RADIO NOTES

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

VOLUME 15, No. 8 *August 29, 1960*

Attached – Project Echo Photographs

Printed in U.S.A.

1

PROJECT ECHO I PROVES SUCCESS

Project Echo experiment (RADIO NOTES, June 23, 1960) became a reality on the morning of August 12 with the successful launching from Cape Canaveral of a three stage Thor Delta rocket which carried a 100 foot inflatable aluminized mylar sphere into a 47° inclined orbit approximately 1,000 miles above the earth. The sphere is being used for tests of long range microwave communication. The first and second stages of the launching rocket were directed by a BTL guidance system. The third stage was unguided. The satellite weighs 137 pounds and carries two beacon transmitters working at 107.94 megacycles for tracking.

Communication between the Jet Propulsion Laboratory radio station at Goldstone Lake, California and the Holmdel, New Jersey station of the Bell Laboratories was established in the west to east direction using 2,390 mc on the first pass of the sphere through the area of mutual visibility between these two stations. The message consisted of a tape recorded speech by President Eisenhower. The speech quality was excellent. Antennas at Holmdel were steered from predicted orbital data transmitted via digital data tape from government computers.

Early on the morning of August 13 two-way circuits were established via the satellite between Holmdel and Goldstone Lake. Later in the same day a one-way voice circuit was established between the Naval Research Laboratory at Stump Neck, Maryland and Holmdel. On August 14 music was transmitted over both of these circuits. Also, on August 14 the satellite was used for a two hop one-way connection routed from Stump Neck to Holmdel to Goldstone Lake.

On August 15 a two-way telephone connection was established from Pasadena, California over switched telephone facilities to Goldstone Lake where it was patched to the circuit to Holmdel via the satellite. At Holmdel the call was routed through the New Jersey Bell exchange at Middletown, New Jersey and back to Holmdel over regular wire circuits.

Many other test connections were made from the Holmdel terminal using signals reflected from the satellite. The Laboratories people feel that the experiments to date have been highly successful in supporting their belief that good long distance communications via satellites will be practicable. Antenna control based on computed orbital data of the satellite appears to be practicable. Subsequent to the initial voice tests, the Laboratories will focus attention on procuring additional technical information including a detailed study of propagation characteristics, tests of various types of modulation, etc.

2

BELL SYSTEM OUTLINES SPACE COMMUNICATIONS PLANS TO F.C.C.

The Bell System has outlined plans for a space communications network to carry telephone calls and television programs throughout the world via a string of satellites circling the globe.

The picture of future worldwide communications was contained in written testimony filed with the F.C.C. by James B. Fisk, President of BTL; John R. Pierce, the Laboratories' Director of Research-Communications Principles; Charles M. Mapes, Assistant Chief Engineer, A.T.& T. Company, and Brockway McMillan, the Laboratories' Director of Military Research.

The testimony was filed to support the Bell System's contention that the Commission should anticipate the requirements of space communications in the portion of the spectrum above 890 megacycles. The F.C.C. about a year ago opened up blocks of frequencies for general use, with no provision for space communications. Last May the case was reopened by the F.C.C. to consider the space issue. Oral arguments were presented July 18.

Mr. Mapes, in his testimony, said a system of about 50 satellites in random polar orbits at a height of about 3,000 miles could provide communications facilities between the United States and "all areas" of the world. He said about 26 transmitter-receiver stations, working in pairs and spotted throughout the world, would be needed to provide ground terminals.

"A very important advantage of such a satellite network is the ability to communicate directly with nearly all the major countries of the

world, without intermediate facilities in other countries," he said.

Mr. Mapes estimated the cost of setting up such a system at $115,000,000 divided between $65,000,000 for the ground installations and $50,000,000 for the satellities. Each pair of ground stations, relaying signals via satellites, could provide 600 telephone circuits.

For about $55,000,000 more, he said, the equipment could be adapted to also provide trans-oceanic television channels between each pair of stations.

"The cost, therefore, for providing the basic facilities for 600 telephone circuits and for television service between each of the 13 pairs of worldwide terminals would total approximately $170,000,000," he said.

The Bell System would expect to make use of a satellite system for international communication and, in collaboration with such foreign organizations as might be involved, would expect to share the cost of launching and maintaining communication satellites.

Dr. Fisk described the need for better international communications. While radiotelephone and the growing network of submarine cables now supply telephone service to most of the world, they cannot supply all the communications services that are available domestically.

He said that the United States, with only 6 per cent of the world's population, now has 55 per cent of the telephones.

"We will necessarily expect a tremendous increase in telephones abroad as the 94 per cent of the world's people outside the United States become more industrialized. In addition to talking with many of these people by telephone, we will need to communicate with them by transmitting and receiving data and other business communications, and by means of television."

Dr. Fisk said it would be impractical for satellite systems to share frequencies with cross-country microwave systems. He said that satellite system ground receivers can function only if they are well beyond the horizon from any ground microwave transmitters operating on the same frequency.

"Our future in world communication and our future in the exploration and the exploitation of space depend on the wise use of the very limited range of frequencies in the electro-magnetic spectrum which is suitable for communication and other space purposes," he said.

