The DENVER DECIBEL

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PROJECT VANGUARD

Speaking before the Seventh Annual Astronautical Congress in Rome, Italy about the earth satellite launching vehicle program for which the Martin Company, Baltimore, Maryland is prime contractor, N. Elliott Felt, Jr., Operations Manager of Project Vanguard, disclosed details of the test firings now scheduled.

"Before the attempt to place an artificial satellite in orbit is made by Project Vanguard," he said, "a flight test program will be conducted at the Air Force Missile Test Center, Cocoa Beach, Florida. It was announced that the first firings will begin some time during the Fall of this year.

"The first Vanguard propulsion unit to be tested will be the third stage solid rocket. This will be carried aloft in a modified Martin Viking rocket. The final test configuration will consist of all three Vanguard stages.

"Consequently, these latter vehicles will be virtually identical with the three stage rockets employed for launching the actual satellite. However, Felt said, "it is not anticipated that an orbit will be attempted during the test program, since all of these vehicles will be heavily laden with instrumentation."

Felt said that Project Vanguard presents us with a challenge to ac-

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MR. H. W. LANCE ADDRESSED DENVER SECTION

HARVEY W. LANCE

Speaker at the Sept. 27 Section meeting in Boulder was Harvey W. Lance, recently appointed as a section chief in the radio standards division of the Boulder Laboratories of the National Bureau of Standards.

Formerly head of microwave systems research at the Naval Ordnance Laboratory in Corona, Calif., Lance will be in charge of the new electronic calibration center now under construction.

His immediate duties will concern securing equipment and personnel for the center as well as preparing general plans for operation. The center has the status of a section

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THE DENVER DECIBEL
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in the organizational structure of the Boulder Laboratories.

The Nation's new Electronic Calibration Center, now under construction at the Boulder Laboratories of the National Bureau of Standards, is expected to reduce greatly inaccuricies now existing in the field of electronics.

By helping to keep the delicate electronic apparatus of the Armed Forces, industry and various laboratories operating with uniform accuracy, the Center may well save millions of dollars and many lives.

For the first time since the electronic industry began mushrooming during World War II the country will have one central government laboratory more adequately equipped for unifying various electronic standards.

Initial impetus for establishing the Center has come from the Air Force, which focused Congressional attention on the urgent need for accurately calibrated equipment. Also recognizing the need for such a centralized agency have been branches of the Army and Navy, especially the Navy's Bureau of Aeronautics, and various industrial laboratories.

In the Calibration Center will be master standards for checking or calibrating many types of transfer or inter-laboratory electronic standards through which industry, the Government, and scientific laboratories may assure the accuracy of their own on-the-job electronic "yardsticks".

Fast-moving advances in the electronic field have resulted in a lack of nation-wide coordination. Industrial and government laboratories, often working independently, have created individualized sets of measurements. This has led in some cases to waste and confusion, particularly when bottlenecks have arisen in repairing and interchanging equipment.

From industry's side, it is important that all manufacturers use the same standards for production so that electronic parts and components may be interchangeable and products be accepted by all potential users.

Over six billion dollars worth of

electronic equipment and apparatus is manufactured annually in this country. Were each manufacturing company to use an even slightly different value for basic electrical units such as the volt or the ohm, the apparatus made by subcontractors might fail to function properly as part of a final product.

Just as NBS has provided the standards upon which the Nation's great electrical industry is built, so must it meet the need for standards in the new field of electronics. The Calibration Center aims eventually to measure and standardize all usable electrical and radio quantities from direct current, or zero frequency, to at least 100,000,000,000 cycles per second.

To start with, calibration will be done at frequencies already in wide use ranging up to 10,000,000,000 cycles per second. Later on as the need arises measurements will be extended to higher frequencies.

With each electronic unit standardized or brought into line with the Nation's primary standards, the fast-growing field of electronics will be placed on a sounder basis for orderly growth.

The Calibration Center will occupy a new 27,000-square-foot wing to be added to the Radio Building of the Boulder Laboratories.

Architect for the new wing is James M. Hunter of Boulder. In charge of construction will be Stanley Green of the Denver Regional Office Buildings Service, General Services Administration.

At least $1,000,000 worth of precision electronic equipment and laboratory apparatus will be installed in the Center. Much of this will be designed and assembled during the construction period of the building so that operations may begin without delay.

