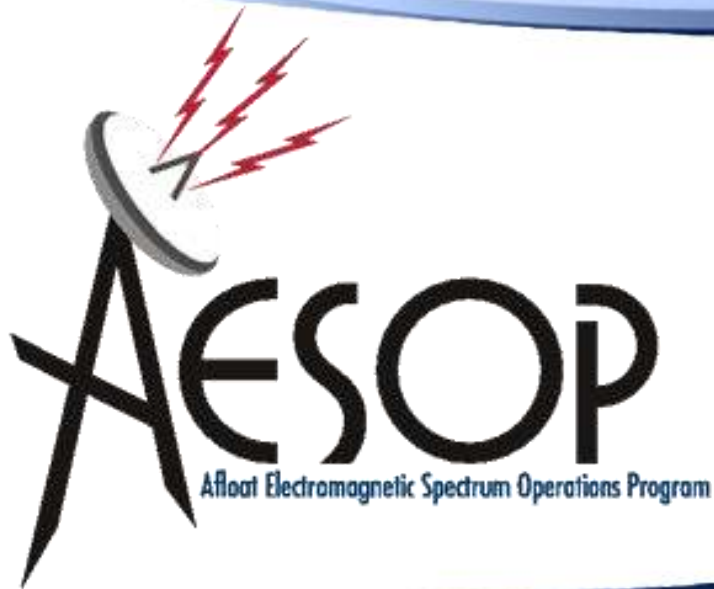


AESOP 3.0 Highlights

Afloat Electromagnetic Spectrum Operations Program



Ken Fewell
SENTEL Corp
901-275-0739

Distribution statement A: Approved for public release;
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aesop@navy.mil
aesop@navy.smil.mil
<http://cni.phdnswc.navy.smil.mil/aesop/>

Report Documentation Page

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What is it?

A Comprehensive Integrated Afloat Spectrum Planning Tool

- ✓ Radar and Combat System Frequency Planning
- ✓ Communications Planning
- ✓ Minimizes EMI Among ALL Afloat Emitters
- ✓ Automated Information Flow of Spectrum Planning
- ✓ Automated Frequency Assignment Generation
- ✓ Analysis of EMI Involving SG and Shore Based Emitters
- ✓ Complete Deployment Frequency Plans and Operational Guidance
- ✓ Compliant with Navy Certification and Messaging Standards
- ✓ Version 2.1 delivered in October 2008

*Mandated by ALCOM 33/05,
ALSECONDFLT 18/04 / ALTHIRDFLT 06/04*

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Spectrum Planning Tools

AESOP Team

Update!
Check the SIPR website for updates to the Database, OP-3840 Appendix F, and Standing Plans.