"We firmly believe that it is clearly in the public interest at this time for the Commission to conserve the use of the frequency spectrum and to maintain its earlier sound policy of restricting the licensing of private microwave systems."

Dr. Fisk said the most favorable frequencies for space communications range between 1,000 and 10,000 megacycles, although those up to 16,000 megacycles might be used. But he said that "natural laws" prevent the use of frequencies above 20,000 megacycles for reliable satellite communications.

Frequencies above 890 megacycles, he said, also are needed for many military and Governmental uses such as Nike radars and the spaceman Project Mercury.

The Bell Laboratories, Dr. Fisk said, "are engaged in an extensive program of experimental research aimed at bringing into being a worldwide commercial satellite communications system as early as possible.

"The Bell System would hope to have an active satellite system launched by a contractor just as soon as intensive development work now being carried out on satellites and the communication equipment to be carried in them gives assurance of reasonable technical and economic success."

Mr. Mapes, in his concluding testimony, said space communications were "absolutely necessary" to provide for the needs of the future. He said the Bell System has spent "sizable sums of money" for research on satellite communications and stands ready to spend "even larger sums" for experimentation, design, engineering and construction.

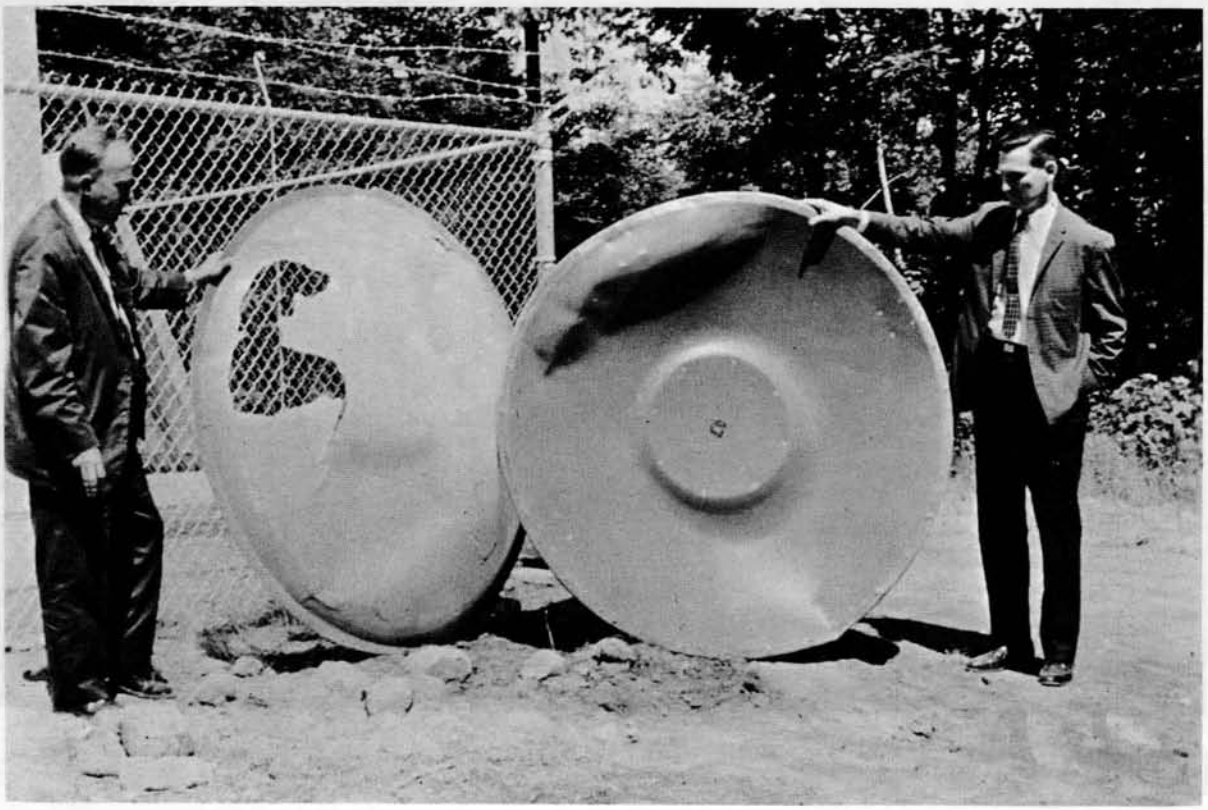
"If we can be assured of reasonably adequate frequencies to provide for the future we will continue this work," he said. "If frequencies are available, there is no reason why America cannot lead the way in this new form of communication."

3

DAMAGED DISH

Item 5 in the last issue of RADIO NOTES described an incident where falling ice from a

tower mounted reflector damaged dish antennas below. This photograph shows the previously mentioned damage received by a TJ dish and its radome. No attempt was made to repair this damage as a spare was available. The feed horn (not shown) was also damaged. Bill Schooley from Michigan Bell on the left supports the radome while Bob Skrabal from the Laboratories is shown with the 5-foot dish on the right.



