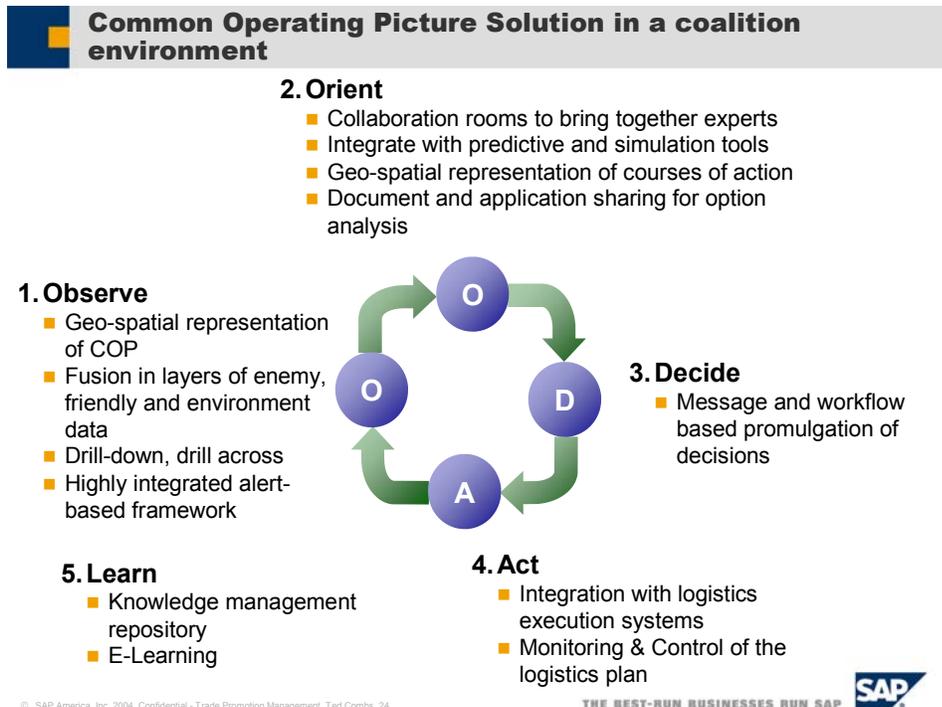


Figure 7.

The following Demonstration gives an impression on what can be achieved with COTS building blocks in terms of:

- **Creation of real-time situational awareness**
- **Compressed decision cycle time (e.g. OODA Loop)**
- **Increased responsiveness to Commander's intent**
- **Creation of predictive assessment of courses of action**

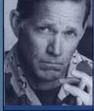
## Common Operating Picture Demo (1)

### SAP for Defense & Security - Common Operating Picture

#### Operational Sense & Respond Logistics



**Benefits**

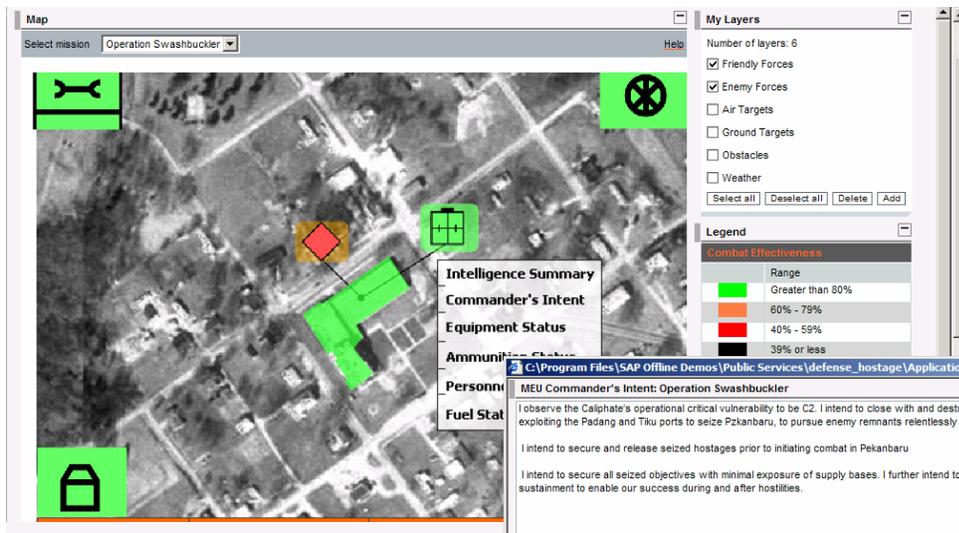


Operation Swashbuckler is launched in response to a hostage situation where a group of Non-Government Organization (NGO) employees are taken hostage by a group of insurgents. Elements of the 1st Special Forces Operational Detachment-Delta are assigned and currently in route from Frankfurt, Germany when the insurgents execute the first hostage and make additional demands. In response, the H-Hour of the mission is advanced, and using SAP software the OODA (Observe, Orient, Decide, and Act) loop begins.

