### Virtual Ground Station Mission Operations Center

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A new 3D interface paradigm

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#### **Overview:** Motivation and Concept



#### • Motivators:

- System development and Operations both must be more agile
- Expertise is geographically scattered and travel costs are increasing
- SOA and cloud architectures support real time distributed operations
- Is there value in a distributed ground ops center supporting remote users?
- How should a distributed operations center be represented?
- Concept:
  - Enable remote distributed ground operations centers using virtual world interface
  - Virtual world environment provides
    - Shared viewspace with virtual displays
    - Investigation of sightlines, view angles and perspective
    - Visual and audio proximity, audio nets for actual operations
    - Familiar environment for remote users

#### Virtual Ground Station (VGS)

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- A familiar space that provides a foundation for user experience
- Use the VGS space for system optimization, workflow development, training and mission rehearsals
- Extend to real world remote operations



Virtual Ground Station System Architecture

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- Server-client architecture Remote clients on Mission WAN



- Build a virtual 3D model of the ground station using virtual world tool
- Set up servers and clients on the selected Wide Area Network
  - Mission servers at the physical operations center or a computing center provide the functionality for the ground station
- Script-driven screen captures from the mission servers are stored to a web server
  - The virtual screens at the client side are updated at a rate determined by the client's network bandwidth
- Remote users with ground station roles use the client software to see a 3D virtual representation of the ground station on their screen
  - Each remote user typically also has one live screen representing the mission console function that he is assigned
  - Live screens are triggered by clicking on a virtual screen
  - Remote screen software or other remote protocol (e.g., web interface) provides the normal realtime interaction for the specific mission console

## Virtual Worlds Used Today for Training and Simulation



- Virtual Training System (VTS)
  - 18 courses designed using interactive multimedia resources
  - Multi-participant interactivity (real and computer-driven avatars)
  - Integrate with hardware devices and C2 systems







• Fully remote distributed operations can be implemented by adding functional links to the virtual world interface

#### **Example Operations Center 2**



- <u>Live video</u> screens from web feeds
- Clickable screens
- Set up in one hour from existing virtual components



#### **Example Operations Center 3**

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- Virtual workstation with 6 screens
- Set up to evaluate "asbuilt" configuration for customer discussions



#### 50 Megapixels of Virtual Op Center

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 Model of Shipboard Combat Information Center

• Fill a virtual space with information in context

 Create and tear down these spaces dynamically as needed, in the middle of a massive infospace

### Virtual Ground Station on a Laptop

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- <u>Virtual Ground</u>
  <u>Station</u> on a laptop
- You can take your ground station with you anywhere
- Bandwidth is managed by scripts for screen updates



# Timeline and Standardization of Virtual World engines

- Long term viability and support of the VW engine is an issue
  - Technology is evolving and the various engines have a season
  - Some open source efforts are good research platforms, but tend to bifurcate

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- Interoperability and data standards are very slowly evolving
  - e.g., IEEE Standards Association P1828 Systems with Virtual Components
  - Classic case of tension between proprietary business models and open source for the common good

![](_page_11_Figure_7.jpeg)

![](_page_12_Picture_0.jpeg)

- Virtual operations centers are easy to create and modify
- Mature protocols for remote operations enable agile, distributed collaboration with less travel
- Virtual representations are a subset of existing capabilities
- Virtual World is simply a set of interfaces running in parallel on the mission LAN/WAN – No adverse impact on security or operations
- Consider the idea of virtual representations of ground stations and operations centers for all phases of the project

#### THE VALUE OF PERFORMANCE.

![](_page_13_Picture_1.jpeg)