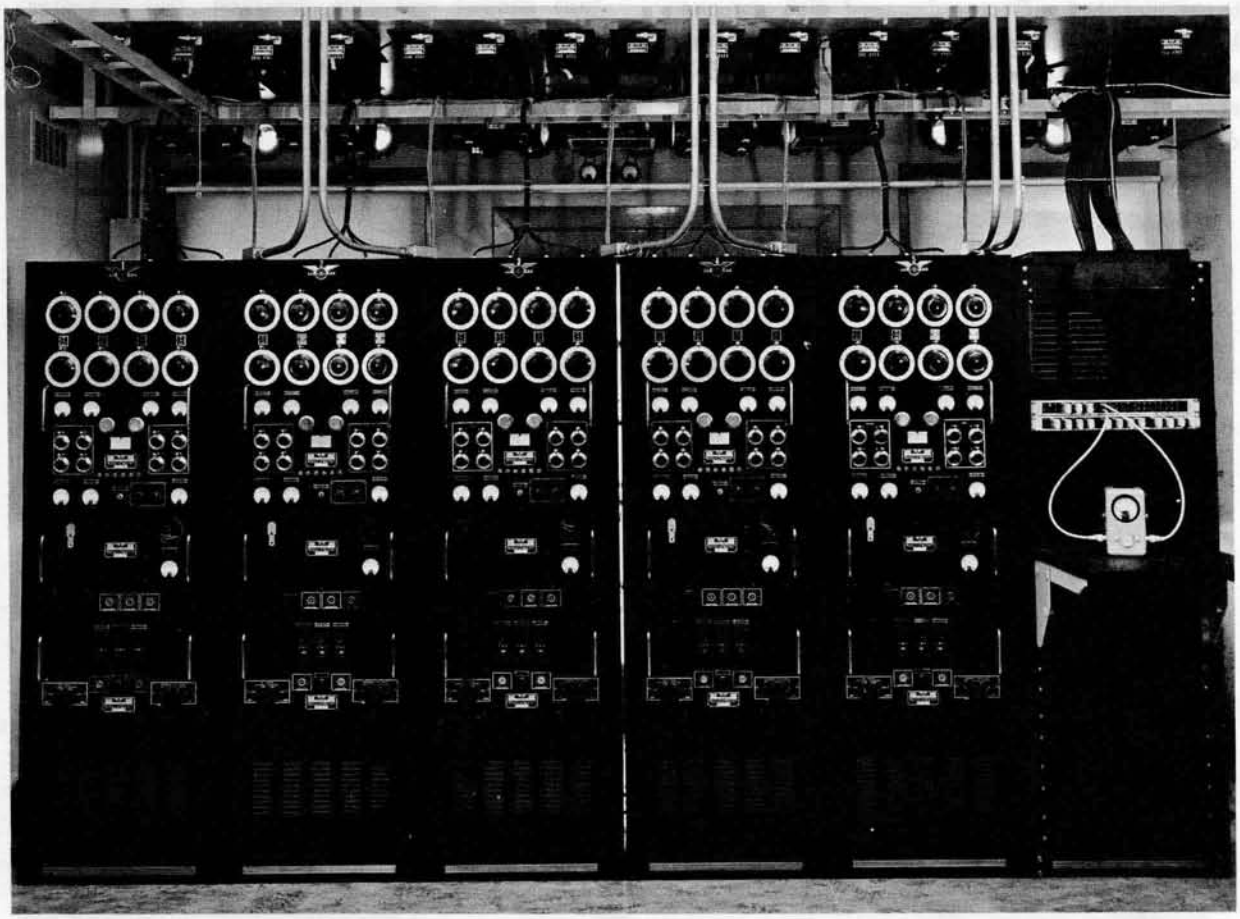
4

REPUBLICAN CONVENTION TV SERVICES

As in earlier political conventions held at the International Amphitheater in Chicago, this year's Republican National Convention required a major service effort on the part of the Illinois Bell Telephone Company. IBT successfully installed and operated the required circuits between the numerous specified points in the Chicago Metropolitan Area.

The largest concentration of radio equipments occurred on the roof of the Amphitheater where 43 microwave antennas were generally directed toward the distant downtown "Chicago loop" area. Considerable work at this location was devoted to minimize interference through frequency coordination, antenna alignment, polarization, etc. Other problems involved interference from a nearby AM radio transmitter and from broadcasters' local radio cueing systems used within the Amphitheater itself. Elimination of this interference was accomplished by a special bonding and grounding system.

No single Company owns sufficient television equipment to meet the extraordinary demands of such a convention; consequently, arrangements were made with 12 other Bell System Companies to borrow the required components. Delivery of borrowed equipment was complicated due to the needs of a closed circuit heavyweight championship boxing match which occurred just a few weeks before the convention.



5

CHICAGO MARITIME STATION "WAY" MAKES CHANGES

Recently Illinois Bell completed major rearrangements in the facilities and operations at their Coastal Harbor Station WAY. The changes will improve maritime radiotelephone service to ship customers on the Great Lakes and Mississippi River System. They also help to serve the increasing number of vessels resulting from opening of the St. Lawrence seaway. Thus far their program has included replacement of certain obsolete or damaged radio station plant and introduction of new operation procedures.

