BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: NASA Use of the VHF Telemetry Band in the Post-1970 Time Period - Case 620

DATE: October 25, 1967

FROM: A. G. Weygand

## ABSTRACT

NASA has been requested by the Department of Defense (DOD) to vacate the 225 to 260 MHz frequency band by January 1, 1970. The Saturn launch vehicles and the Airlock/Orbital Workshop and the Apollo Telescope Mount make use of this frequency band for telemetering. It is likely that missions including these space vehicles will be conducted in the post-1970 time period. It is the current NASA position that fifteen telemetry channels in the VHF telemetry band will be required by NASA programs during the 1970 to 1975 time period and that NASA will vacate the VHF telemetry band by January 1, 1975. All fifteen channels should be clear channels from Cape Kennedy through Ascension Island during launch operations while only ten of these fifteen channels would be required during Earth orbital operations.

This memorandum summarizes (a) the background to the question of NASA vacating the 225 to 260 MHz frequency band by January 1, 1970, (b) the current NASA position on vacating the VHF telemetry band, and (c) possible related problem areas to NASA manned space programs.

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MEMORANDUM FOR FILE

## 1.0 Introduction

There has been much discussion of late concerning the availability of the 225 to 260 MHz frequency band (VHF telemetry band) for use by NASA after January 1, 1970. In addition to certain current unmanned NASA space programs, the Saturn launch vehicles (both the Uprated Saturn I and the Saturn V) used in the Apollo and Apollo Applications Programs make use of this portion of the frequency spectrum for telemetering. In addition, radio frequency communications, both voice and telemetry, between the LM and the CSM and between extravehicular astronauts and the LM or CSM used in these manned space programs are conducted using a carrier frequency of 259.7 MHz. The space vehicle modules, currently under development for use in the initial Earth orbital missions of the Apollo Applications Program, which include the Airlock/Orbital Workshop and the Apollo Telescope Mount, also make use of the VHF telemetry band for telemetering. This memorandum summarizes: (a) the background to the question of NASA vacating the 225 to 260 MHz frequency band by January 1, 1970, (b) the current NASA position on vacating the VHF telemetry band, and (c) possible related problem areas to NASA manned space programs.

## 2.0 Background

The Director, Telecommunications Management (DTM) exercises authority over frequency allocations given to government agency users while the Federal Communications Commission (FCC) has the same authority over frequency allocations awarded to non-government users. The DTM and FCC jointly develop a National Frequency Table allocating portions of the frequency spectrum (up to 40 gHz) for specific applications such as telemetry, communications satellites, tracking mobile communications, etc. The Interdepartment Radio Advisory Committees (IRAC) acts as an advisory organization to the DTM on matters of frequency allocations for government agency users.

In early 1958, IRAC and DTM made available for all government users a total of forty-four 500 kHz channels in the 225 to 260 MHz frequency band for general telemetering use. At

the same time, the DOD petitioned IRAC to shift telemetry operations to the UHF band so that the VHF frequencies might be used for other purposes. The target date, January 1, 1970, was set by the military for vacating the 225 to 260 MHz frequency band for telemetering. On February 19, 1965, the Military Communications Electronics Board(1) issued a memorandum to the military departments of the Department of Defense (DOD) ordering all users to remove all telemetering operations from the VHF band by January 1, 1970, and to use instead the 1435 to 1540 MHz and 2200 to 2300 MHz frequency bands. NASA was then requested by DOD and IRAC to consider vacating this frequency band. As a result, NASA formed a VHF Telemetry Study Group chaired by Mr. F. B. Smith of Langley Research Center to investigate the NASA requirements for use of the VHF telemetry band after 1970 and to estimate the impact upon NASA programs if telemetering operations in the post-1970 time period were conducted in the UHF band.

At the conclusion of this study(2), Dr. R. C. Seamans, Jr., Deputy Administrator for NASA, in a letter(3) addressed to Dr. J. S. Foster, Jr., Director, Defense Research and Engineering, dated August 23, 1966, proposed a plan for NASA use of the 225 to 260 MHz frequency band in the post-1970 time period. This plan included retention by NASA of 15 telemetry channels through January 1, 1975, and retention of 10 of these 15 channels indefinitely on a shared basis with the military users. These 10 channels, it is believed, are required to meet the limited requirements for telemetering in the sounding rocket programs, for communications between spacecraft and between extravehicular astronauts and spacecraft, and for telemetering in Earth orbital programs including and following Apollo. It should be noted that this plan was not readily acceptable to all military agencies. To date, IRAC has not made final recommendations to the DTM for changes in the status of the use of these allocations in the 225 to 260 MHz frequency band. Discussions and negotiations between DOD and NASA and IRAC are continuing on this question.

