

NEXT GENERATION COMMUNICATION SATELLITE PROGRAM FOR THE DEPARTMENT OF DEFENSE

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ABSTRACT

The DoD is planning a new Mil Sat Com Program, one which will provide the U.S. Military with a capability to maintain the peace or if need be, fight a war.

INTRODUCTION

Since 1974 there has been a continuing effort on the part of the Department of Defense to produce a detailed Mil Sat Com Plan. The initial efforts produced concepts for a General Purpose Satellite Communication System and the Strategic Satellite System. These earlier concepts were identified primarily with the Tactical Forces and the Strategic Forces respectively. For several reasons these earlier concepts were either rejected by the Congress or did not have the wholehearted support of the joint C³ community and as a result, a Mil Sat Com program did not materialize.

At the present time DSCS-II, FLT SAT and packages on host satellites are the main Mil Sat Com components which satisfy some of the communication connectivity required by the Strategic and General Purpose Forces. It has been recognized for some time that this collection of resources is not adequate to meet the U.S. Military needs for the 80's and 90's. When DSCS-III is deployed, some deficiencies will be removed, however, there will remain serious shortcomings in the satellite support of both the Strategic and Tactical Forces.

RECENT CHANGES IN EMPHASIS

Prior to the Carter Administration, the World Wide Military Command and Control System plans were essentially complete. While the WWMCCS plans stressed crisis management over large investments in C³ survivability, the plans did reflect a continuing emphasis on enduring C³. During the Carter Administration there were a number of Key Presidential Decisions promulgated. These Decisions dealt with Enduring C³, Mobilization, Continuation of Government and Nuclear Targeting. These Decisions

coupled with the WWMCCS emphasis on crisis management and endurance, the Mx, a new bomber, upgrades to the Theater Nuclear Forces, a recognition of the tremendous endurance of the SSBN fleet, the emergence of the Rapid Deployable Force and Executive Order 12036 have caused the DoD to rethink its Mil Sat Com Plans. That is, the combined effects of these changes in emphasis has caused the C³I community to plan a next generation Mil Sat Com System. This plan is evolving with close cooperation between the sponsors of the weapons systems and the C³I community.

FUTURE MIL SAT COM SYSTEM

At the writing of this paper, the next generation Mil Sat Com System has been described as a Multi-Mission Satellite augmented by upgrades to existing or almost existing systems e.g. DSCS-III. The term Multi-Mission Satellite (MMS) has been tentatively named MilSTAR which stands for Military Strategic Ttactical and Relay satellite. While the MilSTAR will likely be deployed initially in a geo-synchronous orbit, it is possible that it could serve as a bus for applications requiring elliptical or hyper-sync circular orbits e.g. , five times synchronous. Higher than synchronous orbits could be deployed if and when an anti-satellite threat is considered sufficient to warrant the use of such orbits. Hyper-sync orbits might be used in a satellite control satellite system (circa '95) if the threat to the ground based satellite control system is severe and cannot be thwarted through proliferation and mobility of ground based facilities.

The survivability of the satellite system ground segments, particularly those segments which are fixed and associated with satellite control is very important. The new Mil Sat Com Plan should ensure that the user terminals survivability matches the endurance of the Forces and that satellite control has the necessary endurance. Likewise, it is imperative that the new Space Defense Operation Center (SPADOC) possess endurance and that SPADOC and the Mil Sat Com be tightly coupled to ensure maximum joint survivability. It may be appropriate to redesign current TT&C capabilities (e.g. SGLS) to ensure electronic and physical survivability through proliferation, mobility and waveform compatibility with the communications waveform employed by the Strategic and Tactical users of the MilSTAR. Waveform compatibility would allow a number of authorized ground facilities to participate in satellite TT&C.

The major new component of the future Mil Sat Com System is the MilSTAR. With a common frequency hopped waveform for both strategic and tactical users, it could handle fifty to one hundred simultaneous accesses per satellite and feature adaptive antenna technology for beam forming and interference rejection. The use of the 44 ghz uplink band and 20 ghz downlink band ensures adequate bandwidth for high anti-jam and low probability of signal exploitation. Crosslinks may be included as required. Strategic users would operate at a data rate of 75 bps which is commensurate with strategic forces

missions, while tactical users would operate at 2.4 kbps or less. The higher data rate (2.4 kbps) could support voice through the use of a linear predictive voice coder. These data rates (75 bps to 2.4 kbps) are to be supported from a variety of force element terminals on surface ships, submarines, aircraft and mobile ground platforms. The terminal aperture could range in size from 6 inches to 24 inches, depending on the platform. As in the strategic case where endurance of the weapons and supporting C³ is stressed, the tactical situation requires adequate enduring C³ which can be achieved through the proliferation of highly mobile small tactical EHF terminals.

It is conceivable that host satellites will carry a modest EHF capability at 44/20 ghz to provide for high latitude coverage for select military missions, for example, a new bomber equipped with EHF. The host satellite capability would coincide with the new bomber deployment schedules which could precede the initial deployment of MilSTAR. A modest EHF capability on host satellites could serve as a test bed for tactical users who would benefit most from a geo sync MilSTAR deployment.

Both the DOD and NASA are active in the 30/20 ghz satellite system technology. In fact, the similarities between these two R & D programs are such the close cooperation between DOD and NASA appears evident. It is likely that the DOD will introduce a 30/20 ghz capability as an upgrade to the DSCS-III and eventually 30/20 ghz technology could dominate a DSCS-IV system circa 1995. The 30/20 ghz on DSCS-III could accommodate a variety of users. Technology sponsored by the Bell Telephone Laboratories also appears directly applicable to a DOD 30/20 ghz capability. Ground station antennas for the 30/20 ghz band would be on the order of a few meters.

To ensure compatibility with near term force element terminals, the future Mil Sat Com System will probably provide for transitional capabilities. For example, at UHF and SHF, transponders on host satellites could provide the necessary compatibility with strategic and theater force elements outfitted with AFSATCOM I/II modulation equipments. A modicum of such capability could also be placed on MilSTAR as required.

A continuing UHF peacetime capability within the Mil Sat Com System appears imperative as a result of the large number of UHF terminals projected (3500) for procurement between now and 1990. This continuing capability could be provided by a cost effective program based on a continuation of FLT SAT, the introduction of LEASAT, or FLT SATS followed by LEASATS. Continuity of SHF service is expected to be provided by DSCS-III during the '83 to '95 time frame and perhaps beyond.

SUMMARY

As the DoD continues to develop the future Mil Sat Com System there are a number of difficult issues which need to be addressed and resolved.

- There is a need for a definitive operational anti-satellite threat. The threat cannot be based solely on technology, but must reflect the operational difficulties facing an enemy equipped with an anti-satellite capability. The threat to satellites from a nuclear environment also needs to be better quantified.
- A more consolidated management approach to R & D and acquisition of the ground and space segments of Mil Sat Com appears in order. Likewise, more equitable space system funding arrangements within the services seem desirable.
- Satellite System Control survivability needs to be addressed. New concepts for improved TT&C should be part of this addressal.
- EHF satellite service for tactical users must be balanced with a variety of other tactical communication programs.
- How to provide for a continuity of UHF peacetime services needs to be determined.
- Cooperation with NASA on the 30/20 ghz satellite technology seems imperative.
- The DoD needs to maintain the “togetherness” of the Military Services achieved thus far on this program and to convince the U.S. Congress of the need for a war capable Mil Sat Com System.