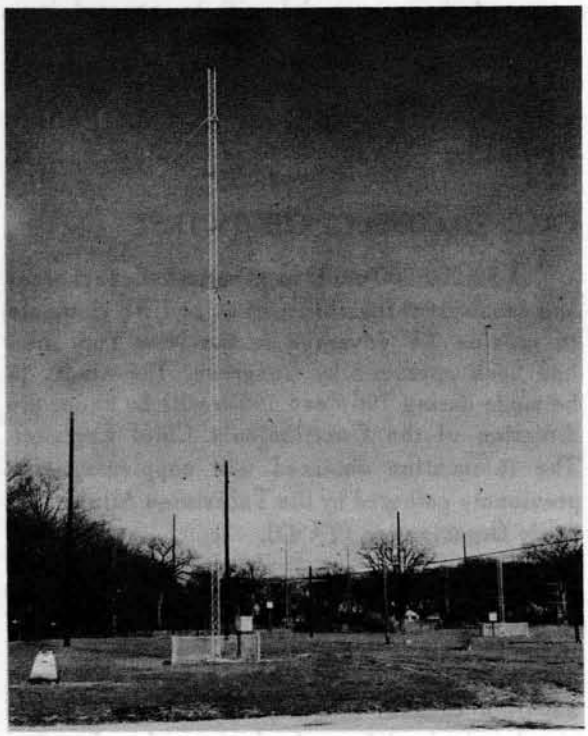
At the Lake Bluff radio station site, obsolete transmitters have been replaced by the five new units shown in the photograph. These Aeronautical Communications Company, Model 1046 transmitters are 1 kilowatt power output equipments with a multi-frequency capacity of four to six channels. Night time power on some of the channels is reduced to 500 watts. The cabinet on the right-hand end of the lineup includes an r-f patch and test panel.

During the winter, three new guyed towers were erected at the transmitter location. Two of these masts are shown in the other photograph. These series-fed vertical antennas were required to replace antennas destroyed by a storm last fall. Other rearrangements in the antenna system were made to maximize the radiation efficiencies.

Station WAY is operated on a locally-attended basis by technical operators at Lake Bluff. Until recently, all connections to the telephone network were made by Chicago Traffic operators via Chicago-Lake Bluff trunks. To consolidate and speed operations, telephone calls in the ship-to-shore direction now are dialed directly and ticketed by the WAY technical operators. Their operating positions have been suitably arranged and equipped for the new operating procedures.

Illinois Bell is exploring and planning other ways of making future improvements in this maritime radio service. They are currently con-

ducting a trial of single-sideband ship-to-shore service in cooperation with other interested maritime organizations (RADIO NOTES, July 28, 1960). Of course, many of the major changes must await the winter season when the Lakes are essentially closed to shipping and telephone traffic is extremely low.



6

TH MICROWAVE

The Long Lines moved one step closer to providing a transcontinental TH microwave route with their plans for adding TH to the existing TD-2 express route from Norway, Illinois to Dodge City Junction, Kansas. The installation of TH at these 25 stations establishes a continuous TH route between Colesville, New Jersey and Dodge City Junction (RADIO NOTES August 28, 1959 and April 19, 1960) for a total distance of 1546 route miles. This route will tie in with the Prospect Valley – Salt Lake City Junction TH system, now undergoing field tests by the Bell Laboratories, and eventually to the West Coast.

The proposed system from Norway to Dodge City Junction will consist of 2 broadband channels of TH in each direction to provide message telephone service and a protection channel. The installation will also include 2 narrow band auxiliary channels each way for order and alarm facilities and for transmission of protection switching signals. Service date for the latest TH installation is set for December 1961.

7

MICROWAVE FLOAT

Many Companies have constructed floats for participating in parades as a means of attracting attention to Bell services. One such float built in the Idaho Area stresses microwave as a means of telephone transmission. This float has been very successful as it has been awarded two first prizes out of three showings throughout the state. Mountain States employees participated in its design and construction.

The float is framed with chicken wire stuffed with large quantities of paper napkins. Recorded music is included in the float. Cards held by the local beauties read, "O'er the land of the free – and the home of the brave – we send speech and music – by microwave."

8

PUBLIC AIR-GROUND TELEPHONE SERVICE MEETING

On July 15, Long Lines and 195 Broadway people from Marketing and Engineering met in Washington, D.C., with representatives from various aeronautical user groups. Included were people from five major airlines, the National

Business Aircraft Association, the Aircraft Owners and Pilots Association, the Air Transport Association and Aeronautical Radio Incorporated.

The Bell people first presented a resumé dealing with the Bell System's interest and objectives, various operating features and details of the proposed service and certain technical considerations.

Considerable interest was shown and much valuable discussion took place during the meeting. It was the feeling of the majority of participants that:

(1) A good potential market exists for the service, especially in the private and corporate aircraft field,

(2) That significant participation by the airlines is not likely to occur until rather extensive nationwide service can be provided, and,

(3) The greatest stimulant to participation by all types of users – private, corporate and airline – would be the rapid geographic development of ground stations across the country.

The discussion also brought out the fact that an airborne set, to really be useful, must be capable of operating on all six channels we have proposed for air-ground service.

