Maintaining Situational Awareness in On-Demand Distributed Space Operations

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#### Goal

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





 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 "costeffective mission operations"
  - Leverage partnerships



#### **Traditional Operations**



#### Staffed 24 x 7

#### Unique and dedicated resources



#### **Our Vision of Distributed Operations**





### 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)



# 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



# 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 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 steams of data from multiple sources, as defined in "Scenarios"
  - FAST then automatically creates incident reports and updates, then with the latest data throughout the incident



#### **FASAT User Interface**

http://mfweb1.mobilefoundations.com/dev/FASAT/events.nsf/home?openfr	ameset&login <u>- Mic</u>	rosoft Internet Explorer		X
File Edit View Favorites Tools Help			4	
😋 Back 🔹 🕥 👻 😰 🐔 🔎 Search 👷 Favorites 🛯 Media 🥝 🔗 🖏	) 🖸 • 🗔 🧐 🍕	) 🖗 🚳		
Address 🗃 http://mfweb1.mobilefoundations.com/dev/FASAT/events.nsf/home?openfram	eset&login	<b>•</b>	🕞 Go 🛛 Links 🎽 Norton AntiVirus 🔙 🕤	•
Incidents	ule Resources	Anomaly Summaries	FASAT	
←Previous →Next ④ Add Alert Refresh Sort: By Date	•		🕐 Help 🔇 Logout	
Document Date Organization Start T	ime End Time	Originator Alert ID		
▼ WIRE				
Inactive Stream Incident #97601 02/08/2003 WIRE (WIRE) 04:32:4	9 PM 04:39:02 PM	NEW_BASIC	:	
Inactive Stream Incident #97591 02/08/2003 WIRE (WIRE) 04:08:3	7 PM 04:18:08 PM	NEW_BASIC		
Inactive Stream Incident #97581 02/08/2003 WIRE (WIRE) 03:46:1	1 PM 03:48:13 PM	NEW_BASIC		
Inactive Stream Incident #975/1 U2/U8/2003 WIRE (WIRE) 03:40:4	3 PM 03:45:11 PM	NEW_BASIC		
Inactive Stream Incident #97551 02/08/2003 WIRE (WIRE) 03:19:4 Inactive Stream Incident #97551 02/09/2003 WIRE (WIRE) 03:03:2	1 PM U3:26:46 PM 6 DM 03:04:20 DM	NEW_BASIC		
Inactive Stream Incident #97541 02/08/2003 WIRE (WIRE) 03:01:2	5 PM 03:04:25 PM	NEW BASIC		
<ul> <li>Inactive Stream Incident #97531 02/08/2003 WIRE (WIRE) 02:58:2</li> </ul>	3 PM 02:59:25 PM	NEW BASIC		
Inactive Stream Incident #97521 02/08/2003 WIRE (WIRE) 02:47:1	7 PM 02:58:23 PM	NEW_BASIC	:	
Inactive Stream Incident #97511 02/08/2003 WIRE (WIRE) 02:45:1	5 PM 02:45:15 PM	NEW_BASIC	:	
To send a message to all of the chat participants, enteryour				-
message in the "Type Message Here" field to the right.		Open chat in separa	ate window	
	Incident Portal Chat		People Here:	
To start a one-on-one chat with a specific person, double-click			Jeff Fox/mFinc	
their name above. Then, enter your message into the dialog box			☆ Mary 5 Hoxie ■ Trinadh Kayuri	
Linat appears.				
	Type message here:	S	end	-
E Done			💿 🖉 Internet	///



### **FASAT Configuration**





#### **FASAT Scenarios**

Scenario		
🗲 Back to Main Workspace (Cancel Edit) 🛔 Add Notification 😬 Add Filter 🎐 Scenario	Delete	🕜 Help 🔕 Logout
*denotes required field		
Scenario Information		
Organization: WIRE  * Scenario ID: Demo1 (alphanumeric without any spaces)  * Scenario Title: Demonstration Scenario  * Description: This scenario is used for demo purposes only  Severity Level: O Low O Medium • High Impacts:		
Notification		
Notification List: Operator Satellite Engineer		



