



Multi-Modal Communication

14 November 2011

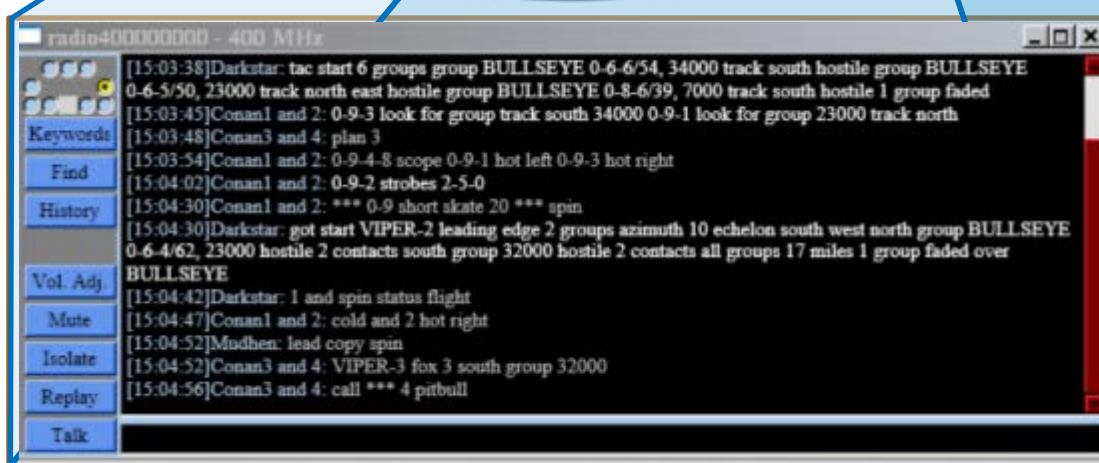
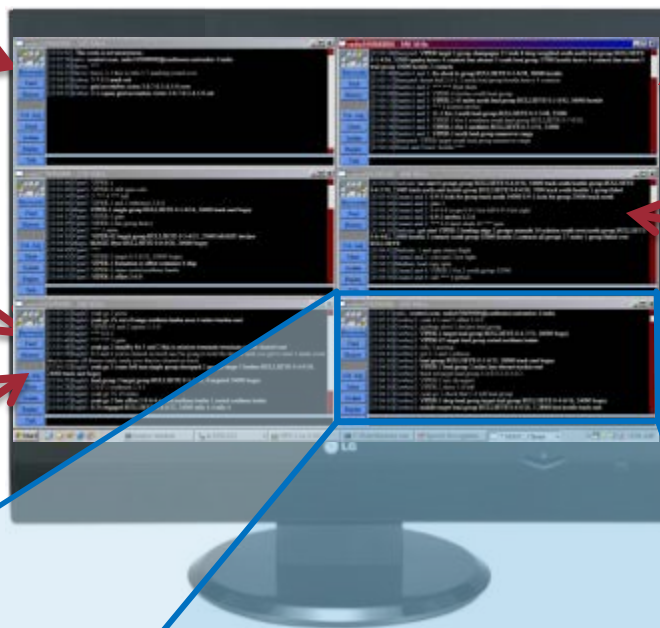


Victor S. Finomore, Jr., Ph.D.
Research Psychologist
Battlespace Acoustic Branch
Air Force Research Laboratory

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 14 NOV 2011		2. REPORT TYPE		3. DATES COVERED 00-00-2011 to 00-00-2011	
4. TITLE AND SUBTITLE Multi-Modal Communication				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Research Laboratory,Battlespace Acoustic Branch,Wright Patterson AFB,OH,45433				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES presented at the MORS Workshop on Joint Framework for Measuring C2 Effectiveness Special Meeting, 23-26 Jan 2012, Laurel, MD.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 42	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Multi-Modal Communication





Spatial Audio

- Spatializing communication into virtual locations increases intelligibility by 30 – 40% as well as reduces listener's perceived mental workload