It is estimated that the Air Force's ten and the Navy Bureau of Aeronautics' three regional depots, which check the accuracy of electronic equipment used in flight, will send in nearly 4,000 items for calibration each year.

The total number of items will increase as more laboratories make use of the Center and as newer developments, plus increased use of electronic equipment, create a greater need for calibration operations.

The Air Force plans to have several teams assigned to the Center to be responsible for the transportation of equipment back and forth from depots to the Center and for calibration of the depot standards. Another group will make minor repairs or adjustments on their electronic standards, as required.

complish something never before attempted, and an opportunity to extend man's knowledge of the universe.

The Martin engineer told the assembled scientists that the Vanguard vehicle is without fins to save weight, but can be adequately stabilized through the use of a gimballed engine. The rocket is composed of three stages which partially fit inside one another. The first stage is powered by a liquid rocket engine using liquid oxygen and gasoline as fuels. The second stage contains a liquid rocket engine which uses white fuming nitric acid (WFNA) and unsymmetrical diemethylhydrazine (UDMH) as fuels. The third stage is a solid propellant rocket which carries the satellite, a 20-inch sphere weighing approximately 21 1/2 pounds. The sphere and its third stage are enclosed within the nose cone of the vehicle. The overall length of the Vanguard vehicle is approximately 72 feet and gross weight at takeoff is approximately 22,600 lbs.

The first stage will lift the entire rocket to an altitude of about 36 miles at which time the vehicle will be moving at approximately 5500 ft. per second, when the fuel for the first stage will have been exhausted. The first stage then will be separated from the rest of the vehicle and will fall into the ocean at an impact point approximately 275 miles down range from the firing site. At the time of this separation, the second stage engine will be ignited. The thrust of this engine then will propel the vehicle along a curved trajectory to an altitude of approximately 140 miles at time of burnout. At this time the vehicle will be travelling at approximately 13,400 feet per second.

Both the second and third stages will coast along the trajectory to an altitude of approximately 300 miles. During this period, the attitude of the vehicle will be controlled by an autopilot which employs small jets of residual second stage pressurization gas. After separation from the second stage, the third stage will accelerate the satellite package to a final velocity of approximately 26,000 ft. per second before exhausting its fuel. Then the satellite proper will be separated from the third stage rocket. The third stage rocket also will become a satellite, since its final velocity is that of its scientific payload.

(Continued on page 5)

"Once the satellite has been established in orbit," Felt said, "the responsibilities of The Martin Company are essentially over. We have been assigned the task of providing a vehicle which will lift the scientific instruments from the earth to an altitude of approximately 300 miles and establish them in an orbit.

"The experiments to be conducted and the instrumentation to be employed are the responsibilities of others. For example, The National Academy of Sciences, through its U. S. National Committee for the IGY which initiated the program, is responsible for the scientific aspects; the experiments and instrumentation and the radio and optical observations and measurements.

"Since the earth rotates beneath the orbit, the satellite will not pass over the same points on successive revolutions," Felt said. "If the satellite completes a revolution in approximately 90 minutes, the ground track will be off-set by approximately 22.5 degrees on the earth's surface on each successive revolution. Most of the world's temperate zone will be covered by the satellite's orbit. Consequently, many observatories will have the opportunity of attempting visual track of the object."

Answering the question, "Why do we want an artificial satellite at all?" Mr. Felt said, "If you require specific justification for this endeavor, there are many predictable results which are of immediate practical value. For example, expected data on the physical characteristics of the upper atmosphere: pressure, temperature and density will be required for future high speed, high

(Continued on page 8)

Engineering Notes & News

URSI WILL MEET IN BOULDER

By invitation of the U. S. A. National Committee of the International Scientific Radio Union (URSI) and the National Academy of Sciences, the XIIth General Assembly of URSI will be held at Boulder, Colorado, August 22 to September 5, 1957. Local hosts will include the University of Colorado, the Boulder Laboratories of the National Bureau of Standards, the High Altitude Observatory, and the City of Boulder. Headquarters for the Assembly and rooms for the technical sessions will be in the Memorial Center of the University of Colorado. Facilities will also be provided in the Boulder Laboratories of the National Bureau of Standards.

Meetings of the General Assembly are held every three years, rotating among the member nations of the Union. This is the second in the United States of America, the 1927 Meeting having been in Washington, D. C.

The member nations of URSI cooperate in research programs of international interest through seven technical commissions, each representing a field of radio research or related activity. The General Assemblies afford an opportunity for delegates from all the nations to exchange scientific information, coordinate research programs, and recommend future courses of action.