#### **FASAT Filters for ITOS**

	Filter			
🗲 Back to Mai	n Workspace (Cancel Edit) 🎐 Delete Filter		Help	🙁 Logout
Org F Filte	anization: WIRE Alert ID: NEW_BASIC Steam: ITOS I Tilter Type: I Event IO Stop r Enabled: I Yes IO No			
Add Filter E	xpression			
Incident	FIELD "EventNumber" Matches "02"	Edit Express	ion Delete Expression	
Incident	FIELD "EventNumber" Matches "01"	Edit Express	ion Delete Expression	
Incident	FIELD "EventNumber" Matches "29"	Edit Express	ion Delete Expression	
Inhibit	FIELD "Message" Matches "Code#0052"	Edit Express	ion Delete Expression	
Incident	FIELD "EventType" Matches "CFG_ALERT"	Edit Express	ion Delete Expression	
Incident	FIELD "EventType" Matches "TCW_FAULT"	Edit Express	ion Delete Expression	
Incident	FIELD "EventType" Matches "STOL_MSG" AND FIELD "Message" Matches "NO R-T TLM RCVD"	<u>Edit Express</u>	ion Delete Expression	
Incident	FIELD "EventType" Matches "STOL_MSG" AND FIELD "Message" Matches "BARKER CODE DID NOT UPDATE - LAST UPLINK TIME'	Edit Express	ion Delete Expression	
Incident	FIELD "Message" Matches "ACS Command Error Counter has incremented"	Edit Express	ion Delete Expression	
Incident	- FIELD "Message" Matches "RTS 24 (Enter ZSP if SOC .* 85%) is DISABLED"	Edit Express	ion Delete Expression	
Incident	FIELD "Message" Matches "Low Battery State-of-Charge Sensed"	Edit Express	ion Delete Expression	
Incident	FIELD "Message" Matches "Action ENABLED_PASSIVE suppressed RTS"	Edit Express	ion Delete Expression	
Incident	FIELD "Message" Matches "WIRE SC_EVENT for DS Start Time Not Found"	Edit Express	ion Delete Expression	
Incident	FIELD "Message" Matches "Timeline Enable Flag is FALSE"	Edit Express	ion Delete Expression	



#### **FASAT Filters for ITOS**

		Expression	
🗲 Cancel			🕐 Help 🛽 Logout
Field E∨entNumber	Matches	Value 02	
EventNumber Date EventType	and		
Mnemonic i ype MnemonicStatus MnemonicName MnemonicValue	Matches		
MnemonicDate Message	and		
	Matches		
	and		
	Matches		
Filter Type: ③ Incident Filter ○ Inhibit Filter			
		Save Expression	





#### **FASAT Incident Reports**

#### STREAM INCIDENT REPORT #97601

#### 🗲 Back to Main Workspace 🖉 Edit

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

1 Help 🙆 Logout

#### **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	Туре	Time
AGYROSTWD	raw = 0	low	Yellow	02-344-14:08:05
AGY1XTT	cnv = 8.697401383	low	Yellow	02-344-14:08:06
AGY1CT	cnv = 10.92970631	low	Yellow	02-344-14:08:06
AGY2XTT	cnv = 8.358837579	low	Yellow	02-344-14:08:06
AGY2CT	cnv = 10.92970631	low	Yellow	02-344-14:08:06
AGY3XTT	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 🛽 Logout
*denotes required field	
Scenario Information	
Scenario ID: NEW_BASIC Organization: WIRE * Position: Satellite Engineer 💌	
Change to notify by person	
* Contact Type: O Standard I Emergency	
Alert Message: This is a FASAT alert.	
Include Fields 🗹 Incident Name Message: 🗹 Scenario ID	
🗖 Scenario name	
Incident Time	
□ Date	
□ Incident Location	
Respond Within 30 minutes.	
C 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	
Submit	



