

# Maintaining Situational Awareness in On-Demand Distributed Space Operations

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# Agenda

- ◆ **Goal**
- ◆ **Situational Awareness and On-Demand Operations**
- ◆ **Fast Access Situational Awareness Toolkit (FASAT)**
- ◆ **Other Applications for FASAT Technology**
- ◆ **Discussion**

# Sponsor

- ◆ **Air Force Research Lab, Human Effectiveness Directorate**
  - POC: Dr. June Skelly
  
- ◆ **Funded through Phase I and II SBIR**

# Space Command's Objectives

- ◆ **The *Air Force Space Command (AFSPC) Strategic Master Plan for FY02 and Beyond***
  - “Total Space Situational Awareness”
  - “Next Generation Space Asset Operations Capabilities”
    - “On-demand operations”
    - “Autonomy”
  - “Reduce the cost of doing business” via “cost-effective mission operations”
  - Leverage partnerships

# Traditional Operations

## Traditional Mission Operations

Mission 1



Mission 2



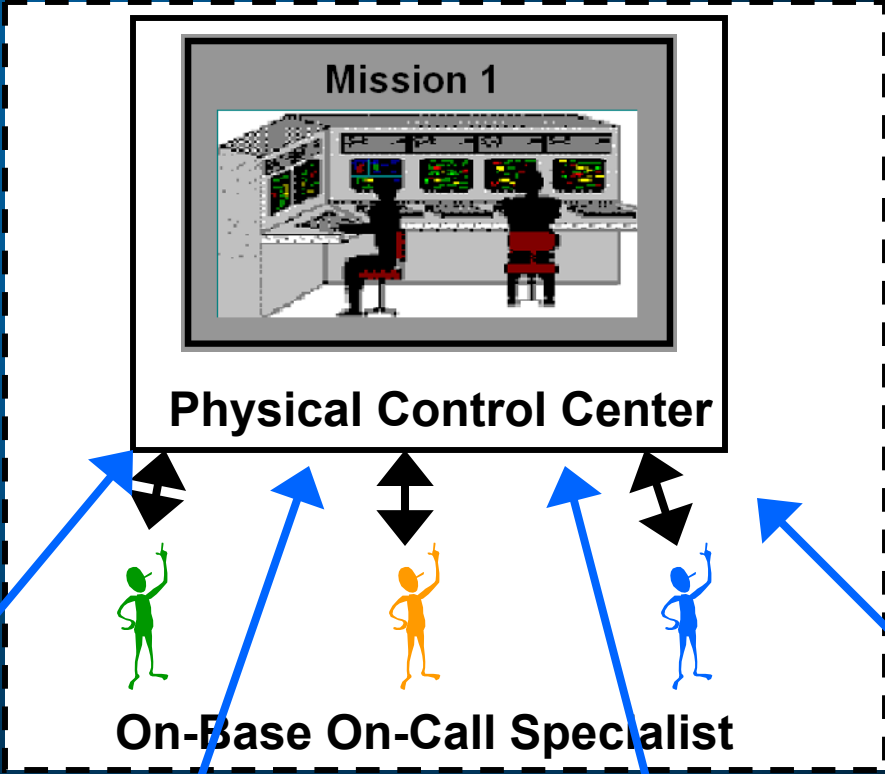
Mission 3



*Staffed 24 x 7*

*Unique and dedicated resources*

# Our Vision of Distributed Operations



**Off-Site Contractors**



**Other Military Locations**



**Troops in the Field**



**Researchers**

# Improving Situational Awareness Can Improve Mission Assurance

# Example Definition of Situational Awareness (SA)

- ◆ “...the **perception** of the 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 (1995)



# Spacecraft Emergency Response System (SERS)

- ◆ **First generation tool to support SA for distributed operations**
- ◆ **Operationally deployed by NASA for post-pass monitoring and alerting**
  - **Features**
    - **Automatically fills in event reports**
    - **Wireless alerts**
    - **Tracks response**
  - **Meets the needs of users**

# Spacecraft Emergency Response System (SERS)

- ◆ **A great tool, but only designed for post-pass automation**
  - Can only monitor (parse) one source of data
  - Alerts limited to “summaries” of pass events
  - No tools to support information sharing
  - Simple call down (roll over logic)
- ◆ **Does not have all the functionality to provide the level the situational awareness needed for the Air Force vision of 7x24 on-demand distributed operations**