RADIO PROPAGATION LAB.

Announced is a reorganization of the Radio Propagation Engineering Division of the Boulder Laboratories of the National Bureau of Standards with ten scientists receiving new assignments.

In the new plan of the division, headed by Kenneth A. Norton, the two original research sections are being divided into seven sections to facilitate increased research research resulting from recent development and widespread use of tropospheric scatter propagation, radio noise, modulation, and navigation techniques.

Assistant chiefs appointed are J. W. Herbstreit, formerly in charge of all tropospheric work, who will now be concerned with research and development; and Kenneth O. Hornberg, formerly project leader of the Cheyenne Mountain experiments in

PGAP NEWS

VERY LOW FREQUENCY PROPAGATION SYMPOSIUM

The Denver-Boulder section of PGAP has announced a Very Low Frequency Propagation Symposium to be held at the NBS Boulder Laboratories January 23-25. The symposium is being jointly sponsered by the NBS Boulder laboratories and the IRE Professional Group on Antennas and Propagation.

SYMPOSIUM COMMITTEE CHAIRMEN

Steering: J. R. Wait; Local Arrangements: R. Silberstein; Finance: J. R. Johler; Publicity: C. L. Bragaw and Betty E. Rees; Panel Discussions: T. N. Gautier and R. A. Helliwell; Regular Technical Papers: J. M. Watts and J. R. Wait; ADVISORS: F. W. Brown, K. A. Norton, R. J. Slutz.

Dr. D. G. Fink (Editor of the Institute of Radio Engineers) and Mr. K. A. Norton have proposed that all symposium papers should be submitted, with a view to publication, to the Proceedings of the *I.R.E.* In view of the favorable attitude of the I.R.E., the Steering Committee of the Symposium urges that all participants send their manuscripts to the Technical Editor, Mr. E. K. Gannett, as soon as possible but, in any case, not later than February 15, 1957.

The plans for the (pre-publication) symposium record are unchanged. If participants wish to have their papers reproduced for the meeting, they should prepare their manuscripts in the following form:

1. Type single space with 1½" margins
2. Use 8-1/2" x 11" bond
3. Make report no longer than about 10 pages, including diagrams (this restriction does not apply for the manuscripts sent to the I.R.E.)
4. Insert and mount diagrams appropriately in the text
5. Number pages in pencil only
6. Include an abstract or short summary

The above material should be sent to James R. Wait, National Bureau of Standards, Boulder Laboratories, Boulder, Colorado, by November 30th.

The participants then have the following choices:

1. Send their manuscript to the I.R.E. directly and an *additional* manuscript to Boulder for the record
2. Send their manuscript to Boulder where it will be reproduced for the record and then communicated to the I.R.E.
3. Send their manuscript or an extended summary to Boulder for the record only if they have made other plans for final publication, or if their material has already been reported elsewhere.

PAPERS ACCEPTED TO DATE

1. "Some Physical Problems in the Generation and Propagation of V.L.F. Radiation" by E. L. Hill, Dept. of Physics, University of Minnesota.
2. "Studies of High Power V.L.F. Antennas" by W. Gustafson and E. Devaney, U.S. Navy Electronics Laboratory, San Diego.
3. "Some Properties and Applications of the Magneto-Ionic Theory at V.L.F." by R. A. Helliwell, Radio Propagation Laboratory, Stanford University.
4. "The Relation Between Group Delay of a Whistler and the Distribution of Ionization Along the Ray Path" by R. L. Smith, Radio Propagation Laboratory, Stanford University.
5. "Measurement and Interpretation of the Polarization and Angle of Arrival of Whistlers" by J. H. Crary, Radio Propagation Laboratory, Stanford University.
6. "The Effect of the Earth's Magnetic Field on the Transmission and Reflection of V.L.F. Waves at the Lower Edge of the Ionosphere" by Irving Yabroff, Radio Propagation Laboratory, Stanford University.
7. "Records of V.L.F. Hiss at Boulder, Colorado During 1956" by J. M. Watts, National Bureau of Standards, Boulder.
8. "Extra-Terrestrial Origins of V.L.F. Signals" by Roger Gallet, National Bureau of Standards, Boulder.
9. "Extensions to the Geometrical Optics of Sky Wave Propagation at V.L.F." by James R. Wait and Anabeth Murphy, National Bureau of Standards, Boulder.
10. "Wave Guide Mode Calculations for V.L.F. Ionospheric Propagation Including the Influence of Ground Conductivity" by James R. Wait and Herbert H. Howe, National Bureau of Standards, Boulder
11. "A Study of Signal-Versus-Distance Data at V.L.F." by J.

