Virtual Ground Station
Mission Operations Center

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)

- 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

- Server-client architecture – Remote clients on Mission WAN
Concept of Operations

• 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 real-time 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


Simulated command posts here solving air, missile defense problems for warfighters around the globe

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• Fully remote distributed operations can be implemented by adding functional links to the virtual world interface
Example Operations Center 2

- **Live video** screens from web feeds
- Clickable screens
- Set up in one hour from existing virtual components
Example Operations Center 3

- Virtual workstation with 6 screens
- Set up to evaluate “as-built” configuration for customer discussions
50 Megapixels of Virtual Op Center

- 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

- **Virtual Ground Station** 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

• 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

Standards efforts can lead to a future-proof toolset
Summary

- 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.

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