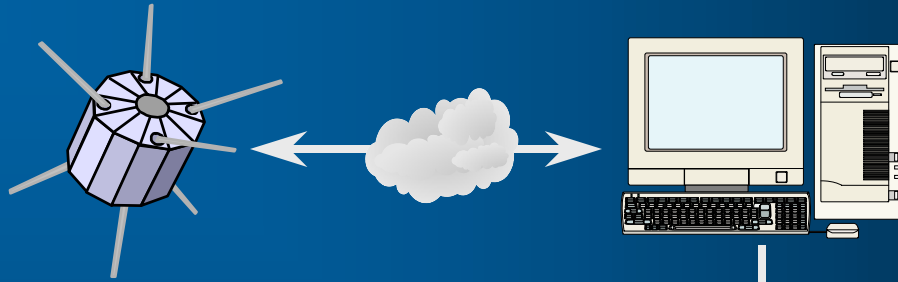
# **New Challenges in 7x24 On-Demand Distributed Operations**

- ◆ **Providing Initial Situational Awareness**
  - **When to send first “alert”**
  - **What level of information to send**
  
- ◆ **Maintaining Situational Awareness**
  - **How to keep on-call users up to date**
  - **How often to update the information**
  - **How to determine when an incident ends**

# **Fast Access Situational Awareness Toolkit (FASAT)**

**Next Generation Suite of Tools  
to Improve Mission Assurance for  
7x24  
On-Demand Distributed**

# FASAT

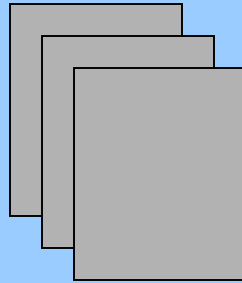


Ground System or Expert System

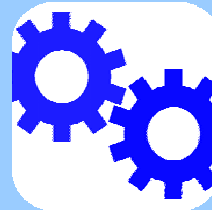
Monitoring / Parsing / Filtering



Web Portal UI



Logging & Reporting

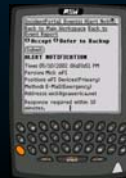


Alerting & Workflow



Remote Collaboration

Universal Wireless Gateway



FASAT

FASAT

# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Perception

- Users (with Web browsers) have access to the latest incident reports
  - FASAT performs near-real-time (NRT) monitoring and filtering of streams of data from multiple sources, as defined in “Scenarios”
  - FASAT then automatically creates incident reports and updates, then with the latest data throughout the incident

# FASAT User Interface

The screenshot displays the FASAT User Interface within a Microsoft Internet Explorer browser window. The address bar shows the URL: <http://mfweb1.mobilefoundations.com/dev/FASAT/events.nsf/home?openframeset&login>. The page title is "Incidents".

The main navigation menu includes: Incidents, Scenarios, People, Assignments, Schedule, Resources, Anomaly, and Summaries. The "Incidents" menu item is currently selected.

The incident list is sorted by date and contains the following entries:

Document	Date	Organization	Start Time	End Time	Originator	Alert ID
WIRE						
<a href="#">Inactive Stream Incident #97601</a>	02/08/2003	WIRE (WIRE)	04:32:49 PM	04:39:02 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97591</a>	02/08/2003	WIRE (WIRE)	04:08:37 PM	04:18:08 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97581</a>	02/08/2003	WIRE (WIRE)	03:46:11 PM	03:48:13 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97571</a>	02/08/2003	WIRE (WIRE)	03:40:03 PM	03:45:11 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97561</a>	02/08/2003	WIRE (WIRE)	03:19:41 PM	03:26:46 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97551</a>	02/08/2003	WIRE (WIRE)	03:03:26 PM	03:04:29 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97541</a>	02/08/2003	WIRE (WIRE)	03:01:25 PM	03:01:25 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97531</a>	02/08/2003	WIRE (WIRE)	02:58:23 PM	02:59:25 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97521</a>	02/08/2003	WIRE (WIRE)	02:47:17 PM	02:58:23 PM	NEW_BASIC	
<a href="#">Inactive Stream Incident #97511</a>	02/08/2003	WIRE (WIRE)	02:45:15 PM	02:45:15 PM	NEW_BASIC	

Below the incident list, there is a chat window titled "Incident Portal Chat". The chat window includes a "Type message here:" field and a "Send" button. The "People Here:" list shows three participants: Jeff Fox/mFinc, Mary S Hoxie, and Trinadh Kavuri.

Instructions for using the chat are provided:

- To send a message to all of the chat participants, enter your message in the "Type Message Here" field to the right.
- To start a one-on-one chat with a specific person, double-click their name above. Then, enter your message into the dialog box that appears.