9

NEW MODEL RCA TELEVISION MICROWAVE EQUIPMENT

RCA recently advised the A.T.& T. and Western Electric Companies that production of the TVM-1A model television microwave equipment has been discontinued. They are now producing a TVM-1B model which differs in several respects from the earlier model though costs are essentially the same.

The TVM-1B model has a redesigned IF strip using a new tube type, a heat sink cooled transmitter klystron (the VA-222 instead of the VA-220 as used on the TVM-1A), an improved video modulator giving slightly more baseband bandwidth, as well as other minor improvements.

One potentially objectionable feature of interest to Telephone Companies has been discussed with RCA, and an optional partial TVM-1A arrangement is being negotiated with RCA to provide a practical alternative. The heat sink klystron, which on fixed equipment normally eliminates the need for a blower, will require a blower when housed in portable carrying cases. Since RCA put the blower on the removable cover, the operating frequency of the klystron may be shifted when the cover is lowered after tuning.

These and other aspects of operation and costs of the new model will be covered in a P.E.L.

10

F.C.C. TO CONDUCT UHF-TV TEST

A $2,000,000 study to ascertain the technical and economical feasibility of using UHF channels to provide TV coverage in the New York area has been approved by Congress. The study, to be made during 1961 and 1962, will be under the direction of the Commission's Chief Engineer. The information obtained will supplement that previously gathered by the Television Allocations Study Organization (TASO).

For the test, a high powered UHF-TV station will be constructed on the Empire State Building, the site of existing VHF-TV stations. Another station will be located about 15 miles away on a separate channel to study any advantages that may be obtained from simultaneous broadcasting of a single program by two stations on different frequencies. 100 receivers are to be built and loaned to selected groups of viewers for public participation. Measurements will be made and correlated with observations of picture quality on receivers installed within the service area of the stations.

11

ORGANIZATION CHANGES

Wallace M. Von Hagen of the Bell Telephone Company of Canada has accepted a position in the Point-to-Point Group effective July 25, 1960. Wally is engaged in the preparation of engineering practices on microwave radio. He can be reached on EXeter 3-2420.

W.G. Chaney from the Mobile Radio Group has accepted a position with the General Electric Company in Lynchburg, Virginia effective August 1, 1960. We are going to miss Bill and wish him much success in his new undertaking.

RADIO INFORMATION

The following have been forwarded since the last issue of RADIO NOTES:

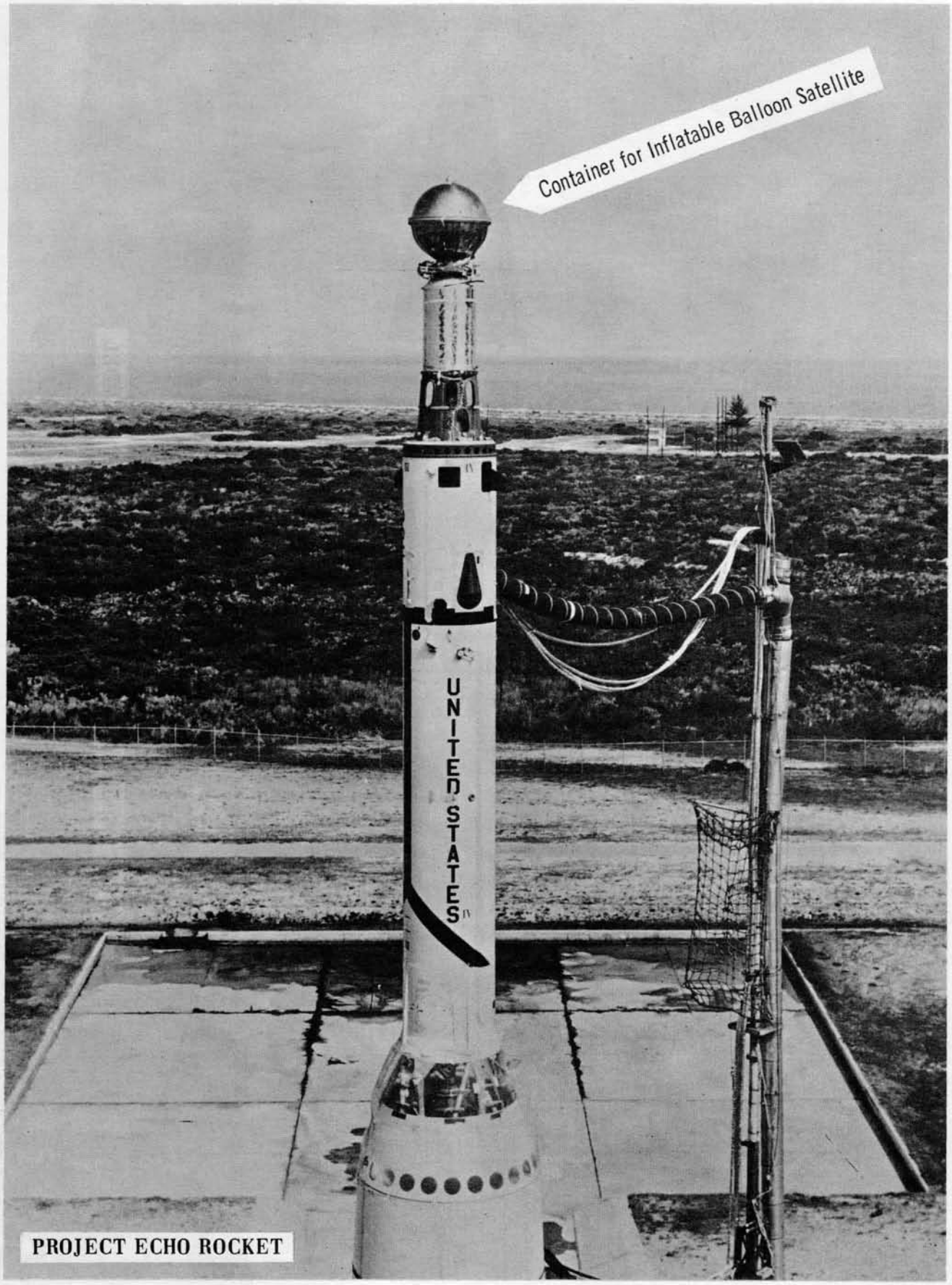
BSPM 727	AA266.083, Issue 1 –	TH Radio – IF and Baseband Patching, Monitoring, Amplifier, Equalization Equipment and Station Transmission Cabling – Toll Systems
	AA268.537, Issue 4 –	37-Type Transmission Measuring Sets – Toll Systems
	AA636.758, Issue 1 –	Performance Requirements – TH Radio Microwave Carrier Supply – Toll Systems
BSPM 727A	–	
BSPM 728	R90.334.20, Issue 2 –	TJ Radio System – Receiver Tests and Adjustments General
	ADDENDUM R70.632, Issue 1 –	J68345A Transmitter – Receiver Test Set (Operating Methods)
BSPM 728A	–	
P.E.L. 6699	Reopening of Above 890 MC Case (F.C.C. Docket 11866)	
P.E.L. 6703	Television – Telechrome 1073D2 Sine Squared – Windown Generator	
P.E.L. 6702	Television – Balanced Monitoring Arrangements at J44107 Television Operating Centers	
P.E.L. 6705	KS-15874 Electron Tube Tester	
P.O.L. 1892		
P.E.L. 6718	Introduction of the TL Radio System (1S3.9P-1)	
P.E.M. 7292	Maritime Mobile Telephone Service – Coast Guard Watch on 2182 KC and Weather Broadcast Schedules (1S2.11D-6)	

