

# Envisioning the Ether: The Battle Commander Spectrum Planner

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# Problem

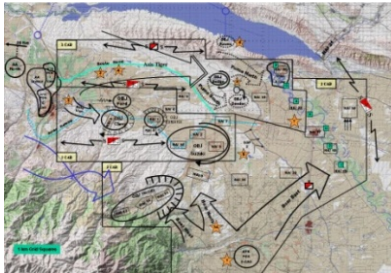


- **The amount of spectrum needed for most military operations is significantly higher than what is available today or projected for the future.**
- **In light of this, the ability to plan the most effective use of this spectrum is critical.**
- **Current spectrum management tools are inadequate. They do not allow a Commander to understand spectrum usage and its impact on network performance or intelligently assign spectrum within an area of operation.**

# Background

## Given

### *Mission*



### *Assets (Spectrum-Dependent Devices)*



### *Spectrum Assignments*

Waveform A	Waveform B	Waveform C
14-19.95 kHz	34-35 MHz	157.0375-157.1875 MHz
2.0-2.065 MHz	36-37 MHz	162.0375-157.1875 MHz
25.33-25.55 MHz	38.25-39 MHz	163.2625-166.2375 MHz
26.48-26.95 MHz	40-42 MHz	166.2625-169.4125 MHz
27.54-28.00 MHz	46.6-47 MHz	169.5375-170.1375 MHz
28.89-28.91 MHz	49.6-50 MHz	170.1625-170.2125 MHz
30-30.56 MHz	138-144 MHz	170.3375-170.4125 MHz
32-33 MHz	150.05-150.8 MHz	170.4375-170.4625 MHz

## Questions

- ❑ How should I configure the “network?”
- ❑ Where should I allocate spectrum within my “network?”
- ❑ What level of performance can I expect from the network given a specific allocation to networks/subnetworks?
- ❑ Does this meet my operational requirements? If not, how can I alter my “network” to meet them?
- ❑ How much spectrum will I use in a given course of action, and is it more than I am allocated?

# Objective



- **Develop a novel network assessment prototype tool – the Battle Commander Spectrum Planner (BCSP)**
- **Provide the ability for a network planner/operator to develop alternative Network Courses of Action and assess their performance for a given scenario**
- **Expose the tool to potential users and developers of spectrum management systems to solicit feedback and recommendations on tool utility and design**
- **Identify potential key technology transitions**
- **Support relevant analysis efforts with the tool**

# Activities



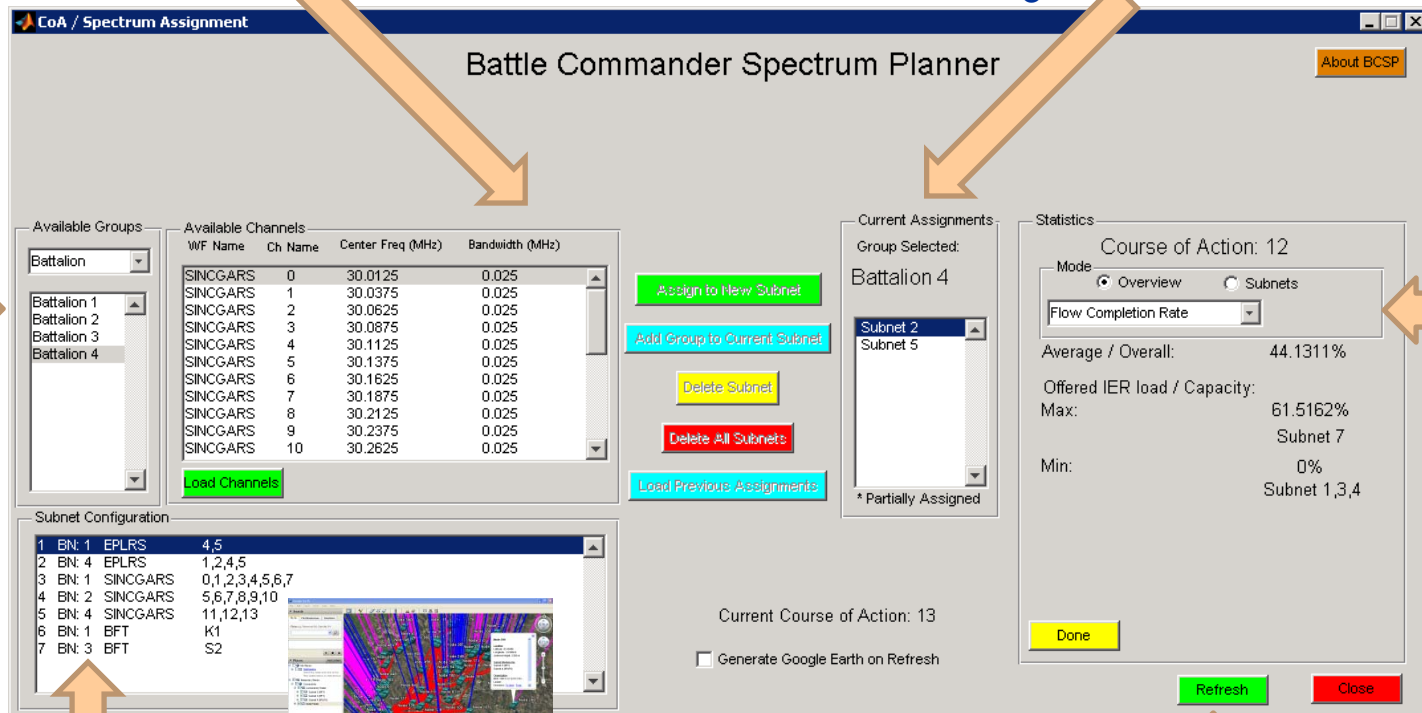
- **Mature the spectrum assignment Graphical User Interface (GUI) to allow user to assign network/subnetwork membership, assign channels, assign scenario specific**
- **Identify, implement, and refine the presentation of network performance metrics**
- **Discuss/demonstrate BCSP to stakeholders in the Spectrum Management community**
- **Evaluate for applicability in a Composable Capabilities On Demand (CCOD) framework**
- **Develop additional capabilities as feedback is received and other needs are identified**