# FASAT Configuration



## Scenarios



Incidents Scenarios People Assignments Schedule Resources Anomaly Summaries

← Previous → Next



Add New Scenario

Sort: By ID



Help



Logout

Alert ID	Title	Severity	Filter Description
----------	-------	----------	--------------------

▼ WIRE

▶ LIMVIOL

LIMVIOL Medium

▼ NEW\_BASIC

NEW\_BASIC Medium

[Event Filter Definition for ITOS: Enabled](#)

[Stop Filter Definition for ITOS: Enabled](#)

[Notify for WIRE: Operator](#)

[Notify for WIRE: Satellite Engineer](#)

Test

Test Medium



# FASAT Scenarios

## Scenario

[← Back to Main Workspace \(Cancel Edit\)](#) [Add Notification](#) [Add Filter](#) [Delete](#)

[Help](#) [Logout](#)

Scenario

\*denotes required field

### Scenario Information

Organization: WIRE

\* Scenario ID:  (alphanumeric without any spaces)

\* Scenario Title:

\* Description:

Severity Level:  Low  Medium  High

Impacts:

### Notification

Notification List: Operator  
Satellite Engineer

# FASAT Filters for ITOS

## Filter

[← Back to Main Workspace \(Cancel Edit\)](#) [Delete Filter](#)

[? Help](#) [X Logout](#)

Organization: WIRE

Alert ID: NEW\_BASIC

Stream:

Filter Type:  Event  Stop

Filter Enabled:  Yes  No

Add Filter Expression

### Filter Expressions:

Incident	FIELD "EventNumber" Matches "02"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "EventNumber" Matches "01"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "EventNumber" Matches "29"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Inhibit	FIELD "Message" Matches "Code#0052"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "EventType" Matches "CFG_ALERT"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "EventType" Matches "TCW_FAULT"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "EventType" Matches "STOL_MSG"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
	AND	
	FIELD "Message" Matches "NO R-T TLM RCVD"	
Incident	FIELD "EventType" Matches "STOL_MSG"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
	AND	
	FIELD "Message" Matches "BARKER CODE DID NOT UPDATE - LAST UPLINK TIME"	
Incident	FIELD "Message" Matches "ACS Command Error Counter has incremented"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "Message" Matches "RTS 24 (Enter ZSP if SOC .* 85%) is DISABLED"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "Message" Matches "Low Battery State-of-Charge Sensed"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "Message" Matches "Action ENABLED_PASSIVE suppressed RTS"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "Message" Matches "WIRE SC_EVENT for DS Start Time Not Found"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>
Incident	FIELD "Message" Matches "Timeline Enable Flag is FALSE"	<a href="#">Edit Expression</a> <a href="#">Delete Expression</a>

# FASAT Filters for ITOS

### Expression

[Cancel](#) [Help](#) [Logout](#)

Field	Matches	Value
EventNumber	Matches	02
EventNumber		
Date		
EventType	<b>and</b>	
MnemonicType	Matches	
MnemonicStatus		
MnemonicName		
MnemonicValue	<b>and</b>	
MnemonicDate	Matches	
Message		
	<b>and</b>	
	Matches	
	<b>and</b>	
	Matches	

Filter Type:  Incident Filter  Inhibit Filter

[Save Expression](#)

# FASAT Incident Reports

## STREAM INCIDENT REPORT #97601

[← Back to Main Workspace](#) [✎ Edit](#)

[? Help](#) [X Logout](#)

Mission: WIRE  
Episode Started: 02/08/2003 04:32:49 PM EST  
Posted At: 02/08/2003 04:32:49 PM

Originator:  
Spacecraft: WIRE  
Episode Ended: 02/08/2003 04:39:02 PM EST

### Event Information

Alert ID: NEW\_BASIC  
Stream Status: Inactive  
Last Update: 02/08/2003 04:32 PM  
Last Alert: 02/08/2003 04:32 PM