Unnumbered Letters to Chief Engineers

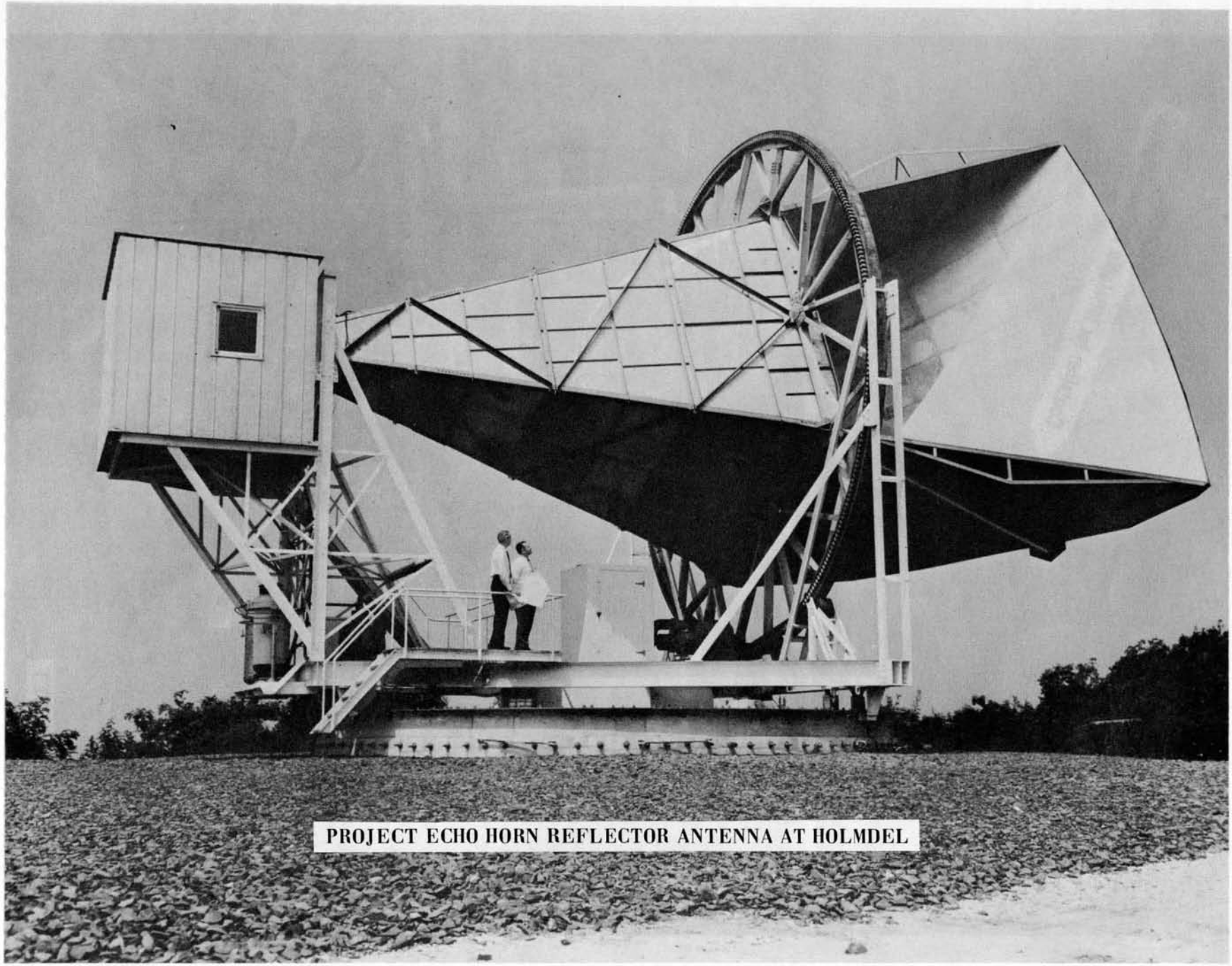
7-27-60	Checking List for General Letters Dealing with Radio Matters – Supplement 2 (1S3.0-45)
8-5-60	Topical List of Active Plant Engineering Circulars, Memoranda and Letters – Radio Engineering Section
8-10-60	Mobile Telephone Service – Use of Frequency Meters as Calibrated Radio Frequency Signal Generators (1S3.7-105)
8-11-60	Public Radiotelephone Service to Aircraft (1S1.12-6)