# Highlight

## ■ The Spectrum Assignment GUI

Local spectrum authority provides  
whitelist of available frequencies  
based on relevant policy

Spectrum assignment of node  
groupings into reconfigurable  
subnets



**Battle Commander Spectrum Planner**

Available Groups:

- Battalion
- Battalion 1
- Battalion 2
- Battalion 3
- Battalion 4

Available Channels:

WF Name	Ch Name	Center Freq (MHz)	Bandwidth (MHz)
SINGGARS	0	30.0125	0.025
SINGGARS	1	30.0375	0.025
SINGGARS	2	30.0625	0.025
SINGGARS	3	30.0875	0.025
SINGGARS	4	30.1125	0.025
SINGGARS	5	30.1375	0.025
SINGGARS	6	30.1625	0.025
SINGGARS	7	30.1875	0.025
SINGGARS	8	30.2125	0.025
SINGGARS	9	30.2375	0.025
SINGGARS	10	30.2625	0.025

Subnet Configuration:

BN	Group	Channels
1	BN: 1 EPLRS	4,5
2	BN: 4 EPLRS	1,2,4,5
3	BN: 1 SINGGARS	0,1,2,3,4,5,6,7
4	BN: 2 SINGGARS	5,6,7,8,9,10
5	BN: 4 SINGGARS	11,12,13
6	BN: 1 BFT	K1
7	BN: 3 BFT	S2

Current Assignments:

Group Selected: Battalion 4

- Subnet 2
- Subnet 5

Statistics:

Course of Action: 12

Mode: Overview

Flow Completion Rate: [Dropdown]

Average / Overall: 44.1311%

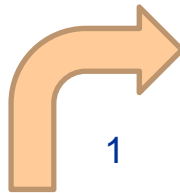
Offered IER load / Capacity: 61.5162%

Max: Subnet 7

Min: 0%

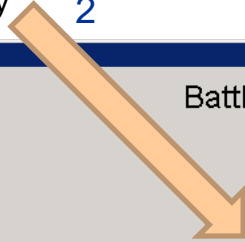
Subnet 1,3,4

Refresh Close

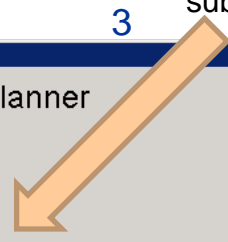


1

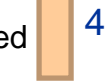
Rapid redistribution of network nodes by operational organization



2

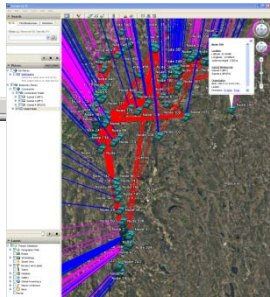


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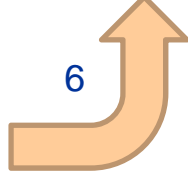
4

Google Earth-based visualization of network connectivity



5

Network focused assessment of potential spectrum assignments



6

Export of desired frequency assignments for approval by local spectrum authority

# Demonstration

## ■ BCSP prediction of network performance given specific spectrum assignments

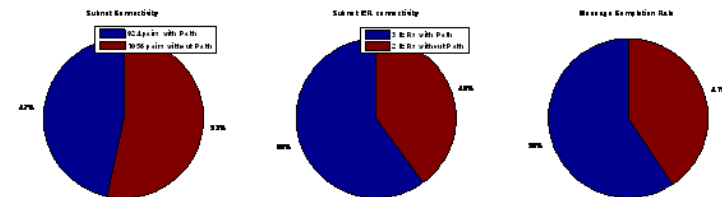
### Network Architecture Input

- Platform/Waveform/Channel Mappings
- Spectrum Assignments
- Tolerable Pathloss
- Burst Information Rates

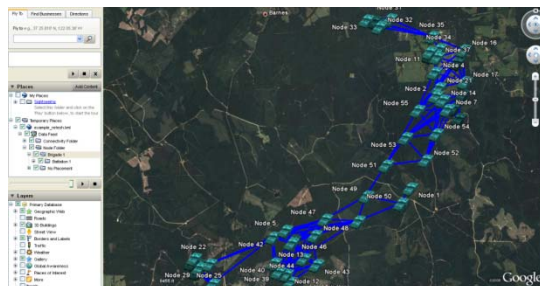
### Network Performance Output

- Subnet Connectivity
- IER Connectivity
- Message Completion Rate

### Initial Course of Action



### Course of Action Two



# Impacts



- **Enhanced Operations**
  - Provide expanded analytical capability by including network performance factors into existing spectrum deconfliction, assignment, and related processes
- **Analytic Tool**
  - Provide the ability to consider network performance in on-going MITRE and sponsor analysis efforts
- **Lessons Learned**
  - Explore the utility and acceptability of network performance estimation tools in spectrum management
    - At what echelons is the capability needed and appropriate?
    - What specific capabilities are needed or not needed?
    - What performance is needed (scalability, speed of results)?

# Future Plans



- **Continue to explore feedback from the operational user community**
- **Enhance Course of Action (COA) optimization capabilities**
- **Continue to use the tool in demonstrations and analytic studies**
- **A potential follow-on extension that should be considered is the applicability of this type of tool in future Dynamic Spectrum Access (DSA) development**