### Anomalous Alert Information

#### Limit Violations

Mnemonic	Value	Status	Type	Time
AGYROSTWD	raw = 0	low	Yellow	02-344-14:08:05
AGY1XIT	cnv = 8.697401383	low	Yellow	02-344-14:08:06
AGY1CT	cnv = 10.92970631	low	Yellow	02-344-14:08:06
AGY2XIT	cnv = 8.358837579	low	Yellow	02-344-14:08:06
AGY2CT	cnv = 10.92970631	low	Yellow	02-344-14:08:06
AGY3XIT	cnv = 8.016732271	low	Yellow	02-344-14:08:06
AGY3CT	cnv = 10.41641414	low	Yellow	02-344-14:08:06
AGY1V	cnv = 0.6787741	low	Yellow	02-344-14:08:07
AGY2V	cnv = 0.6410603	low	Yellow	02-344-14:08:07
AGY3V	cnv = 0.8107724	low	Yellow	02-344-14:08:07
AKSTDPAVAIL	raw = 0	low	Yellow	02-344-14:08:13
AKESAFESTAT	raw = 1	high	Yellow	02-344-14:08:13

# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Perception

- Remote users wirelessly receive custom incident data as soon as possible
  - FASAT's NRT alert-workflow engine sends alert notifications out to the appropriate on-demand remote users (pre-defined)
  - FASAT manages and sends specific content based on user roles
  - FASAT sends reminders for users to respond to alerts
  - FASAT automatically performs roll-over functions to ensure that someone receives the data in a timely manner
  - FASAT incorporates mobileFOUNDATIONS' Universal Wireless Gateway that sends wireless data and voice alerts to remote users

# FASAT Notification

**Notification**

[← Back to Main Workspace \(Cancel Edit\)](#) [Delete Notification](#) [? Help](#) [X Logout](#)

\*denotes required field

**Scenario Information**

Scenario ID: NEW\_BASIC  
Organization: WIRE  
\* Position:

\* Contact Type:  Standard  Emergency

Alert Message:

Include Fields  Incident Name  
Message:  Scenario ID  
 Scenario name  
 Incident Time  
 Date  
 Incident Description  
 Submitted By  
 Incident Location

Respond Within  minutes.  
 Information Only (do not rollover across people)  
 Response required (rollover across people of no response or deferred to backup)

Category  
 ALTAIREVENT  EVENT  LIMIT\_VIOL  SC\_EVENT  
 CFG\_ALERT  GROUND  Other

# FASAT Schedule

<a href="#">← Previous</a> <a href="#">Next →</a> <a href="#">New Entry</a>		Sort: <input type="text" value="Calendar"/>	<a href="#">? Help</a> <a href="#">X Logout</a>
<a href="#">February 2003</a>		<span style="border: 1px solid black; padding: 2px;">16</span>	<a href="#">February 2003</a>
<b>3</b> Monday			Monday <b>10</b>
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Satellite Engineer	Dave Gillen (Primary)
<b>4</b> Tuesday			Tuesday <b>11</b>
<b>5</b> Wednesday			Wednesday <b>12</b>
<b>6</b> Thursday			Thursday <b>13</b>
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Satellite Engineer	Dave Gillen (Primary)
<b>7</b> Friday			Friday <b>14</b>
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Satellite Engineer	Dave Gillen (Primary)
<b>8</b> Saturday			Saturday <b>15</b>
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Satellite Engineer	Dave Gillen (Primary)
<b>9</b> Sunday			Sunday <b>16</b>
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)
	<a href="#">12:00 AM - 12:00 AM</a>	<b>WIRE</b> Satellite Engineer	Dave Gillen (Primary)

# FASAT Team Profiles (1 of 2)

## Team Member Profile

[← Back to Main Workspace \(Cancel Edit\)](#)



[Delete Person](#)



[Help](#)



[Logout](#)

### Contact Information

\*First Name:

\*Last Name:

Telephony PIN:  (4 digits)

### Work Contact Information

\*Phone:

Fax:

\*E-Mail:

Address:

### Home Contact Information

Phone:

Fax:

E-Mail:

Address:



# FASAT Team Profiles (2 of 2)

## Cell Phone Contact Information

Cell Phone:

## Pager Contact Information

Send To:  No pager  
 E-mail Address  
 Pager PIN and service specified here

Pager PIN Number:  (if applicable)

Pager Service Name:  (if applicable)

Pager E-mail Address:  (if applicable)

Wireless Web Address:  (if applicable)

Other Address:  (if applicable)

## Contact Method

\*Standard Contact:

Send Code Only

Backup Device:

mins

\*Emergency Contact:

Send Code Only

Backup Device:

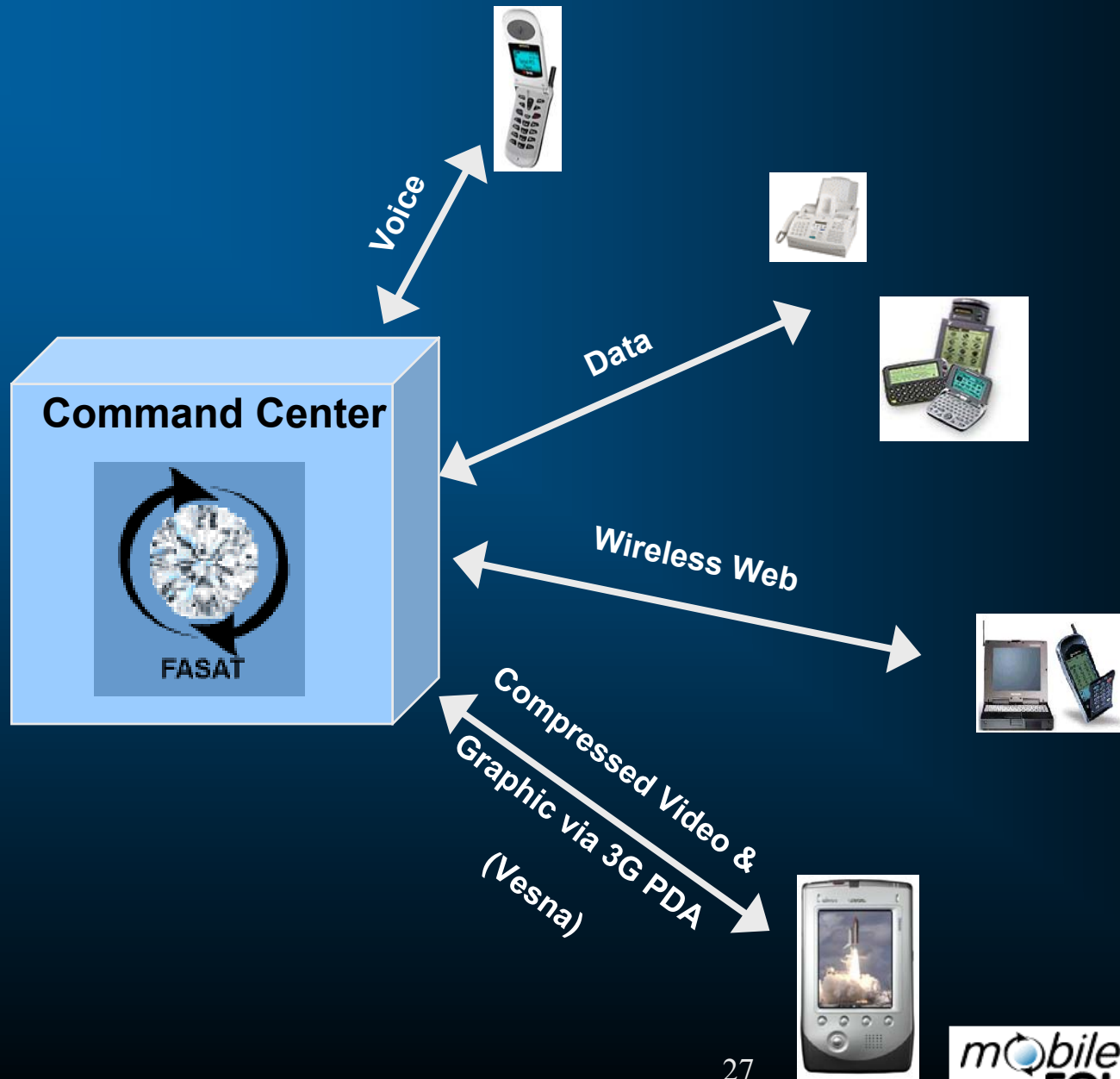
mins

# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Comprehension

- Remote users receive the most content, formatted in the best format possible
  - FASAT optimizes the content based on the characteristics of the wireless device and service provider

# Universal Alert Notification & Response



# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Perception

- Users (with full Web browsers) can stay informed as to who has been notified, responded, and receiving updates
  - FASAT's Incident View posts the latest status of the incident
  - FASAT's Incident View visually represents the current status of the remote users

# FASAT Alert Tracking



## Incidents

Incidents Scenarios People Assignments Schedule Resources Anomaly Summaries

← Previous → Next Add Alert Refresh Sort: By Date

Document	Date	Organization S
▼ WIRE		
▼ <u>Inactive Stream Incident #97601</u>	02/08/2003	WIRE (WIRE) 0-
✗ <a href="#">Mick Baitinger (Operator) - Notified by Pager at 02/08/2003 04:32:50 PM</a>		
✓ <a href="#">Dave Gillen (Satellite Engineer) - Notified by Wireless Web at 02/08/2003 04:32:50 PM</a>		
✓ <a href="#">Jeff Fox (Operator) - Notified by Phone Call at 02/08/2003 04:37:00 PM</a>		

# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Comprehension

- Remote users can make better informed decisions by receiving updates on the status of the incident
  - FASAT pushes updates to users (if requested) detailing the most recent data about the incident throughout the incident
  - FASAT allows users to remotely request “contextual” data

# FASAT Reminders, Updates, and Confirmations

## Set Alert Options

**Auto Reminder:** Prompt responders who have not yet responded to notifications to remind them to do so.

- Do not send Auto Reminders.
- Send Auto Reminder every  minutes
  - Stop sending Auto Reminders after  messages have been sent.

**Updates:** are sent to users to keep them aware of the current status of incidents.

- Do not allow users to request updates.
- Allow users to request update.

When there are changes/new data, send updates every  minutes.

When there are no changes/new data, send updates every  minutes.

**Verifications:** Keep users informed of whether (and when) FASAT receives responses.

- Do not send a notification
- Send a notification whenever FASAT receives a response.

# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Comprehension

- Users (with full Web browsers) can post and have access to supporting information
  - FASAT incorporates a “resources” area for storage of and access to any to type of file (e.g., manuals, schematics)



# FASAT Resources



## Resources

[Incidents](#) [Scenarios](#) [People](#) [Assignments](#) [Schedule](#) [Resources](#) [Anomaly](#) [Summaries](#)

[← Previous](#) [Next →](#) [Add Resource](#)

[? Help](#) [X Logout](#)

Title

▶ Links

▼ Training

[ITOS Training Documents](#)

# FASAT Resources

## Resources

[← Back to Main Workspace](#) [Discuss this Resource](#) [Edit Resource](#)

[Help](#) [Logout](#)

Title: ITOS Training Documents

Type: Training

Description: Training documents on how to operate ITOS

Date entered: 02/05/2003 07:55:26 PM

Entered by: Jeff Fox

Comments:



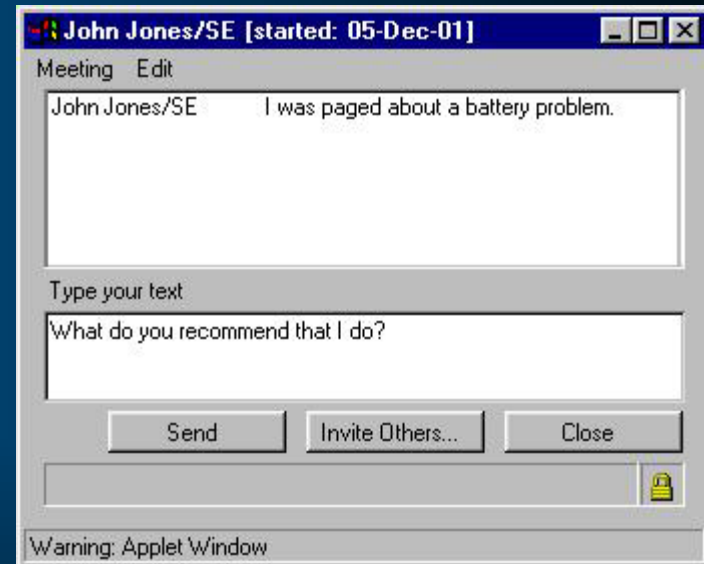
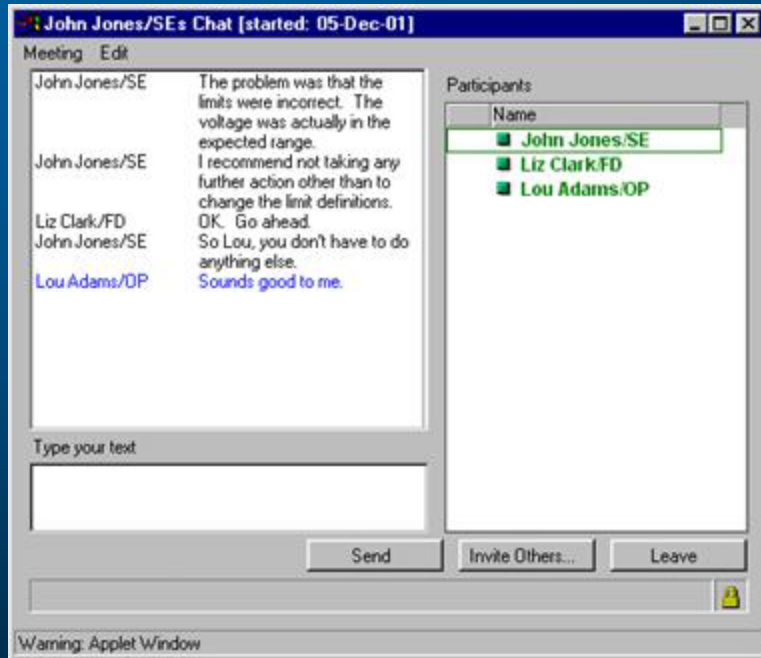
[itos-stol.pdf](#) [itos-overview.pdf](#)