AESOP Software



Spectrum Planning Guide



OP-3840 Technical Manual and Appendix F



AESOP Info Sheet



Ship Card



SIPR Web Site Resource Updates



Restrictions & References

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AESOP 3.0 New Features

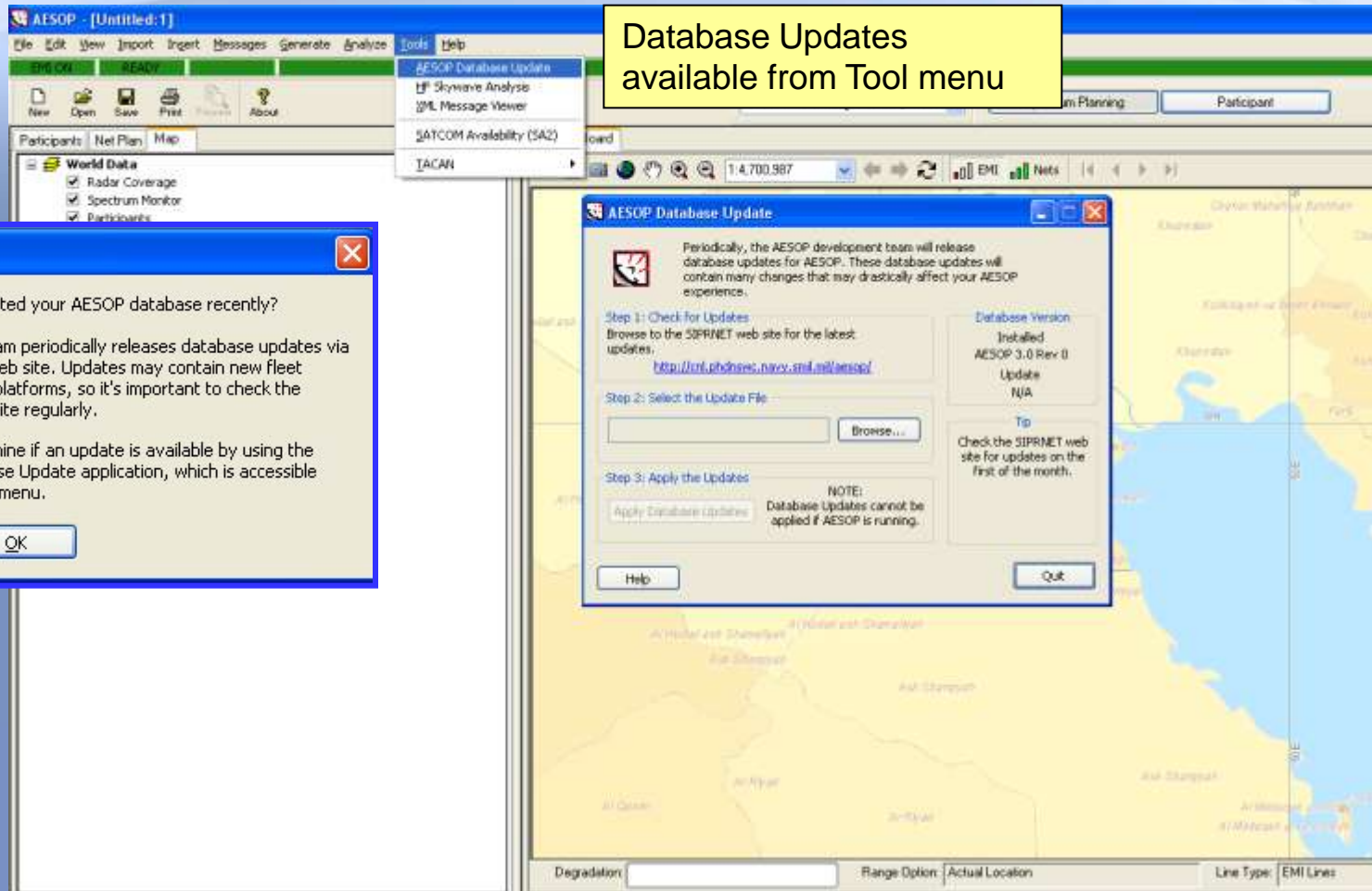


Afloat Electromagnetic Spectrum Operations Program

- ✓ **Database Update Tool**
- ✓ **Positions of Intended Movement (PIMs)**
- ✓ **Joint Restricted Frequency List (JRFL)**
MCEB Pub 8, Version 2.0.1 (1 July 2010); Tactical Information - JRFL
- ✓ **Enhanced Mapping Capability**
2-D and 3-D maps with Digital Terrain Elevation Data (DTED)
- ✓ **Enhanced Radar Coverage Plots**
- ✓ **Comm Link and Net Connectivity Analysis**
- ✓ **Net View and Planning Board Graphics Enhancements**
- ✓ **Database Updates** (Radar & Comm Equipment, Fourth Fleet AOR, CREW devices, Trucks, Manpacks, and UAVs)
- ✓ **Expanded Net Restoral Plan**
- ✓ **Updated Standing Communications Plans** (Commercial Broadband Satellite Program (CBSP) usage and SATCOM downlink, uplink, and rider usage, emission designator encrypted/unencrypted info)
- ✓ **TACAN Scheduler**

AESOP 3.0 Spectrum Planning Component

AESOP 3.0 prompts the user to check the SIPR website for database updates

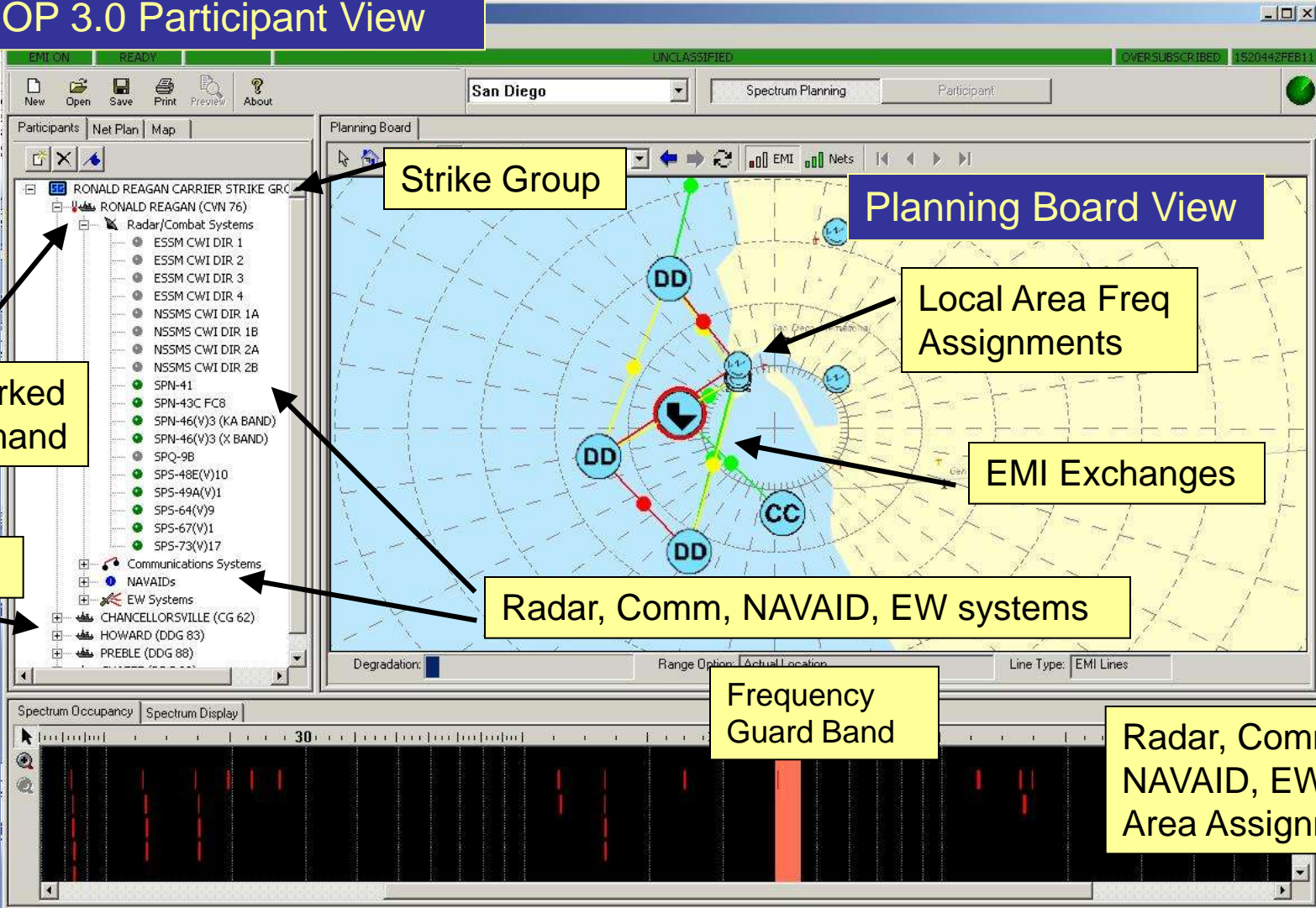


The screenshot shows the AESOP 3.0 Spectrum Planning Component interface. The 'Tools' menu is open, highlighting 'AESOP Database Update'. A yellow callout box points to this menu item with the text 'Database Updates available from Tool menu'. Two dialog boxes are overlaid on the interface:

- Database Updates (Left):** A dialog box with a hand icon asking 'Have you updated your AESOP database recently?'. It explains that updates are released periodically via the SIPRNET website and provides instructions on how to check for updates. It includes a 'Don't show this again' checkbox and an 'OK' button.
- AESOP Database Update (Right):** A detailed dialog box with a hand icon. It contains the following text:
 - Periodically, the AESOP development team will release database updates for AESOP. These database updates will contain many changes that may drastically affect your AESOP experience.
 - Step 1: Check for Updates:** Browse to the SIPRNET web site for the latest updates. <http://net.phdswes.navy.mil/aesop/>
 - Step 2: Select the Update File:** A text field and a 'Browse...' button.
 - Step 3: Apply the Updates:** An 'Apply Database updates' button.
 - Database Version:** Installed AESOP 3.0 Rev 0, Update N/A.
 - Tip:** Check the SIPRNET web site for updates on the first of the month.
 - NOTE:** Database Updates cannot be applied if AESOP is running.
 - Buttons for 'Help' and 'Quit'.

AESOP 3.0 Spectrum Planning Component

AESOP 3.0 Participant View



Embarked Command

Ship

Strike Group

Planning Board View

Local Area Freq Assignments

EMI Exchanges

Radar, Comm, NAVAID, EW systems

Frequency Guard Band

Radar, Comm, NAVAID, EW, Local Area Assignments

AESOP 3.0 Spectrum Occupancy View with International Taboo List Frequencies

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AESOP 3.0 Spectrum Planning Component

AESOP 3.0 Map View – Select layers and features

The screenshot displays the AESOP 3.0 Spectrum Planning Component interface. The main window is titled "Gulf of Oman" and "Spectrum Planning". On the left, a "Globe layers" panel lists various map features, including "Radar Coverage", "Spectrum Monitor", "Participants", "Local Area Frequency Assignments", "EMI/Net Lines", "Positions of Intended Movement", "Tracklines", "Maneuvering Board", "National Capitals (1 million and over)", "National Capitals (250,000 to 1 million)", "National Capitals (50,000 to 250,000)", "National Capitals (Under 50,000)", "Non-Capitals over 250,000", "Non-Capitals under 250,000", "Airports Gazetteer", "Landsong", "State-Prov Boundaries", "Country Boundaries", "Continental Boundaries", "World Region Boundaries", "Rivers", "Arabian_Gulf_CADRIG_100", "Arabian_Gulf_CBI10", "World_HIRShade_1 (Raster)", "World_DTED_1 (Raster)", "Numbered Fleet Anno", "Numbered Fleet Boundaries", "Lakes", "Terrestrial Biomes", "Marine Biomes", "Continental Areas", "WorldDTED", "World_DTED_1 (Elevation)", and "Flooding Group Layer (empty)".

The main map area shows a 3-D view of the Gulf of Oman with terrain. Several ship icons are visible, including "USS MOMSEN DD", "USS ABRAHAM LINCOLN DD", "USS SHOUH DD", "LAMPB III", "USS COURTS TF", "USS MORILE BAY CC", and "USS RUSSELL DD". A "HAWKEYE" icon is also present. A red circle highlights a specific location on the map. A yellow line connects the USS COURTS TF icon to the USS MORILE BAY CC icon. A green line connects the USS MORILE BAY CC icon to the USS ABRAHAM LINCOLN DD icon. A blue line connects the USS ABRAHAM LINCOLN DD icon to the USS MOMSEN DD icon.

At the bottom of the map, there are controls for "Degradation", "Range Options", "Actual Location", "Line Type", and "EMI Lines". Below the map, there is a "Spectrum Occupancy" and "Spectrum Display" section with a frequency axis ranging from 0 to 100 MHz. The Windows taskbar at the bottom shows the start button and several open applications: "Job - Microsoft Out...", "Microsoft PowerPoint...", "SAZ", "AESOP", "aesop30 objv.tmp - P...", "AESOP - (L)PCOLN C...", and the system clock shows "3:55 PM".