L. Heritage and S. Weisbrod of Smyth Research Associates and J. E. Bickel of U. S. Navy Electronics Laborarory

12. "Basic Experimental Studies of the Magnetic Field of Electromagnetic Sources Immersed in a Semi-Infinite Conducting Medium" by M. B. Kraichman, U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Maryland.
13. "A Technique for the Rapid Analysis of Whistlers" by J. K. Grierson and L.R.O. Storey, Radio Physics Laboratory, Ottawa, Canada.
14. "A Method to Interpret the Dispersion Curves of Whistlers" by L.R.O. Storey, Radio Physics Laboratory, Ottawa, Canada.
15. "Relations Between the Character of Atmospherics and Their Place of Origin" by J. Chapman and E. T. Pierce, Cavendish Laboratory, Cambridge, England.
16. "Survey of Investigations of V.L.F. Propagation at Cambridge" by K.G. Budden, Cavendish Laboratory, Cambridge, England.
17. "A Study of V.L.F. Ground Wave Propagation in Alaska" by G. M. Stanley, Geophysical Institute, College, Alaska.
18. "The Phase and Group Velocity of the V.L.F. Ground Wave" by J. R. Johler, National Bureau of Standards, Boulder.
19. "Polarization of the Ground Wave of a Radio Atmospheric" by A. W. Sullivan, University of Florida.
20. "Noise Investigation at V.L.F. by the National Bureau of Standards" by W. Q. Crichlow, National Bureau of Standards, Boulder.
21. "Spectrum Analysis of Spherics" by W. Taylor, National Bureau of Standards, Boulder.
22. "Statistical Descriptions of Atmospheric Radio Noise" by A. D. Watt, National Bureau of Standards, Boulder.
23. "On the Polarization of Spherics" by A. G. Jean, National Bureau of Standards, Boulder.
24. "The Effect of Receiver Bandwidth on the Amplitude Distribution of V.L.F. Atmospheric Noise" by F. F. Fulton, Jr., National Bureau of Standards, Boulder.
25. "Our Present State of Knowledge of the Lower Ionosphere" by A. H. Waynick, Ionospheric Research Laboratory, State College, Pa.
26. "Heavy Ion Effects in Audio-Frequency Propagation" by C. O. Hines, Radio Physics Laboratory, Ottawa.
27. "Some Recent Measurements of Atmospheric Noise in Canada" by C. A. McKerrow, Radio Physics Laboratory, Ottawa.

MEETING NOTICES

October 26, Bureau of Standards, Boulder, Colo. ***Speakers*** Dr. William Culshaw, Bureau of Standards, Dr. John M. Richardson, Bureau of Standards. ***Subj:*** The use of Optical Techniques at Millimeter Wave Lengths.

November 9, Place in Denver to be announced. Ladies Night Program to be sponsored by Glenn L. Martin. The speaker will talk on some phase of Rocket work.

December 7, Place to be announced. ***Speaker*** Dr. Lind of the University of Colorado. ***Subj:*** Particle Accellators.

January 25, Place to be announced. ***Speaker*** Dr. K. G. Budden, Cavendish Laboratory, England ***Subj:*** Very Low Frequency Propagation

tropospheric propagation of radio signals, whose duties now will include engineering, logistics, and technical administration of the division.

Remaining in his position as consultant will be Dr. James R. Wait, theoretical physicist.

Named to a consultant position to do original research on microwave refractometers and special instruments relating to tropospheric effects on radio waves propagation is Dr. Moody C. Thompson who has been concerned with phase stability measurements in the microwave region and with radio-meteorological investigation of the troposphere.

Newly organized sections and their chiefs are as follows:

Data reduction instrumentation section concerned with developing data reduction techniques and systems with emphasis on automatic methods—Walter E. Johnson, formerly project leader with prime responsibilities in the design and development of special instrumentation for tropospheric propagation research.

Modulation systems section concerned with determination of the characteristics and limitations of various types of radio communication, navigation, and control systems—Arthur D. Watt, formerly carrying on studies of detailed statistical characteristics of atmospheric radio noise.