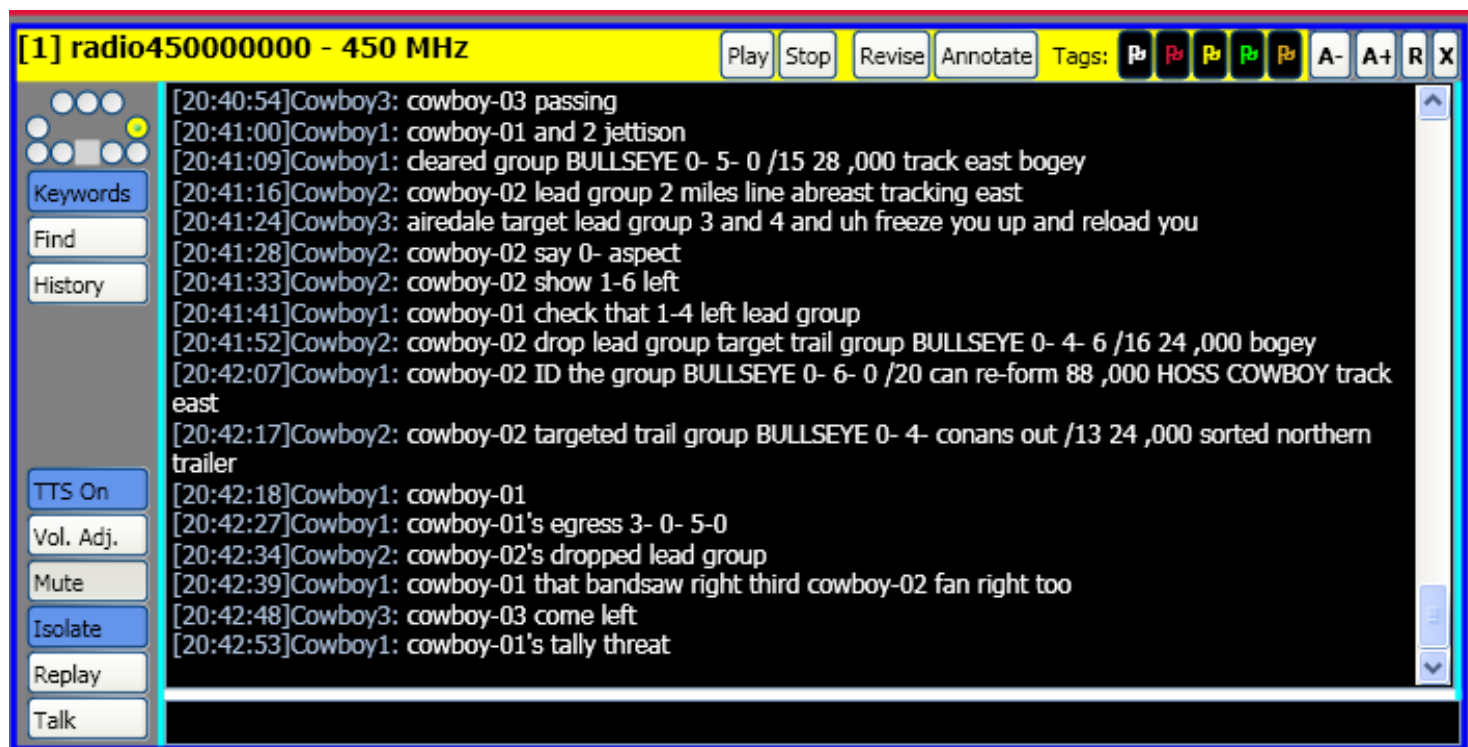




Capture and Display of Radio Messages



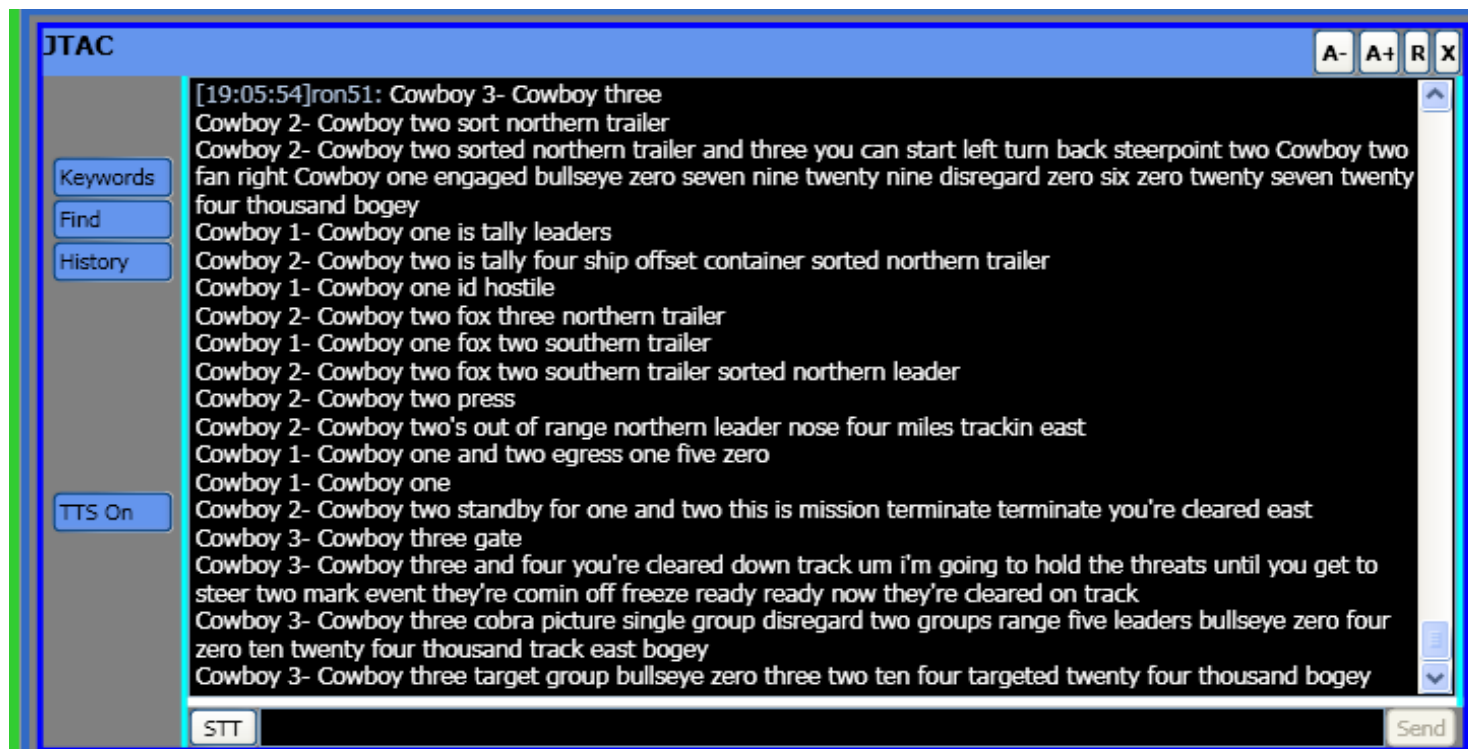
- Real-time speech-to-text transcription of radio messages
- Audio files are recorded and linked to transcription
 - Messages can be replayed in faster than real time
- Messages are timestamp





Text-Chat

- Sends and receives Chat messages
- Chat input via typing or speech-to-text (STT)
- Chat messages can be heard with text-to-speech (TTS)





Edit / Annotate Messages



- ASR is not 100% accurate
- Messages can be edited to reflect the correct information
- Text can be formatted to user's preference
- Ability to copy and paste
- Operators can leave notes to themselves for later review or debriefings

The screenshot displays two windows of a radio communication interface. The top window is titled 'radio450000000 - 450 MHz' and the bottom window is titled 'radio350000000 - 350 MHz'. Both windows have a toolbar with buttons: Play, Stop, Revise, Annotate, and a set of colored buttons (P, B, G, R, A, A+, R, X). Below the toolbar is a list of messages with timestamps and speaker identifiers. The messages are as follows:

radio450000000 - 450 MHz

- [17:12:13]Cowboy1: CONAN trail group BULLSEYE 0- 4- 0 /11 can target 0- 5- 0 /12 conan-04 ,000 track east bogey
- (R)[17:12:17]Cowboy3: cowboy-01 and 2
- [17:12:28]Cowboy2: cowboy-02 say aspect of the lead group track 0- 7- 0-1 and 2-1 conan-03's up and reload ship
- (R)[17:12:36]Cowboy3: cowboy-03 drop lead group gimbal airedale target
 - 1. cowboy-02 drop lead group gimbal airedale target
 - 0. cowboy-03 drop lead group gimbal airedale target
- [17:12:45]Cowboy3: cowboy-03 target trail group now BULLSEYE 0- 5- 5 /28 4 ,000
- cowboy-03 target trail group now BULLSEYE 0- 5- 5 /28 4 ,000
- [17:12:51]Cowboy1: cowboy-01 sorted northern trailer
- [17:13:02]Cowboy3: can a all target group BULLSEYE 0- 6- 5 /28 28 ,000
- [17:13:18]Cowboy3: cowboy-01 and 2 crackle
- [17:13:18]Cowboy1: cowboy-03's 10 miles power hud

radio350000000 - 350 MHz

- [17:14:59]: This room is not anonymous.
- [17:11:07]Rambo1 and 2: cowboy-01 in-place 90 left reference 2- 5- 5 BARNYARD bogey dope
- [17:11:18]Barnyard: CONAN 01 as group BRAA 2- 5- 5 /33 static out of 10 ,000 hostile heavy 4 contacts
- [17:11:25]Rambo1 and 2: rambos push
- (A)[17:11:27]Barnyard: BARNYARD
- [17:11:55]Barnyard: counter are 3- group champagne 15 wide 8 deep weighted south north lead group BULLSEYE 0- 5- 4 /36 32 ,000 spades heavy 4 contacts line abreast 3 cowboy-03 group 27 ,000 hostile heavy 4 contacts line abreast 5 trail group 10 ,000 hostile 2 contacts
- [17:12:03]Rambo1 and 2: rambo-02 group BULLSEYE 0- 5- 6 /38 36 ,000 hostile
- [17:12:13]Barnyard: cowboy-02 locked north lead group hostile heavy 4 contacts
- [17:12:20]Rambo1 and 2: rambos float skate
- [17:12:24]Rambo3 and 4: RAMBO 0- 4- strobes south lead group
- [17:12:33]Rambo1 and 2: cowboy-02 45 miles north lead group BULLSEYE 0- 5- 8 /42 36 ,000 hostile
- [17:12:41]Rambo1 and 2: rambo-02 45 miles north lead group BULLSEYE 0- 5- 8 /42 36 ,000



Accessing Information



- 'Find' function allows operators to search for specific words or phrases
- Flag lines of communication for easy retrieval
- 'History' goes to particular times

The screenshot displays a radio communication interface with two windows. The top window, titled "[3] radio300000000 - 300 MHz", shows a list of communication logs. The bottom window, titled "[12] radio450000000 - 450 MHz", shows a similar list. The interface includes a top bar with tabs for JTAC, Tanker, AWACS, and Fighters. A search bar is located at the top of each window. The communication logs are displayed in a list format, with each entry starting with a timestamp and a call sign. Red arrows point from the text on the left to specific features: the 'Find' button, a line of communication, and the 'History' button.

Window [3] radio300000000 - 300 MHz:

- [20:28:58]Eagle3: eagle-03's 10 miles
- [20:29:08]Eagle3: eagle-03's engaged BULLSEYE 0- 6- 0 /22 24 ,000 tally 4-4 tally 4
- [20:29:17]Eagle3: eagle-03 ID hostile hostile fox 2- northern trailer fox 2- southern trailer
- [20:29:21]Eagle1: eagle-01 and 2 hook left 04 sorted BRAA northern leader
- [20:29:27]Eagle3: eagle-03 let's off flow out 0- 9- 0
- [20:29:53]Eagle1: eagle-01 and 2 reference those 2- 5- 0 /2 go ahead nah float it ,000 02 hold about 2- 0- 8 /10
- [20:29:57]Eagle1: eagle-01 2 ship below a yeah that
- [20:30:04]Eagle1: conans /31 80 in the north eagle-01
- [20:30:09]Eagle1: eagle-01 and 2 gate
- [20:30:13]Eagle1: eagle-01 and 2 you're cleared down track
- [20:30:25]Eagle1: eagle-01 cobra CONAN picture's 2 groups range 12 leaders green BULLSEYE 0- 0- 3- 0 /10 28 ,000
- [20:30:33]Eagle1: eagle-01 trailers BULLSEYE 0- 3- 0 /1 5 /8 24 ,000 track east bogey
- [20:30:40]Eagle2: eagle-02 hits lead group 0- 3- 5 /12 20 ,000
- [20:30:41]Eagle1: eagle-01
- [20:30:47]Eagle1: eagle-01 and 2 offset 2- 9- 0