Planning Board View

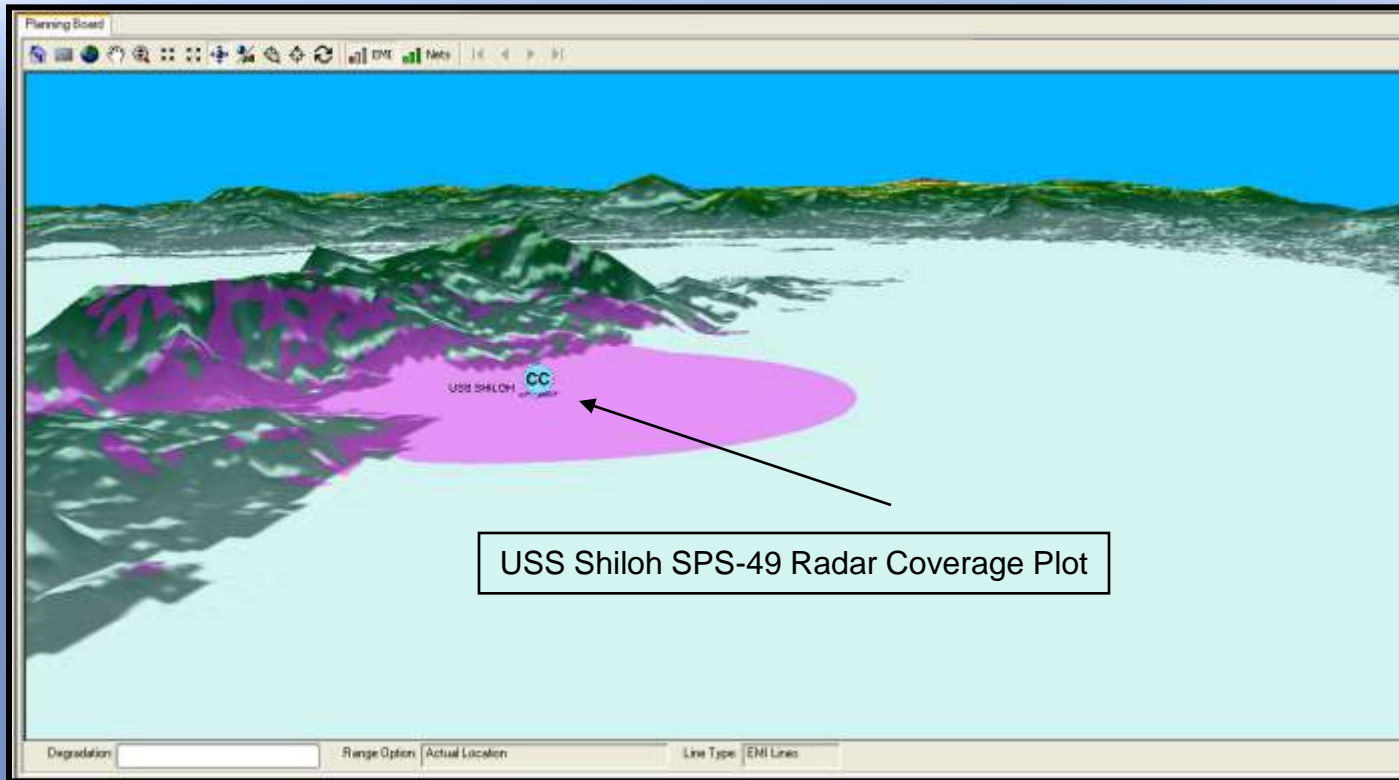
3-D Map View with Terrain

AESOP 3.0 Spectrum Planning Component

Map View

AESOP 3.0 Draped Radar Coverage Plot using
Advanced Propagation Model (APM) and DTED data

Planning Board View



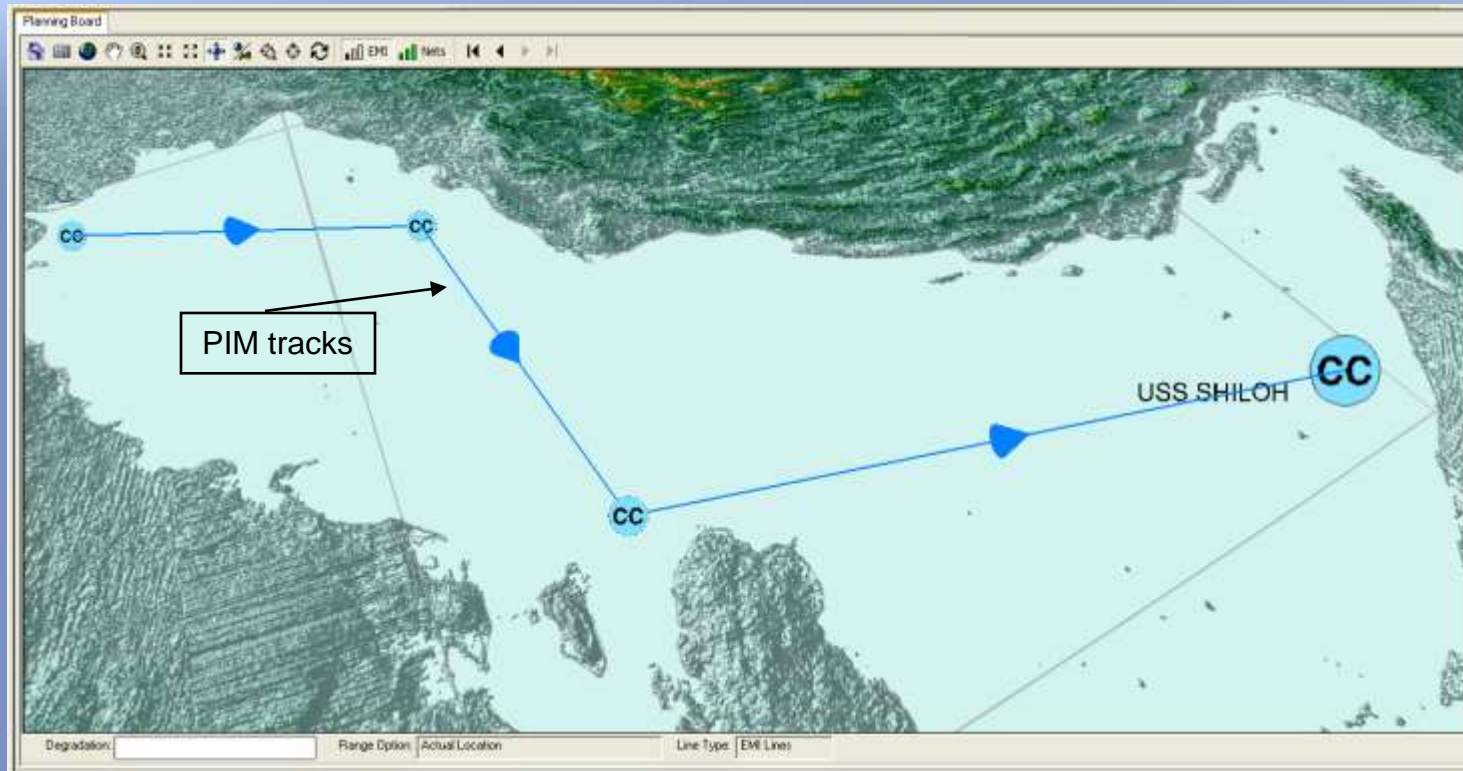
USS Shiloh SPS-49 Radar Coverage Plot

3-D Map View with Terrain

AESOP 3.0 Spectrum Planning Component

AESOP 3.0 Position of Intended Movement (PIM) Tracks

Planning Board View



3-D Map View with Terrain

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AESOP 3.0 Spectrum Planning Component

AESOP 3.0 Nets View Indicators

The screenshot displays the AESOP 3.0 interface with the following components:

- Participants Table:** A table listing various communication nets with columns for Line No, Circuit Title, Emission, Lower Range, Upper Range, Frequency, Guard Keys, and Type.
- Planning Board View:** A map of the Gulf of Mexico region showing a network of nodes (DD, FF, CC) connected by lines, representing net connectivity.
- Spectrum Display View:** A graph showing Cumulative PSD (dB) vs Frequency (MHz) with a highlighted guard band.