# FASAT Support for On-Demand 7x24 Distributed Operations

## ◆ Projection

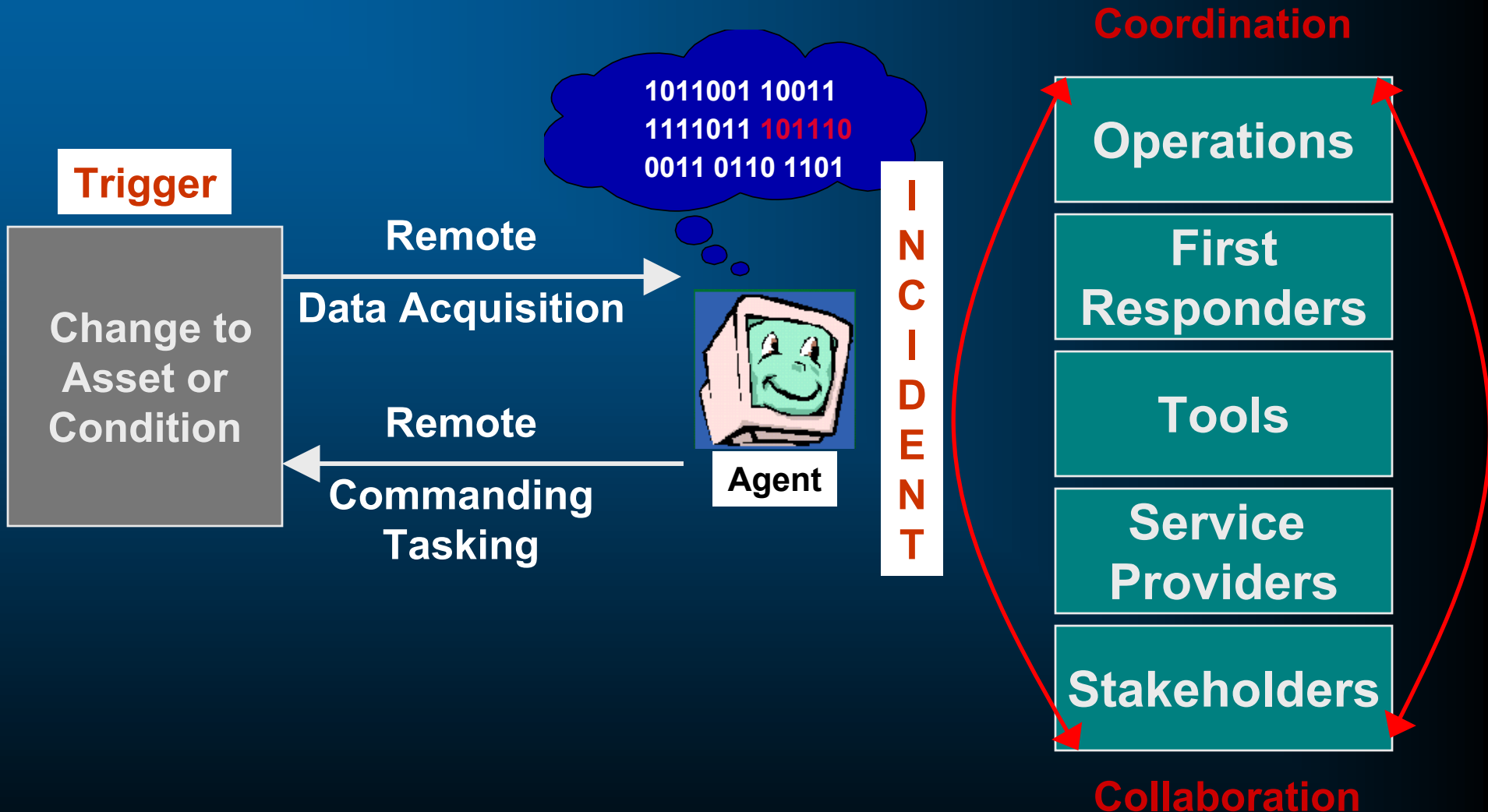
- Users can collaborate to gain insight into how to respond to incidents
  - FASAT incorporates real-time collaboration tools, including:
    - Chat, Awareness, screen sharing, whiteboarding
- Users have access to use other tools to assist in support of FDIR activities
  - FASAT provides a “portal” infrastructure for access to other tools and applications to assist in decision making

