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OPERATIONAL SPACE SUPPORT TO TACTICAL FORCES

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OPERATIONAL SPACE SUPPORT TO TACTICAL FORCES

The driving reasons for developing space systems in DOD at the dawn of the space age were strategic in nature. Arms control and intelligence constituted space imperatives at the height of the Cold War. Tactical applications came later and with much less priority.

Although much of this division of priorities continues today, **Space Support to the Warfighters** has become an increasingly common theme. Acquisition driven by combat related requirements is the new imperative by which development organizations must abide. We've become so quickly attuned to this activity that we have identified a separate mission area and given it a name: **Force Enhancement.** We talk about it as though we knew what it was, and refer to it as though others understand what we mean. In fact, very few understand the term. Many engaged in the area are even working counter to our warfighters' true needs.

To understand such an argumentative statement, consider the following observations. Ground mobile forces (which also include air units) must have small, rugged radio receivers in order to operate in a battle zone. They need to take their comm with them when they move, and they need to move in a hostile environment. These forces also need assured access to communications networks so they get the support they need when they need it. Their lives depend on responsiveness and they cannot tolerate delays in critical combat situations. Their comm requirements are simple: **keep it small, rugged, and guarantee access.**

These tactical users look at today's MILSATCOM systems with large 20 foot antennas, and they look at their own low priority on the communications pecking order, and it becomes painfully obvious that those systems are not scratching their itch. They were built and continue to be maintained for a different breed of user.

With this in mind, operational space commands -- chartered to advocate space solutions to tactical terrestrial problems -- have rushed forward with the answer: **Tacsats!** Dedicated to individual CINCs -- available to ops units whenever they need it -- ready to go to war with manpack receivers and guaranteed connectivity.

Unfortunately, this "solution" is only an illusion. Small satellites do not equate to small terminals.

A small, disadvantaged receiver antenna needs increased transmitter power to close a comm link. This additional "gain" must come from somewhere -- most likely a combination of larger satellite antennas, more power from the satellite, or directional beam steering. Large antennas cost volume and weight, more power requires more or larger batteries, and directional beams mean extra weight for computing receiver positions and driving antennas. The bottom line: tactical receivers require more help from satellites, not less. Put another way, tactical receivers are not compatible with tactical satellites.

Furthermore, when U.S. forces go to war, they can't tolerate electronic jammers stepping on their comm. To remedy this problem, they need to do two things. First, for those users who must truly communicate during conflict, they need to leave the narrow, cluttered confines of the UHF frequency band. Second, they need to employ anti-jam techniques. Now, many of these techniques involve dividing a message into small bits and transmitting them repeatedly at random points in frequency. This, in turn, requires signal processing, which further requires computer capacity and comm modifications -- in other words, more weight. You can add the weight on the satellite or on the receiver. Which end truly needs to be lightweight and "tactical?"

Again, searching for the bottom line in the comm area, we find that our forces need assured access to tactical comm, they aren't well served by present MILSATCOM systems, but our rush to sell them Tacsats may not be well founded either. What they really need is a better DSCS (Defense Satellite Communications System) -- optimized for disadvantaged terminals with larger antennas and with guaranteed capacity for our Ground Mobile Forces. An improved COMSAT would provide more channels, more power, and continued commonality with the DSCS waveform. More channels might be easily achieved by following commercial SATCOM examples and using cross-polarization to **double** the channels available. More power is a function of upgraded batteries. **"Demand access"** allocation of available transponders (DAMA) rather than fixed assignment of transponders to individual users would also open up capacity and ensure that users gain access when they need it.

The truth is, that with a limited number of relatively simple steps, nearly all MILSATCOM shortfalls can be redressed. A completely new way of doing business -- i.e. TACSATs -- does not appear to be called for.

Similar statements might be made regarding intelligence support, environmental sensing, wide area surveillance, and every other Force Enhancement mission area.

Our credo must be that if we can't put it in a mobile commander's hands in a realistic, credible manner, then **we are not doing our job.** Tactical satellites are absolutely beside the point. **What we need is tactical user equipment** -- small, rugged, and usable in today's combat environment.

Attached is a notional system illustrating my meaning in this regard. It shows a fictional Army support vehicle perhaps ten years from now. I call it the **Space Hummer.** (Hummer is a nickname derived from HMMV -- High Mobility Multipurpose Wheeled Vehicle.) It looks conventional enough, but it represents the culmination of wide-ranging changes that have (by then) affected entire satellite constellations and system designs.

Inside it is a comm terminal compatible with a universal modem that can receive and process data and voice on UHF, SHF and EHF frequencies. The UHF receiver uses an omnidirectional blade antenna mounted on top of the van. The SHF and EHF receivers share a dish antenna shown here as set up next to the van, but which could be structurally integrated to it. The advantage of "remoting" the antenna is to disguise the position of the van itself from unfriendly forces who may be able to focus on transmissions. This antenna is selectively pointed according to specific networks which the operator intends to join.