Line No	Circuit Title	Emission	Lower Range	Upper Range	Frequency	Guard Keys	Type
A5339B	SC HELO CNTR...	25K0A1E	225 MHz	400 MHz	286.6 MHz	G	ANTI-SUBMARINE
A5339C	SC HELO CNTR...	25K0A1E	225 MHz	400 MHz	337.55 MHz	G	ANTI-SUBMARINE
A5341	ASW CBR UHF (P)	25K0A1E	225 MHz	400 MHz	341.575 MHz	G	ANTI-SUBMARINE
A5342	ASW CBR HF (S)	2K8032E	2000 kHz	30 MHz	12179.4 kHz (L...	G	ANTI-SUBMARINE
NG376A	NGF GRND 1P	2K8033E	2000 kHz	30 MHz	5125.9 kHz (51...	G	NAVAL GUNFIRE
NG376B	NGF GRND 1S	2K8033E	2000 kHz	30 MHz	2144 kHz (2142.6)	G	NAVAL GUNFIRE
NG377A	NGF AIR SPOT 1	25K0A1E	225 MHz	400 MHz	289.45 MHz	G	NAVAL GUNFIRE
NG377B	NGF AIR SPOT 2	25K0P2E	30 MHz	88 MHz	NET ID	G	NAVAL GUNFIRE
A4406A	ADC CBR (P)	2K8033E	2000 kHz	30 MHz	5990 kHz (5938.6)	G	ANTI-AIR WARF...
A4406B	ADC CBR (S)	2K8033E	2000 kHz	30 MHz	15509.1 kHz (1...	G	ANTI-AIR WARF...
A0461	VERTREP HELO...	6K00A3E	225 MHz	400 MHz	291.9 MHz	G	AIR OPERATIONS
A0458A	HOMER	2K04A2A	225 MHz	400 MHz	344.775 MHz	G	AIR OPERATIONS
A0458B	HOMER	2K04A2A	225 MHz	400 MHz	236.2 MHz	G	AIR OPERATIONS
A0458C	HOMER	2K04A2A	225 MHz	400 MHz	239.4 MHz	G	AIR OPERATIONS
A0458D	HOMER	2K04A2A	225 MHz	400 MHz	226.1 MHz	G	AIR OPERATIONS
A0458E	HOMER	2K04A2A	225 MHz	400 MHz	289.95 MHz	G	AIR OPERATIONS
A0458F	HOMER	2K04A2A	225 MHz	400 MHz	263.4 MHz	G	AIR OPERATIONS
A0458A	LAND-LAUNCH	6K00A3E	225 MHz	400 MHz	361.65 MHz	G	AIR OPERATIONS
A0459B	LAND-LAUNCH	6K00A3E	225 MHz	400 MHz	298.325 MHz	G	AIR OPERATIONS
A0459C	LAND-LAUNCH	6K00A3E	225 MHz	400 MHz	254.25 MHz	G	AIR OPERATIONS
A0459D	LAND-LAUNCH	6K00A3E	225 MHz	400 MHz	265.25 MHz	G	AIR OPERATIONS
A0459E	LAND-LAUNCH	6K00A3E	225 MHz	400 MHz	311.25 MHz	G	AIR OPERATIONS
A0460	CCA LAND-LAK...	6K00A3E	225 MHz	400 MHz	311.25 MHz	G	AIR OPERATIONS
A0464A	HD 1 UHF	25K0A1E	225 MHz	400 MHz	311.25 MHz	G	AIR OPERATIONS
A0464B	HD 2 UHF	6K00A3E	225 MHz	400 MHz	311.25 MHz	G	AIR OPERATIONS

Oversubscribed Comm Net and Net Connectivity Indicators

Planning Board View

Oversubscribed Comm Net Indicator

Spectrum Monitor

Net Connectivity Lines for Selected Net

Spectrum Display View

Frequency Guard Band

AESOP 3.0 Spectrum Planning Component

AESOP 3.0 Net View – Net and Link Analysis

The screenshot displays the AESOP 3.0 Net View interface. The main window shows a map of the Gulf of Oman with various ship icons (CVN, DDG, etc.) and their connectivity. Two analysis windows are open:

FP185B Link Connectivity between CVN 72 and DDG 59

Platform	Transmitter	Platform	Receiver	Link Margin (dB)
CVN 72	SFC 54 NO. 2	DDG 59	VRC 46 NO. 2	5.784
DDG 59	VRC 46 NO. 2	CVN 72	SFC 54 NO. 2	4.194

Link Details: This link is not affected by EMI. Link distance is 52.308 nmi.
Power/Sensitivity Details: Received power: -112.257 dBm, Receiver sensitivity: -118.041 dBm.

FP185B Net Connectivity

Net Summary

Worst link status: ■ Good links: 2

Oversubscribed platforms: ■ Fat links: 7

■ Poor links: 3

The systems below are being used to guard the selected Net. The predicted level of net connectivity (good, fair or poor) is indicated by the color at the left.