Navigation systems concerned with basic study of very low frequency propagation and its application to radio navigation systems—Gifford Hefley, formerly in charge of several projects in very low frequency radio propagation.

Radio Noise Section concerned with basic study of methods of measurement and measurement of radio noise on a world-wide basis in order to make accurate predictions of expected radio noise for all geographical locations—William Q. Crichlow, under whose supervision the new National Bureau of Standards' atmospheric radio noise recorder has been developed.

Tropospheric measurements concerned with development of equipment, systems, and techniques for measuring various factors affecting tropospheric propagation of radio waves, and with performing experiments which will relate the tropospheric effect to propagation—Charles F. Peterson, formerly engineer-in-charge of the Cheyenne Mountain field station, Colorado Springs, which comprises the major transmitting facilities for the tropospheric work.

Radio systems application engineering responsible for the application of tropospheric propagation research to specific problems of other governmental agencies and industry—Robert S. Kirby, formerly a project leader investigating terrain effects on tropospheric propagation.

Tropospheric analysis section responsible for the collection and descriptive analysis of radio and meteorological data, study and development of theories concerning the propagation of radio waves at very low and higher frequencies, and the use of appropriate theories to solve.

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NOTES & NEWS *(Continued)*

specific problems of service, interference, and frequency allocation for such agencies as the Federal Communications Commission, Civil Aeronautics Administration, Radio Technical Commission for America, and Air Navigation Development Board—Philip L. Rice, formerly project leader in charge of some phases of analysis of radio data and development of propagation theory.

PROJECT VANGUARD *(Cont. from p. 5)*

altitude airplane design. Triangulation measurements employing a satellite will permit more exact determination of the size of the earth and of the relative locations of the land masses. In addition, more complete information on solar radiation, cosmic ray intensity, dust concentration, and magnetic phenomena undoubtedly will be of great value to the meteorologist and the physicist.

"However," Mr. Felt concluded, "All of this relates to the attainment of short range objectives. The true significance of the project is that we have accepted a challenge to create something never before seen by man. Something to be used for the advancement of mankind by extending our knowledge of our environment. We have taken the first step in the exploration of the universe."

Project Vanguard is the name assigned to the Department of Defense logistical support of United States participation in the International Geophysical Year, July 1, 1957 to December 31, 1958, as announced by the White House on July 29, 1955. The Project was under-

taken at the request of the U. S. National Committee for the IGY, established by the National Academy of Sciences and the National Science Foundation, which are sponsoring U. S. Participation in the IGY.

Department of Defense support is on a three-service basis, with Navy management through the Chief of Naval Research, with the Naval Research Laboratory responsible for the technical program, which includes the three-stage launching vehicle, and the manufacturing, launching and radio-tracking of the earth satellite.

CHANGES IN MEMBERSHIP

New Members

J. C. Axtell	A
H. E. Bussey	SM
M. Hirai	M
S. T. Jacks	M
N. B. Kindig	S
R. G. Maras	M
P. L. McQuate	M
J. M. Richardson	SM
B. R. Rinn	A
L. E. Vogler	M
R. W. Wilber	M

Change in Status

C. C. Cook	M
F. F. Fulton, Jr.	M
H. R. Trukken	M
J. E. Watson	M

Transfer to Section

W. J. Byrne	M
J. M. Chapman	M
R. S. Cohen	M
A. E. Cole, Jr.	A
B. E. Cowart	M
G. E. Crawford	A
V. M. Davis	SM
Hau-Wong Ho	M
L. M. Hodson	A
R. R. Laird	S
R. O. Leighou	M
E. M. Lonsdale	SM
J. L. Martinez	A
A. G. Revilla	M
W. T. Steve	M
J. J. Tary	M

EDITOR ASKS FOR HELP

Your editor is asking tor help in gathering news items for the section bulletin. Please send any items that you think would be of interest to other members to the Decibel Address. The deadlines for issues are Winter, Dec. 15; Spring, Mar. 15; Summer, June 15; Fall, Sept. 15.

CALL FOR PAPERS

TECHNICAL PROGRAM

1957 IRE NATIONAL CONVENTION

MARCH 18-21, 1957

Waldorf-Astoria Hotel & New York Coliseum, New York City, N. Y.

DEADLINE DATE FOR RECEIPT OF PAPERS — NOVEMBER 2, 1956

NOTE: Original papers only shall be considered, not published or presented prior to the 1957 IRE National Convention.

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