Unnumbered Letter to Transmission Engineers

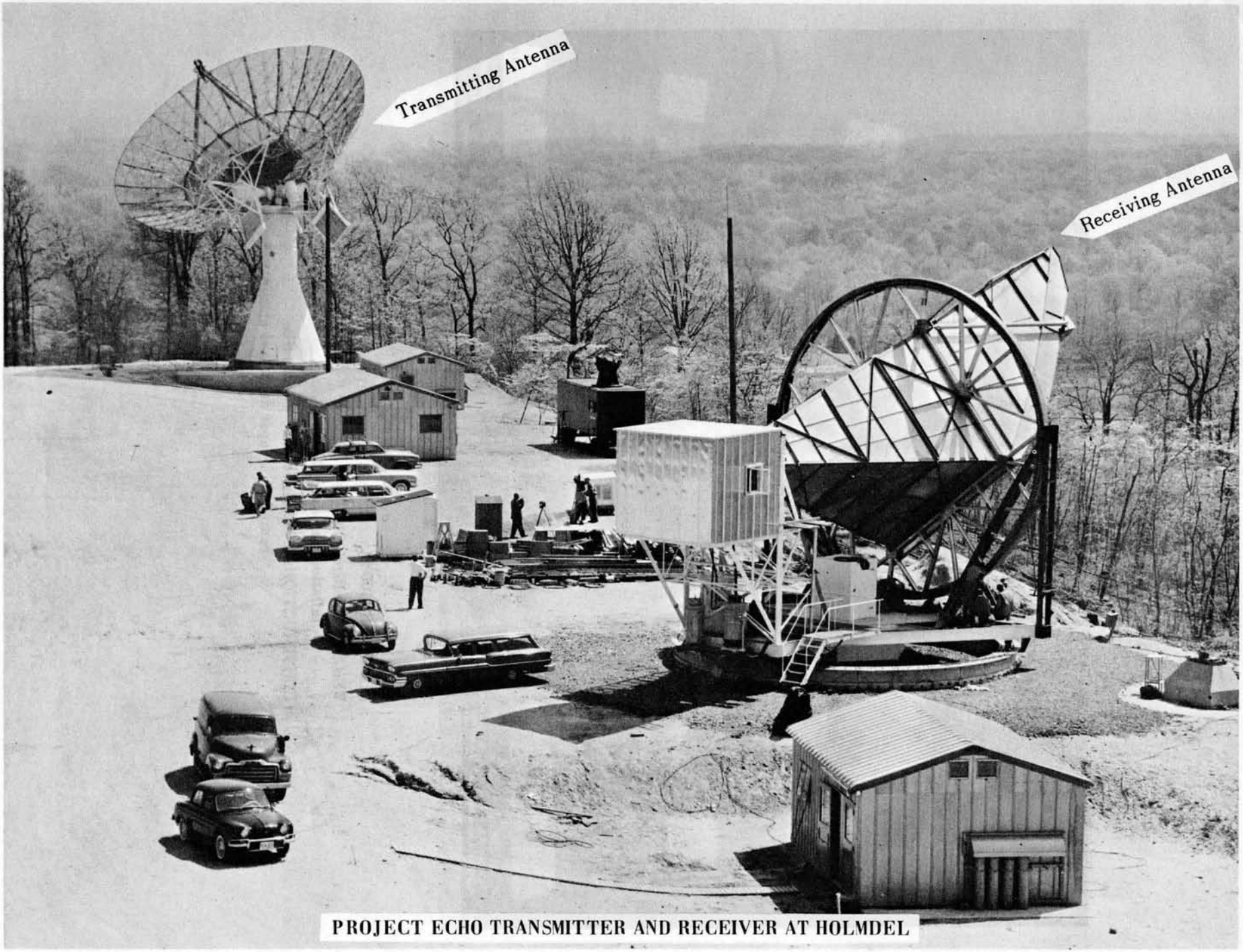
7-15-60	Maritime Mobile Services – Mailing List for Radio Technical Commission for Marine Services Executive Committee Meeting Minutes (1S12.4)