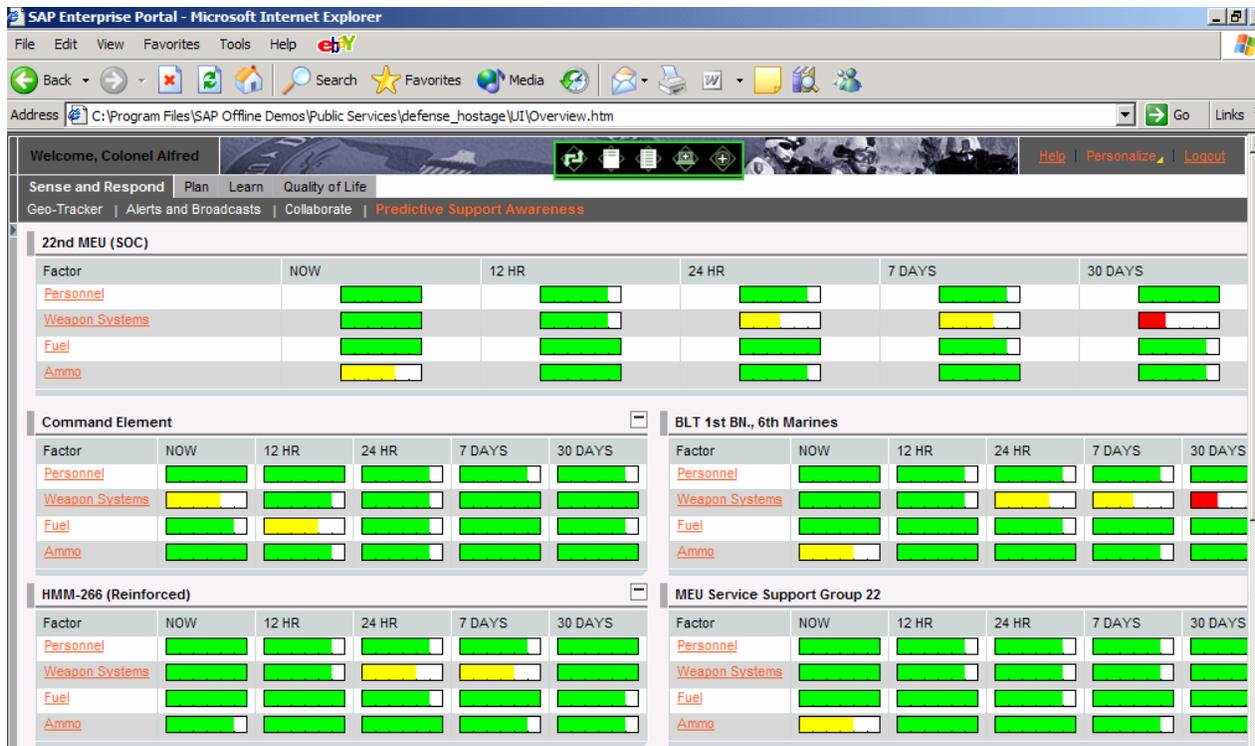
<ul style="list-style-type: none"> <li>-GIS Drilldown</li> <li>-PSA</li> <li>-Alert</li> <li>-GIS Drilldown</li> </ul>	<ul style="list-style-type: none"> <li>-Collaboration Room</li> </ul>	<ul style="list-style-type: none"> <li>-Workflows</li> </ul>	<ul style="list-style-type: none"> <li>-GIS Drilldown</li> </ul>	<ul style="list-style-type: none"> <li>-Lessons Learned</li> </ul>
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Figure 8.

The Common Operating Picture provides the Commander with traffic lights giving him situational awareness and a predictive view of his resources. The Portal Technology provides based on authorization and role the appropriate Layers in the appropriate granularity. By drilling down on Intelligence Summary, Commanders Intent, Ammunition Status, Personnel and Fuel all coalition partners share the same common operating picture.



The Basic Blocks of a COP build on COTS are People Integration, Information Integration and Process Integration linked to Feeder Applications.



The predictive support awareness PSA provides a scorecard view with Red, Yellow and Green indicators to depict the resource situation information as it evolves from current time through 12h, 24 h, 7 days, and 30 days. This requires an underlying enterprise service architecture that is feeding resource information over time and takes the planned courses of action into account. This enables the commander to take corrective action and adapt to the bottle necks in terms of Personnel, Weapon Systems, Logistics, Training or Budget

Summary: Technical enabler that providing an evolutionary, step-by-step way to an Enterprise Services Architecture and a Net-Centric Enterprise are available and already in implementation at various NATO Defense Forces. As the most comprehensive integration and application platform, SAP NetWeaver gathers the information from all heterogeneous applications into a unified, homogeneous form. It then uses that information to build a new, focused and process oriented solution based on a comprehensive Common Operating Picture of the enterprise by connecting Combat Service Support to the Combat Service domain enabling interoperability in a coalition environment.