# FASAT Awareness and Chat

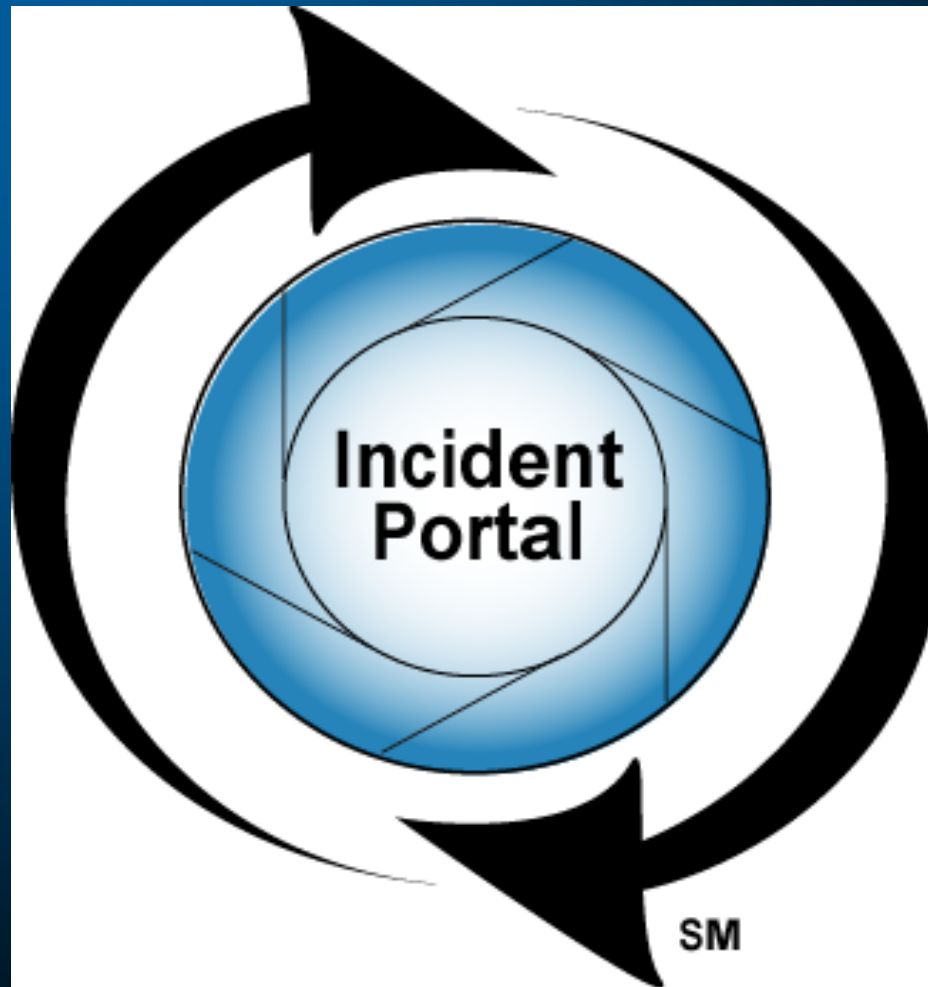


# Tech Transfer & Commercialization

# Incident Management Concept



# Incident Management



# IncidentPortal™ Features

Web-based  
Incident Management

Reliability & Security

Diverse Triggers



Content Management  
& Data Fusion

Wireless Access

Collaboration Tools

Alert Management &  
Workflow

Interoperability



# Sample Applications

- ◆ **Critical infrastructure & force protection**
- ◆ **Cyber Security**
- ◆ **Public Safety**
- ◆ **Search and rescue**
- ◆ **Counter-terrorism**
- ◆ **General public safety**
- ◆ **Natural disasters**
- ◆ **Critical infrastructure & force protection**
- ◆ **Distributed situational awareness for command & control**

**Deliver the right data to the right people all the time, anywhere, any device.**

# Contact Information

## ◆ For more information, please contact:

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**[www.mobilefoundations.com](http://www.mobilefoundations.com)**