Green indicates good (link margin of 10 dB or more)
Yellow is fair (link margin between 0 and 10 dB)
Red is poor (link margin of 0 dB or less)

Platform	Transmitter	Platform	Receiver	Link Margin (dB)
CVN 72	SFC 54 NO. 2	DDG 92	RT-1747 NO. 6	0.549
CVN 72	SFC 54 NO. 2	DDG 99	VRC 46 NO. 2	5.784
CVN 72	SFC 54 NO. 2	DDG 96	RT-1747 NO. 4	-3.099
DDG 59	VRC 46 NO. 2	CVN 72	SFC 54 NO. 2	4.194
DDG 59	VRC 46 NO. 2	DDG 92	RT-1747 NO. 6	-0.200
DDG 59	VRC 46 NO. 2	DDG 96	RT-1747 NO. 4	-3.362

Link Details: This link is not affected by EMI. Link distance is 46.775 nmi.
Power/Sensitivity Details: Received power: -107.451 dBm, Receiver sensitivity: -100.000 dBm.

FP 158 Link Connectivity Analysis between CVN and DDG

FP 158 Net Connectivity Analysis for all ships guarding the net

AESOP 3.0 Spectrum Planning Component

AESOP 3.0 Net View – TACAN Scheduler

The screenshot displays the AESOP 3.0 TACAN Scheduler interface. The main window shows a map of the LANTFLT region with various TACAN assignments. Overlaid windows include:

- Participants:** Lists various aircraft carriers and support ships, including the ABRAHAM LINCOLN CARRIER STRIKE GROUP.
- TACAN Assignments:** A table listing platform names, numbers, TACAN IDs, channels, start/end dates, and OPAREAs.
- System Restrictions:** A window showing TACAN system restrictions for a specific location (LANTFLT) and channel, with a table of restricted channels.
- TACAN OPAREAs:** A window showing a list of OPAREAs for selection.
- ABRAHAM LINCOLN (CVN 72) Configuration:** A window for configuring the TACAN location and range for the Abraham Lincoln.

TACAN Assignments

LANT TACAN Restrictions

TACAN OPAREAs

AESOP 3.0 Common Operational Spectrum Report



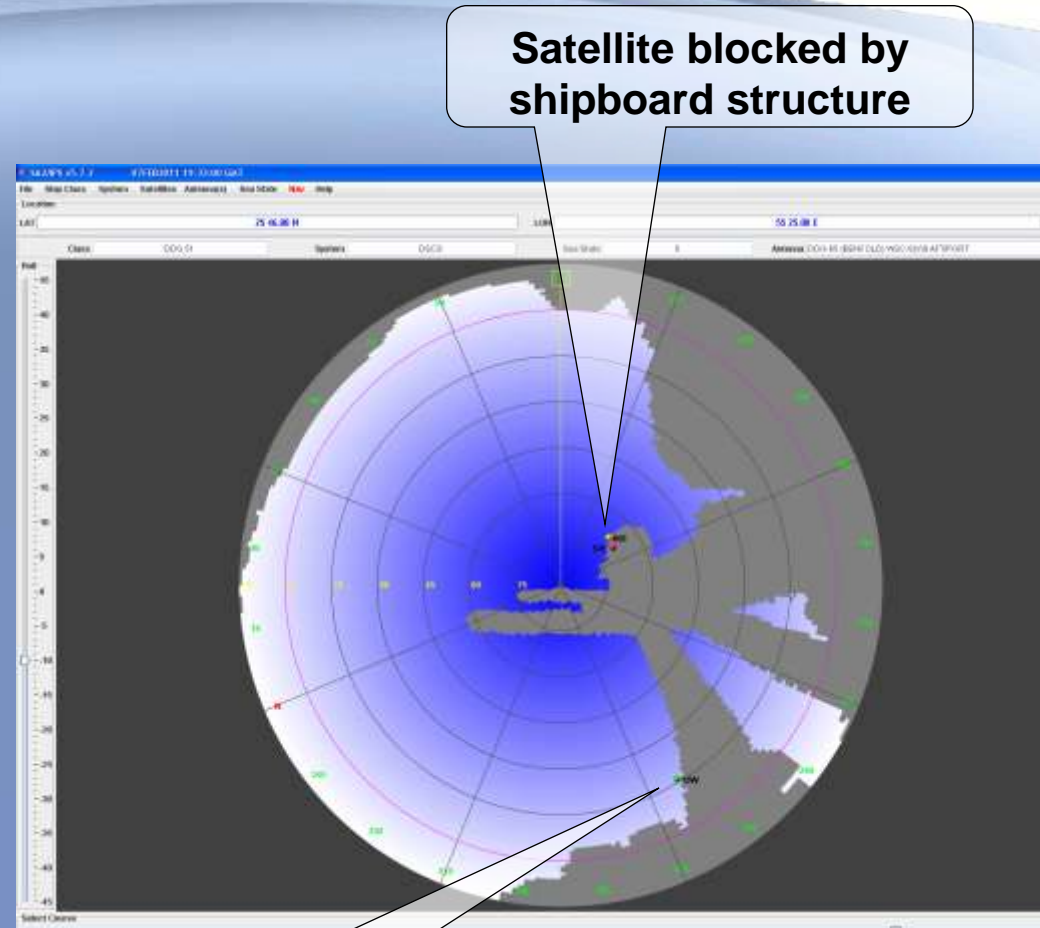
AESOP 3.0 includes Joint Restricted Frequency List (JRFL) frequencies