MILSATCOM use has already grown to serve tactical units more reliably. In ten years, Army units will certainly have incorporated them down to the battalion level and all special forces units will be similarly equipped. They will then have available to them secure, reliable, anti-jam communications that is small, rugged, mobile, and with guaranteed access. They will no longer be burdened by large trucks, huge antennas, or easily jammed radios. In order to accommodate this new user community, the DSCS satellites and constellations will have to undergo a degree of reconfiguration.

Also contained in this van is a terminal for receiving weather data. It will take in information from DOD, civil, commercial, and even foreign satellites. It will integrate this data with lateral tell weather updates sent by Army, Navy, Air Force and allied units all over the theater. This local information will be incorporated into an amalgamated feed to tactical units and processed for easily understood display. It is going to enable critical choices to be made with regard to weapons sensitive to moisture, temperature, wind velocity, etc. It will allow commanders to anticipate changing conditions such as soggy battlefields, limited visibility, and severe storm fronts which will directly affect conduct of the battle. In short, it will provide up-to-the-minute, precise, decision-making assistance to tactical commanders of engaged forces. Again, unseen in this drawing are the changes wrought in our Defense Meteorological Satellite System. These changes will allow receipt of realtime smooth data to flow to small, tactical receivers. The change will be relatively small. It will probably make Army commanders wonder why it took so long to implement.

One prominent display available to our Space Hummer operator provides selective looks at **enemy forces.** He can call up on his multi-use display screen, and also print out, scenes of **enemy air activity** taken from organic air defense radars, AWACS, and Space-Based Radar. Images from all three sources will be fused and displayed in the same proportions against a common map background. Or, he can use the same screen and select a view of **enemy ground forces** in a variety of area magnifications. Data on electronic emitters, gathered by a variety of resources, will be integrated into one presentation. JSTARS (E-8) aircraft will data link information from their powerful radars and provide detailed looks at enemy ground vehicles behind the lines. Optical images of varying degrees of clarity will also be available and selectable. All these sources of information on ground forces can be individually selected to appear on the screen or mixed and matched as integrated data, tailored to the commander's needs.

Unseen in this image, however, are tremendous improvements and changes which will enable such solid support to become available. Connectivity at the unit level will be increased sufficiently to guarantee reliable, secure connection with sufficient bandwidth to transmit a wide variety of data. Increases in computer processing speed and capacity, along with corresponding reductions in size, weight, cost, and heat must be dramatic to allow integration of all this data and reduction to a useable, human-centered form. Satellites and other sensor platforms which contribute information to

this vehicle must all be reconfigured to optimize their support to small, mobile, combatant units.

In other words, the center of the Force Enhancement world will have to change from one based on satellites and sensors to one based on users -- warfighters. There will have to be major behind the scenes changes to make it happen, but once those changes are complete, we will finally have the cart back in front of the horse.

Of course some things don't need to change. The Space Hummer will know its position with extremely high precision. Rugged, pocket-sized GPS receivers have been available for years. Using standard ground forces comm nets and JTIDS in conjunction with full integration of GPS receivers across all services, will ensure that all allied forces maintain full and continuous situation awareness regarding friendly locations. This will certainly increase force coordination and effectiveness significantly.

Since this Space Hummer is pictured out on its own, we might imagine that it is part of a Special Forces deployment. In that case, its "space connection" would be even more helpful. For, while enroute in the SOF C-130, the Space Hummer will be plugged into the aircraft to gain access to external power and an external antenna. **It will be fully up and functional during the entire deployment flight and covert insertion.** C^3 with the force should be continuous. Regular updates on enemy ground vehicle, air, and electronic activity in the destination area would be available all the way in. Diversion for unexpected weather would be possible. In short, by being totally compatible with transport aircraft and ships, the Space Hummer ensures what enroute SOF forces need most -- NO SURPRISES!

But how achievable is this so-called Space Hummer concept, and how firm are the requirements behind it?

It is certainly a very achievable project if done in a step-by-step approach using proven technology. Many companies and agencies in DOD are currently working on pieces that would fit right in.

A MILSATCOM architecture study is currently underway by AFSPACECOM which **starts with user receiver requirements and works backwards to space solutions.** This effort was undertaken at the request of HQ USAF for the Faga

Investment Strategy Review. It will point out exactly how to modify or replace current MILSATCOM support to mobile forces in the manner described earlier. At the same time, a variety of companies have very advanced efforts underway to develop small, rugged receivers at the higher frequency ranges. These typically use one meter as the **largest** acceptable antenna size. So, in the comm area, efforts are underway which will produce a high fidelity, fully achievable roadmap leading to a Hummer-like capability.