PROJECT ECHO ROCKET

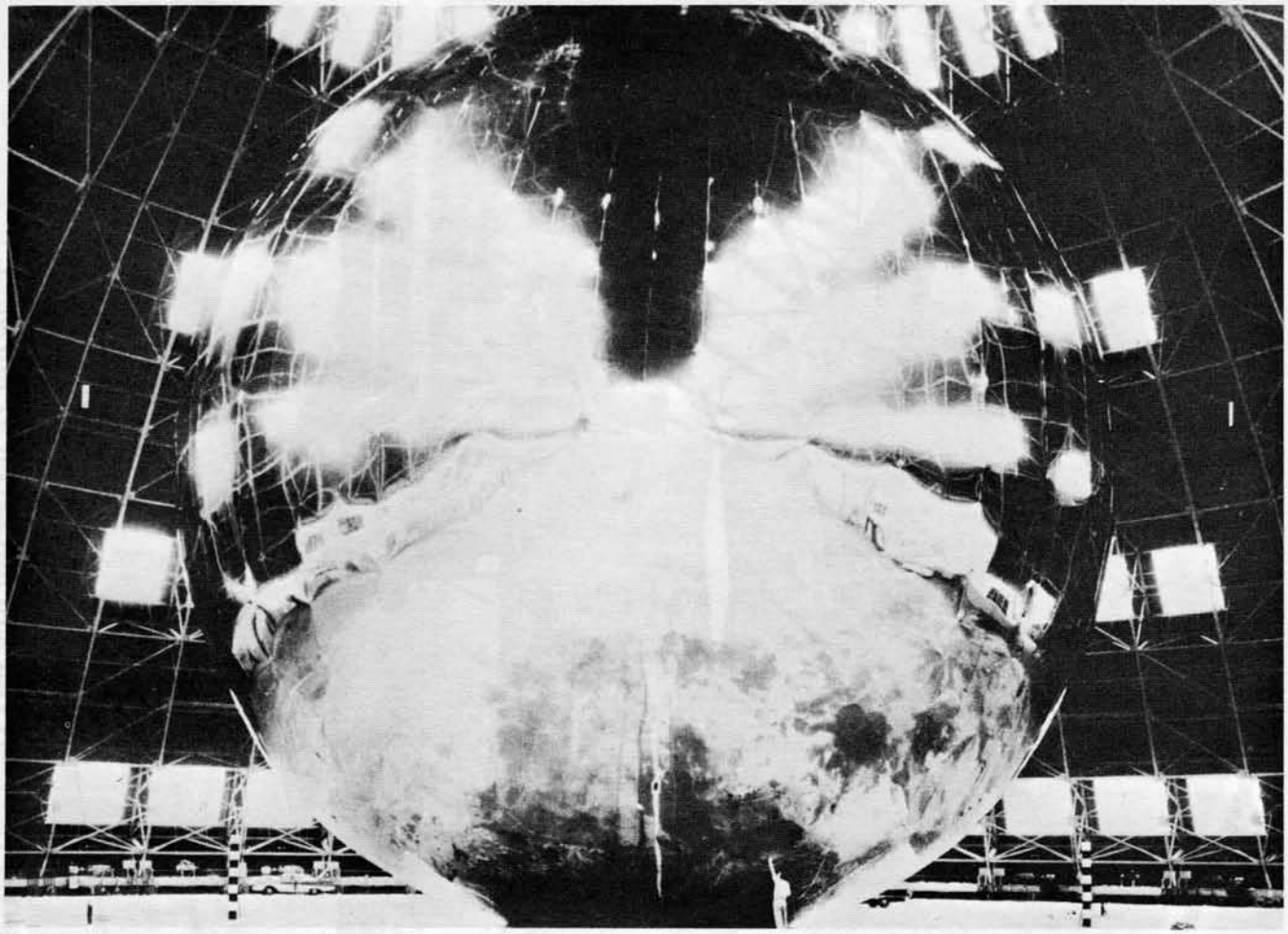


PROJECT ECHO HORN REFLECTOR ANTENNA AT HOLMDEL



PROJECT ECHO TRANSMITTER AND RECEIVER AT HOLMDEL

NASA ECHO COMMUNICATIONS SATELLITE



DIAMETER: 100 ft.

WEIGHT: Satellite - 130 lbs.
Inflation Material - 30 lbs.

CONSTRUCTION: 0.0005 inch thick plastic film
coated with vapor deposited aluminum.