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Protection Code	Priority	Identifier	Description	Frequency	Status	Justification	Type			
NAVY JRFL FREQUENCIES										
Taboo	A1	LP157	BTB CHNL-13	156.65 MHz	Approved	International Taboo	Frequency List	Net		
Taboo	A1	LP158	BTB CHNL-16	156.8 MHz	Approved	International Taboo	Frequency List	Net		
Taboo	A1	ED651	INT DISTRESS-CALLING	2183.4 kHz (2182)	Approved	International Taboo	Frequency List	Net		
Taboo	A1	ED653	INTL AIR DISTRESS	121.5 MHz	Approved	International Taboo	Frequency List	Net		
Taboo	A1	ED654	MIL AIR DISTRESS	243 MHz	Approved	International Taboo	Frequency List	Net		
JOINT JRFL FREQUENCIES										
Taboo	A1		GMDSS/MET AND NAV WARNINGS	490 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/NAVTEX/MET AND NAV WARNINGS	518 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	2176 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTERNATIONAL DISTRESS	2183.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	2189 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTERNATIONAL SAR	3024.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	4126.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	4179 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	4209 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL MARITIME NAV SAFETY	4211.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/NAVTEX MET AND NAV WARNINGS	4211.5 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTERNATIONAL SAR	5681.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTERNATIONAL DISTRESS SAFETY	6216.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	6269.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	6313.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL MARITIME SAFETY/GMDSS	6316 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	8292.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL SAR/SURVIVAL CRAFT	8364 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	8378 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	8416 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/INTL MARITIME SAFETY	8418.5 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	12291.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	12521.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	12578.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/INTL NAVIGATION SAFETY	12581 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	16421.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	16696.4 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/SAFETY	16806 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/INTL MARITIME SAFETY	16808.5 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/INTL MARITIME SAFETY	19682.5 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/INTL MARITIME SAFETY	22378 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		GMDSS/INTL MARITIME SAFETY	26102.5 kHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/AERONAUTICAL EMERGENCY	121.5 MHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL DISTRESS/AERONAUTICAL EMERGENCY	123.1 MHz	Approved	International Taboo	Frequency List	ITFL		
Taboo	A1		INTL SHIP/AIRCRAFT SAR	156.3 MHz	Approved	International Taboo	Frequency List	ITFL		

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Satellite Availability & Analysis (SA2)

- ✓ AESOP 3.0 – SA2 v5.7.2
- ✓ Software application – situational awareness for SATCOM operators
- ✓ Shows locations of satellites
- ✓ Shows relation of satellites to shipboard structures (masts, cranes, deckhouses, and other antennas)
- ✓ Shows Line Of Sight (LOS) blockage