The DMSP Program Office has plans to implement a small, realtime data smooth direct downlink receiver in the Block 5D series. With Block 6, such service will be mandatory. Air Weather Service, in addition, has produced a roadmap which shows how, when, and why to integrate information from a variety of ground, airborne, and space-based weather sensors in a mobile, battlefield capability. This is not difficult technically. It is largely a question of policy.

Multiple efforts are underway to integrate intelligence information of various kinds from various sources into a single, simple, human-centered display. Such a display would also include JSTARS products and fuse it together to create a full picture of enemy ground vehicle activity. Information from Space-Based Wide Area Surveillance systems likewise look to integrate into this common architecture with information on enemy airborne activity. The efforts we currently see are diverse but all headed in generally the right direction. Challenges include not only data fusion, but secure, wideband connectivity. What is needed as much as development, however, is a single integrator capable of focusing the diverse ongoing efforts into a single, manageable initiative.

What about requirements? Current, validated requirements exist for comm, weather, intel support, surveillance, etc. In each case they are written to advocate satisfaction of tactical user needs. Each program is at least exploring options to satisfy those needs. The question is whether there is anyone bringing it all together -- whether there is a requirement to put it all into one truck.

The answer is that no, there is no such requirement on the books. But we know that if we build something that is difficult to use or to carry along, then soldiers will simply leave it behind when they go to war. For example, the Army has lots of commercial terminals to receive civil/commercial weather data. But they leave DMSP

behind when they go to the field. Is there a requirement therefore for a small, mobile DMSP terminal? I believe so.

Does satellite comm have to fit in a manpack? Not necessarily, but it certainly has to fit into a small and inconspicuous enough package that the position of a field headquarters won't be given away. And the package must be mobile so it can be carried along -- or else it will be left behind. Does it have to fit in a manpack? Pretty close.

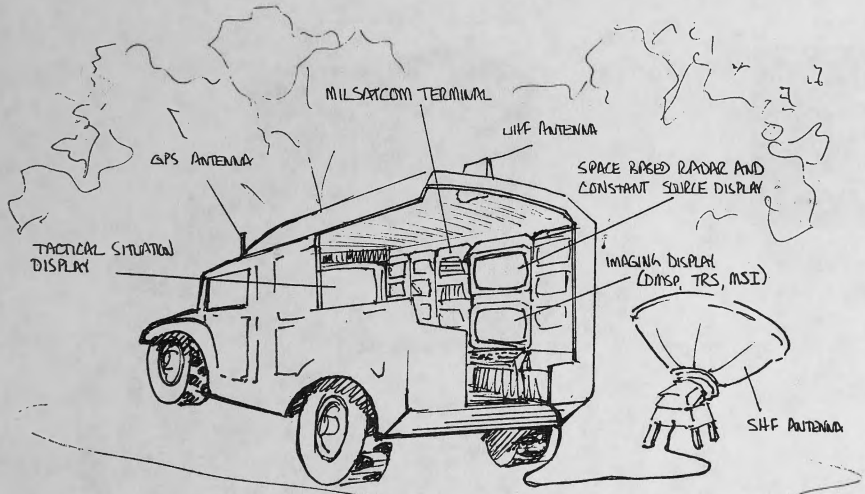
Bottom line. Does all Force Enhancement equipment have to fit in a single Hummer? No. But it's not bad as a goal.

Force Enhancement.

It's a space mission area. DOD and service policies defined the job that must be done. Now military space organizations have to take it seriously. They have to know what it is, and what it isn't.

It doesn't care a whit about space systems or how big they are. It cares about making combat units more effective -- smarter, better coordinated, able to surprise enemies without being surprised, able to shoot when they hit the ground.

If we want to build tactical, warfighting systems, we should start at the warfighters end. Everything else must flow from that. It may turn out that "tactical space system" is not an oxymoron after all -- but that "tactical satellite" is.



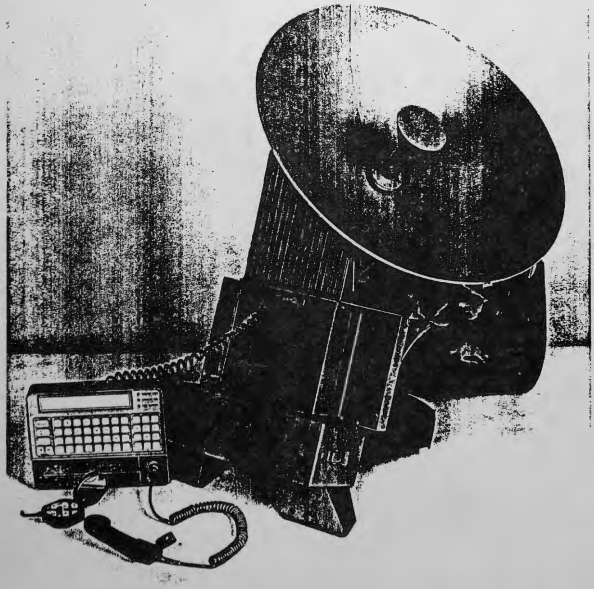
THE SPACE HUMMER

ULTIMATE GOAL OF FORCE ENHANCEMENT

(LT COL JENSEN)