Window [12] radio450000000 - 450 MHz:

- [20:34:11]Cowboy2: cowboy-02 lead group 2 miles line abreast tracking east
- [20:34:18]Cowboy3: airedale target lead group 3 and 4 and uh freeze you up and reload you
- [20:34:22]Cowboy2: cowboy-02 say 0- aspect
- [20:34:27]Cowboy2: cowboy-02 show 1-6 left
- [20:34:35]Cowboy1: cowboy-01 check that 1-4 left lead group
- [20:34:46]Cowboy2: cowboy-02 drop lead group target trail group BULLSEYE 0- 4- 6 /16 24 ,000 bogey
- [20:35:01]Cowboy1: cowboy-02 ID the group BULLSEYE 0- 6- 0 /20 can re-form 88 ,000 HOSS COWBOY track east
- [20:35:10]Cowboy2: cowboy-02 targeted trail group BULLSEYE 0- 4- conans out /13 24 ,000 sorted northern trailer
- [20:35:12]Cowboy1: cowboy-01
- [20:35:21]Cowboy1: cowboy-01's egress 3- 0- 5-0
- [20:35:24]Cowboy2: cowboy-02's dropped lead group
- [20:35:34]Cowboy1: cowboy-01 that bandsaw right third cowboy-02 fan right too
- [20:35:42]Cowboy3: cowboy-03 come left
- [20:35:47]Cowboy1: cowboy-01's tally threat
- [20:35:51]Cowboy2: cowboy-02's tally 2 ship trail group
- [20:35:58]Cowboy1: cowboy-01 hostile hostile
- [20:36:02]Cowboy2: cowboy-02 fox-3 northern trailer
- [20:36:14]Cowboy1: cowboy-01 fox-2 southern trailer cowboy-03 0 /32 egress 1 2- 0-



Keyword

- User defined keywords are highlighted
- Counts number of messages since channel was last visited

[18] radio300000000 - 300 MHz

Keywords
Find
History

TTS On
Vol. Adj.
Mute
Isolate
Replay
Talk

[20:34:36]Eagle3: eagle-01 and 2 gate
[20:34:45]Eagle2: eagle-02 say aspect of the lead group track 0- 7- 0 want bandsaw 2 untargeted 0 02
[20:34:53]Eagle3: hud eagle-03 drop lead group gimbal cobra uh target
[20:35:03]Eagle3: eagle-03 target trail group now **BULLSEYE** 0- 5- 5 /28 24 ,000
[20:35:06]Eagle1: eagle-01 sorted northern trailer
[20:35:16]Eagle3: cobra targeted lead group **BULLSEYE** 0- 6- 5 /28 28 ,000 track east bogey
[20:35:21]Eagle3: eagle-01 and 2 shackle
[20:35:27]Eagle1: eagle-03's 10 miles power hud 30
[20:35:38]Eagle3: eagle-03's engaged **BULLSEYE** 0- 6- 2 /25 24 ,000 tally 2-4 tally 2
[20:35:41]Eagle1: eagle-01 and 2 cross turn
[20:35:47]Eagle3: eagle-03's ID hostile hostile
[20:35:52]Eagle2: eagle-02 fox-2 northern trailer
[20:35:58]Eagle3: eagle-03 fox southern trailer
[20:36:04]Eagle3: eagle-03's out east below 20
[20:36:12]Eagle3: eagle-03 this is mission terminate you're cleared out east
[20:36:15]Eagle1: eagle-01's ready
[20:36:19]Eagle1: eagle-01 you're cleared on track
[20:36:31]Eagle1: can 01 cobra-03 target 2- groups 0 /10 15 north group **BULLSEYE** 0- 1- 0 /15 22 ,000 track east bogey
[20:36:42]Eagle3: eagle-01 and 2 offset 2- 9- 0 south group **BULLSEYE** 0- 7- 5 /7 28 ,000 track east bogey



Multi-Modal Communication



Questions?

Victor S. Finomore

937-904-7123

victor.finomore@wpafb.af.mil