## 3.0 Current NASA Position

The latest NASA position on the use of the 225 to 260 MHz frequency band in the future is as follows:

(a) Twenty-nine of the 44 channels will be vacated by NASA by January 1, 1970,

(b) The remaining 15 channels will be vacated by NASA by January 1, 1975,

(c) Ten of these 15 channels should be clear channels during Earth orbital operations as required through January 1, 1975, and

(d) All of these 15 channels should be clear channels from Cape Kennedy through Ascension Island during launch operations as required through January 1, 1975.

It is believed that any acceleration of the plan outlined above to vacate the VHF telemetry band by NASA would present serious technical and economic problems in NASA programs and would have a major impact on the schedule of the Apollo and Apollo Applications Programs.

## 4.0 Possible Problem Areas

If IRAC and subsequently the DTM adopt the recommendation submitted by DOD, namely that the 225 to 260 MHz frequency band not be allocated for telemetering applications on a primary basis after January 1, 1970. NASA would be required to operate at these frequencies in the post-1970 time period only on a non-interference basis with military operations.

Since it is apparent that missions of either or both the Apollo and Apollo Applications Programs will be conducted in the post-1970 time period and because the Saturn launch vehicles the Airlock/Orbital Workshop and Apollo Telescope Mount make use of the VHF telemetry band, it is obvious that such a recommendation adopted by the DTM would have a profound affect on these programs. Development and qualification would be required for new spacecraft antenna and transmitter designs resulting in program schedule delays and increased program costs.

The order by DOD to its departments to vacate the VHF telemetry band by 1970 also means that the support capabilities of all of the telemetry stations of the Air Force Eastern Test Range (AFETR) may be converted by 1970 to support transmissions in the UHF band. Consequently, if NASA chooses not to vacate the VHF telemetry band by 1970, the telemetry stations of the AFETR may not be capable of providing telemetry support for these programs in the post-1970 time period. Current issues of the Saturn IB and Saturn V Program Support Requirements Document (PSRD)[4,5] contain requirements for VHF telemetry support (receive and record only) during the launch and Earth orbital phases of these missions from the following AFETR telemetry stations: (a) Cape Tel IV, (b) Grand Bahama Island, and (c) Antigua.

An earlier study[6] showed that, without altering the existing or planned capabilities of present NASA facilities (namely, the MSFN station at MILA and the Central Instrumentation Facility, CIF), the MILA MSFN station and the CIF (which is not used for orbital support) can provide the required telemetry support for an Apollo-Saturn space vehicle during the launch and Earth orbital phases of the defined Apollo missions of AS-200 series after AS-204/L and of the AS-500 series after AS-505. The previous statement is also true for the currently defined missions of the Apollo Applications Program. Therefore, the loss of Cape Tel IV VHF telemetry support in the post-1970 time period would not affect the Apollo or Apollo Applications Programs.

It can be shown in a similar manner that the stations of the MSFN located at Grand Bahama Island and Antigua will be capable of providing the required VHF telemetry support of the defined Apollo and Apollo Applications Program missions during the Earth orbital phase of the missions expected to be conducted in the post-1970 time period. If support of the VHF telemetry links from the first stage of the Saturn launch vehicle is not required, these MSFN stations could also provide the required VHF telemetry support during the launch phase of these missions. However, it is very likely that support of the VHF telemetry from the first stage of the Saturn vehicles during launch will be required from these two stations. Therefore, at least two additional VHF telemetry receivers would be required at both of these stations to provide the necessary support capability. This would eliminate the need for VHF support from the AFETR stations at Grand Bahama Island and Antigua.

A. G. Weygand

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A. G. Weygand

Attachment
List of References

## REFERENCES


1. MCEB-M 92-95, Memorandum for (a) Chief of Communications - Electronics, USA, (b) Director, Naval Communications, USN, and (c) Director of Command Control and Communications, USAF, from the Military Communications - Electronics Board of the Joint Chiefs of Staff, dated February 19, 1965.

2. "VHF Telemetry Study Group Report," F. B. Smith, Langley Research Center, Chairman, NASA Study Group, dated June 1966.

3. Letter addressed to the Honorable John S. Foster, Jr., Director, Defense Research and Engineering from Dr. R. C. Seamans, Jr., Deputy Administrator for NASA, dated August 23, 1966.

4. NASA, Office of Manned Space Flight, Program Support Requirements Document, Apollo-Saturn IB, Revision 30, dated July 24, 1967.

5. NASA, Office of Manned Space Flight, Program Support Requirements Document, Apollo-Saturn V, dated October 2, 1967.

6. "Summary of Apollo-Saturn Space Vehicle Telemetry Systems and Telemetry Support From Stations Located in the MILA/Cape Area for Apollo," Bellcomm, Inc., Memorandum For File, A. G. Weygand, February 14, 1967.

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