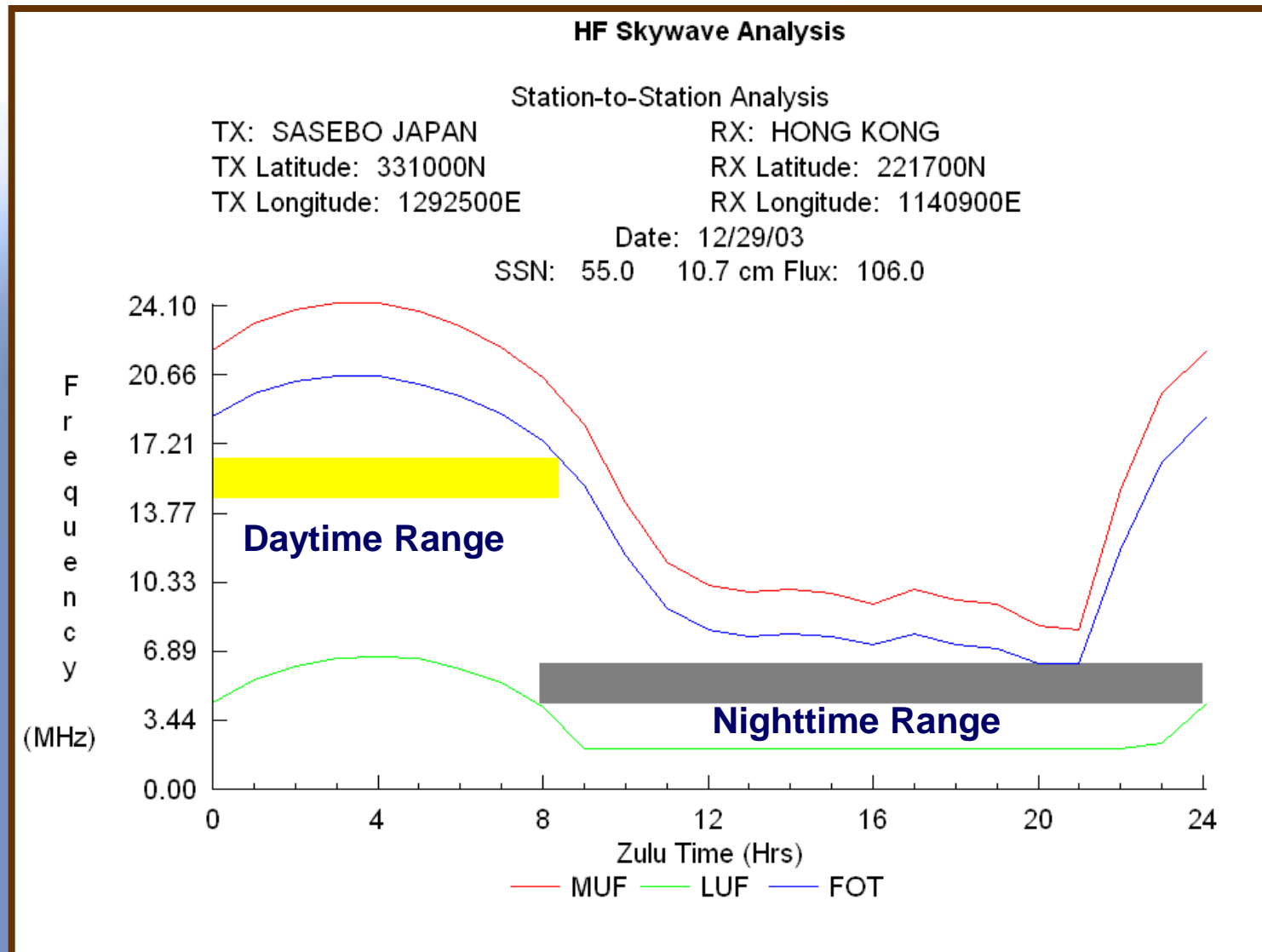


Satellite blocked by shipboard structure

Satellite free from blockage

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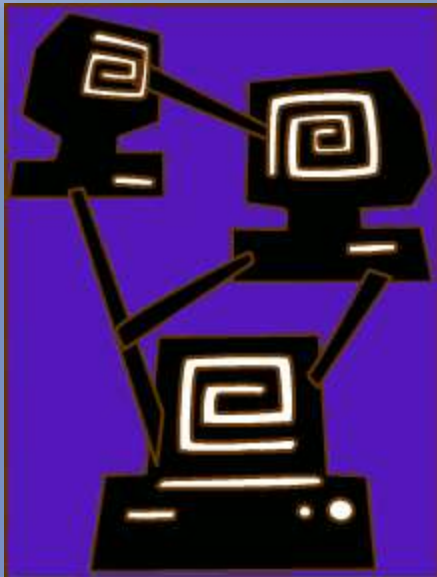
HF Skywave Analysis



SFAF and SSRF

Standard Frequency Action Format (SFAF)

Standard Spectrum Resource Format (SSRF)



- ✓ Joint Interoperability Requirement
- ✓ MCEB Pub 7 (SFAF)
- ✓ MCEB Pub 8 (SSRF)
 - Version 2.0.1 (1 July 2010)
 - Tactical Information - JRFL
- ✓ Standard for DoD Import and Export of Frequency Management Information
 - Government, Civilian, Other DoD Systems
 - Area Frequency Coordinator (AFC)
 - Joint Task Force Commander

AESOP 3.0 Outputs

Messages

- Communications Planning:
 - Frequency Request
 - OPTASK COMM Plan
(XML or GENADMIN)
- Radar Planning:
 - Request
 - Assignment
- Participant:
 - Reply (XML or GENADMIN)
- **TACAN Assignment and Periodic**
(SFAF or GENADMIN)
- **JRFL Message (XML – MCEB PUB 8)**

Graphical Displays

- Planning Board View – EMI and Net Connectivity
- Spectrum Occupancy View
- Spectrum Display
- Radar Coverage Plot
- HF SkyWave Analysis
- SA2

Reports

- **Common Operational Spectrum**
- Assignments
- Comm Nets
- Electromagnetic Environment
- EMI Victims & Interactions
- Engineering Analysis
- Guard Requirements
- IMI Analysis
- Inventory
- Net Prioritization
- Participants
- Phase
- Platform Equipment Inventory
- Platform Position
- Restriction
- Radar and Comm Plans in SFAF
- Spectrum Use
- System Characteristics

Future Plans - AESOP 4.0

- ✓ MCEB Pub 8 XML Compliance.
 - 3.0 JRFL output already complies with Pub 8.
 - Current SFAF output will be available in Pub 8 format.
- ✓ Net-Centric Application.
 - Web-enabled, thick-client application.
 - Remotely-located database allowing collaboration.
 - Master AESOP database will be deployed ashore, accessible via SIPRNET.
 - AESOP's stand-alone capability will be retained for users without SIPRNET or with limited bandwidth capability.

More Future Plans - AESOP 4.0

- ✓ Improved Antenna Modeling
 - For improved analysis and visualization capabilities.
 - Users will be able to view and use 2D and 3D antenna pattern data from the database.
- ✓ System Operational Effectiveness Visualization
 - Enhanced radar coverage plots
 - The effects of EMI on target detection,
 - Show a multi-sensor coverage area,
 - Provide a 3D view of radar coverage.
 - Coverage plots for other systems types (communication, NAVAID, and EW) in the presence of EMI.
- ✓ Automated Spectrum Analyzer Interface
 - Interface with a spectrum analyzer
 - Observed signals will be displayed on AESOP's Spectrum Display
 - Will allow comparison of planned spectrum use to actual RF environment.

AESOP 3.0 Highlights

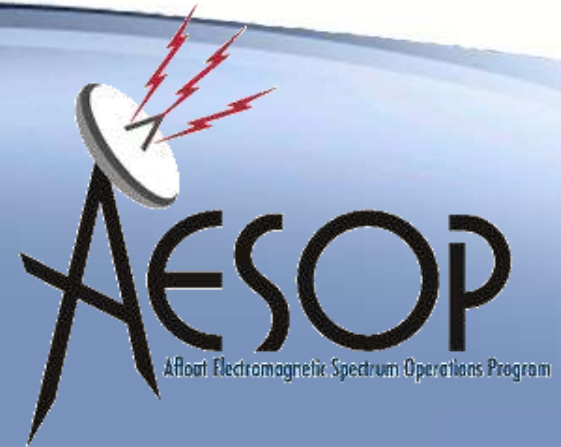


Questions?

Contact Info

Ken Fewell
SENTEL Corp
kfewell@sentel.com
or
aesop@sentel.com
kenneth.fewell.ctr@navy.smil.mil
901-275-0739

aesop@navy.mil
aesop@navy.smil.mil
<http://cni.phdnswc.navy.smil.mil/aesop/>



AESOP Version 2.1/3.0

- ✓ System Security Authorization Agreement (SSAA) and Authority To Operate (ATO), 14 APRIL 2009
- ✓ Department of Navy Application and Database Management System (DADMS)
 - 52038
- ✓ Navy-Marine Corps Intranet (NMCI)
 - RFS-106579
 - ISF-117477
- ✓ Information Technology for the 21st Century (IT-21)
 - PSC-2009-00076
- ✓ Naval Education and Training Command (NETC) Training Network (TRANET)
 - NETC_N00076_TRANET-C_S
 - NETC_N00076_TRANET_U
- ✓ OCONUS Navy Enterprise Network (ONE-NET)
 - Reference DADMS Number 52038 when calling the ONE-NET Help Desk for installation.