HARRIS

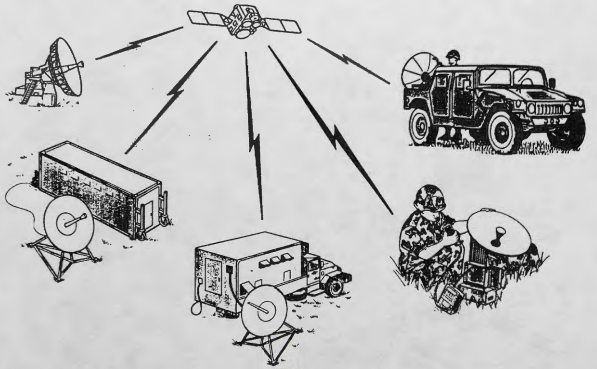
SHF Man Transportable Terminal Series 1000



Applications

The Harris SHF Man Transportable Terminal (MTT) is a lightweight, rugged, and modular radio which provides voice and data communications over DSCS, NATO, and SKYNET satellites for a wide range of applications including:

- Intelligence gathering
- Reconnaissance
- Crisis management
- Pararescue operations
- LPI/LPD communications



System Concept

The Harris SHF MTT system provides both point-to-point and broadcast capability for voice and data on demand. It consists of up to 128 individual MTTs, a Network Control Applique at a larger satellite terminal, and the Network Control software.

The Network Control Applique (NCA) hardware and software provide unattended control of MTT network communications. The NCA controls the net and relays data in real-time between MTTs. The NCA equipment interfaces with an existing earth terminal, such as the AN/TSC-100A at 70 MHz, and is compatible with existing up/down converters and IF patching. The NCA can operate concurrently with the existing earth terminal's traffic. The control terminal requires a 20-foot or larger antenna to assure efficient use of satellite resources. The NCA requires 5-1/4" of rack height, so it easily fits into the smallest of earth stations. The NCA is also compatible with existing satellite resource planning functions.

Network Operations

Harris Network Control software is the key to rapid and efficient connectivity between the users and the management of satellite and network terminal resources.

Communication assets are managed using a Demand Assigned Multiple Access (DAMA) scheme. DAMA provides resources to users on an as needed basis, then reallocates them to other users.

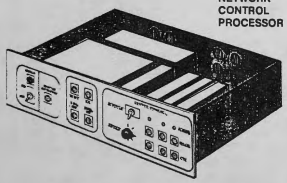
The NCA provides control of network members' transmit capabilities; terminals cannot transmit without its concurrence. The MTT output power levels are also controlled directly by the NCA to assure efficient use of satellite resources.

The Harris network control software is designed to maximize the available resources as well as minimize call set-up times. Resources are generally available a few seconds after the request.

Communications Capabilities

The SHF MTT provides secure voice and data communications from 75 b/s to 2.4 kb/s. The MTTs contain a built-in cryptographic module and vocoder to provide the secure voice/data I/O capabilities. The MTT also provides an auxiliary I/O port for user-supplied devices. The user I/O port supports a variety of physical/electrical interface protocols.

The modular construction of the MTT permits a variety of configurations. Combinations of the manpack, transit case, and vehicle mounted systems can be configured from the standard modules of the Harris MTT system.

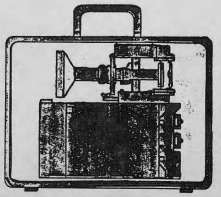


NETWORK CONTROL APPLIQUE (NCA)

TYPICAL VEHICLE INSTALLATION

Summary of Features

- Efficient use of satellite resources
- Flexible, expandable rapid response DAMA system
- Secure voice and data communications
- Positive control of resources
- MIMIC technology enhances reliability
- Flexible configurations
  - Manpack/vehicle/transit case
- Compatibility with existing assets
  - NCA integrates easily with existing terminals
  - Control system compatible with existing satellite planning functions
- Flexible input/output capability
  - Interfaces with most existing I/O devices
- Built-in COMSEC vocoder
- Commonality of modules reduces ILS cost
- Full MIL Spec or ruggedized versions
- LPI/LPD performance superior to that of UHF TACSAT



CASE #1

CASE #2

TRANSIT CASE CONFIGURATIONS