#### **FASAT Schedule**

🗧 🕈 Previous 🗖	Next 🛄 New E	intry Sort: Calendar 🗾		0	Help 🕙 Logout
February 2003		Į	16		February 2003
3 Monday			<u>12:00 AM - 12:00</u> AM	WIREOperator	Monday <b>10</b> Mick Baitinger (Primary) Jeff Fox (Backup 1)
			<u>12:00 AM - 12:00</u> <u>AM</u>	WIRE <sup>Satellite</sup> Engineer	Dave Gillen (Primary)
4 Tuesday					Tuesday <b>11</b>
<b>5</b> Wednesday					Wednesday <b>12</b>
6 Thursday					Thursday <b>13</b>
<u>12:00 AM - 12:00</u> AM	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)			
<u>12:00 AM - 12:00</u> <u>AM</u>	WIRE <sup>Satellite</sup> Engineer	Dave Gillen (Primary)			
7 Friday					Friday <b>1</b> 4
<u>12:00 AM - 12:00</u> <u>AM</u>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)			
<u>12:00 AM - 12:00</u> <u>AM</u>	WIRE <sup>Satellite</sup> Engineer	Dave Gillen (Primary)			
8 Saturday					Saturday <b>15</b>
<u>12:00 AM - 12:00</u> <u>AM</u>	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)			
<u>12:00 AM - 12:00</u> <u>AM</u>	WIRE <sup>Satellite</sup> Engineer	Dave Gillen (Primary)			
9 Sunday					Sunday <b>16</b>
<u>12:00 AM - 12:00</u> AM	<b>WIRE</b> Operator	Mick Baitinger (Primary) Jeff Fox (Backup 1)			
<u>12:00 AM - 12:00</u> AM	WIRE <sup>Satellite</sup> 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: Jeff *Last Name: Fox Telephony PIN: 1234 (4 digits)	
Work Contact Information	
*Phone: 555-555-5555 Fax: 1234567890 *E-Mail: jfox@mobilefoundation Address:	
Home Contact Information	
Phone: 555-555-1111 Fax: 555-555-2222 E-Mail:	
24	<i>m</i> obile FOUNDATION

## FASAT Team Profiles (2 of 2)

Cell Phone Contact I	nformation
Cell Phone: 5	55-555-3333
Pager Contact Inform	lation
Send To: Pager PIN Number: Pager Service Name: Pager E-mail Address: Wireless Web Address: Other Address:	<ul> <li>No pager</li> <li>E-mail Address</li> <li>Pager PIN and service specified here</li> <li>6527802 (if applicable)</li> <li>skytel2 ▼ (if applicable)</li> <li>(if applicable)</li> <li>(if applicable)</li> <li>mick@mobilefoundatio (if applicable)</li> </ul>
Contact Method	
*Standard Contact: ( Backup Device: [F *Emergency Contact: [V Backup Device: [F	Other Address     Send Code Only       Pager     0     mins       Vork Phone     Send Code Only       Pager     0     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**

	Inc	idents	;					
	Incident	ts Scenarios P	eople Assig	inments Sch	edule	Resources	Anomaly	Summaries
🗧 🕈 Previous	→Next	🍭 Add Alert	Refresh	Sort: By Da	ite	•		
Document	t						Date	Organization S
<b>WIRE</b>								
Inactive	<u>e Stream</u>	Incident #97601					02/08/	2003 WIRE (WIRE) 0
× <u>Mick</u>	Baitinger	(Operator) - Notifi	<u>ed by Pagera</u>	<u>t 02/08/2003 0</u>	4:32:50	<u>) PM</u>		
🖌 🖌 Dave	Gillen (Sa	atellite Engineer) -	Notified by W	/ireless Web at	t 02/08/	/2003-04:32:5	<u>0 PM</u>	
🖌 🖌 Jeff F	Fox (Opera	ator) - Notified by I	Phone Call at	<u>02/08/2003 04:</u>	37:00 F	<u>PM</u>		



# 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.

- O Do not send Auto Reminders.
- C 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.

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

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

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

- O Do not send a notification
- O 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**





#### **FASAT Resources**

Resources	
Back to Main Workspace 📮 Discuss this Resource 💋 Edit Resource	🕐 Help 🛽 Logou
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:	





# 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
- Uses 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**

John Jones/SE	The problem was that the	Participants
	limits were incorrect. The voltage was actually in the	Name
	expected range.	John Jones/SE
John Jones/SE	I recommend not taking any further action other than to	Liz Clark/FD
	change the limit definitions.	
Liz Clark/FD John Jones/SF	So Lou you don't have to do	
001110018573E	anything else.	
Lou Adams/OP	Sounds good to me.	
Type your text		
	Send	Invite Others Leave

Iteeting       Edit         John Jones/SE       I was paged about a battery problem.         Type your text         What do you recommend that I do?         Send       Invite Others         Close	
John Jones/SE I was paged about a battery problem. Type your text What do you recommend that I do? Send Invite Others Close	
Type your text What do you recommend that I do? Send Invite Others Close	
What do you recommend that I do? Send Invite Others Close	
Send Invite Others Close	
/aming: Applet Window	



### Tech Transfer & Commercialization



# **Incident Management Concept**



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#### Incident Management







# **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**

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