PROFESSIONAL GROUP ON RADIO FREQUENCY INTERFERENCE

NEWSLETTER

Number 25 January 1963

SECOND RAD HAZ CONGRESS SCHEDULED:

The following advance notice of the Second "HERO" Congress is as follows: (Further information can be obtained from Mr. Gunther Cohn, The Franklin Institute, Philadelphia 3, Penna.)

Announcing the
SECOND HERO CONGRESS
On Hazards of Electromagnetic Radiation to Ordnance
Sponsored by
U.S. Naval Weapons Laboratory, Dahlgren, Va.

When and Where

The Congress will be held at The Franklin Institute, Philadelphia, Pennsylvania, on Tuesday, Wednesday and Thursday, 30 April, 1-2 May 1963.

Objectives

The purpose of this Congress is to review the present state of knowledge of the hazards to ordnance from environmental radio frequency fields. Particular emphasis will be placed on the many advances which have been made in this area as a result of increased interest and effort since the First HERO Congress in May 1961. The program will include progress of current investigations, surveys and discussions of new ideas, techniques, components and materials, and anticipation of future needs. It is believed that the Congress will provide for exchange of information and ideas, stimulate efforts toward early solutions to present problems, help to identify new problem areas, serve as a means of reviewing over-all program objectives and provide, in the proceedings, a state-of-the-art report.

Agenda

The agenda will include presentations of formal papers and informal discussion periods. Proceedings will be mailed to attendees shortly after the meeting. The following subjects are tentatively scheduled:

- Relation of Current Test Results to RF Hazard
  - Laboratory and Field Tests
  - Theory and Prediction
- RF Fixes
  - Approaches - Discrimination, new initiator concepts
  - Attenuation Materials
  - Filters
  - Design
- Evaluation and Instrumentation
- Other Related Hazards

Security Clearance

Secret security clearance and, in case of non-government organizations, certification of need-to-know by the cognizant military agency will be required for attendance.

Further Information

FURTHER DETAILS, SECURITY FORMS, AND HOTEL RESERVATIONS INFORMATION WILL BE MAILED DIRECTLY BY THE FRANKLIN INSTITUTE AT A LATER DATE.

Los Angeles Chapter Holds EMI Control and Interface Design Meeting:

Two talks were given at the January 17th meeting of PTGRFI, Engineers' Club, Los Angeles. Fred J. Nichols, President, Genistron, Inc. spoke on "The Future of Electromagnetic Interference Control" and stated that "today there is great need for EMI programs to prevent the deterioration of present and future weapon systems, as well as military and commercial communication systems. The near complete collapse of harmonic controls on pulse emitters, such as radar systems, has led to the establishment of ECAC (Electromagnetic Compatibility Analysis Center) and unless proper recognition of other EMI problems are forthcoming, there will be further needs of expensive programs typical to ECAC."

Thomas H. Herring, Senior Project Engineer, Genistron, Inc., discussed "Designing The Structure-Circuit Interface". He said that the subject of this design problem is the gray area between pure circuit conductors and pure structural metal. He called attention to the fact that circuit energy is never totally confined to the explicit conductors of the breadboard stage, nor to the idealized circuit paths of the circuit schematic. A portion of circuit current will flow through nearby metallic parts such as shields, conduit, armor, brackets, hangars, beams, etc. It is postualted that the electrical nature of these fabrications will affect individual circuit and integrated system performance and that the general manner of this effect is substantially independent of circuitry grounding. Thus, the electrical designers must develop criteria for the interface region as the circuit design progresses, and as the structure design progresses. It is the job of management to recognize the existence of the interface design problem, and the responsibility of the specialist to assist in setting criteria. This paper will attempt to describe the problem and its general method of solution well enough to alert those who may be concerned."

Questionnaire Sent to Attendees at 6th Armour Conference:

Tabulation of Questionnaires

Total number of questionnaires returned: 404
Members of PGRFI 305
Non-members of PGRFI 99

	Members	Percent	Non-Members	Percent	Total	Percent
Age						
20-30 yrs. old	39	9.7%	19	4.6%	58	14.3%
30-40 " "	138	34.2%	57	14.1%	195	48.3%
40-50 " "	79	19.6%	15	3.7%	94	23.3%
50-60 " "	30	7.4%	8	2.0%	38	9.4%
60-70 " "	9	2.2%	-	-	9	2.2%
no reply	8	2.0%	2	0.5%	10	2.5%
Employed by						
Government	58	14.4%	17	4.2%	75	18.6%
Consulting	18	4.5%	5	1.2%	23	5.7%
University	15	3.7%	7	1.7%	22	5.4%
Large Company	92	22.8 %	49	12.1%	141	34.9%
Small Company	113	28.0%	21	5.2%	134	33.2%
no reply	7	1.7%	2	0.5%	9	2.2%
Degrees Received						
No degrees	37	9.2%	22	5.5%	59	14.7%
B. S.	243	60.3%	78	19.3%	321	79.6%
M. S.	67	16.6%	16	4.0%	83	20.6%
Ph. D.	15	3.7%	2	0.5%	17	4.2%

(Continued)

	Members	Percent	Non-Members	Percent	Total	Percent
Those with Publications or Patents	102	25.3%	23	5.7%	125	31.0%
No. of Publications	611+	151.5%	48+	11.9%	659+	163.0%
No. of Patents	456+	113.0%	22+	5.5%	478+	118.5%
Years RFI Experience						
1 to 5 yrs.	Does not appear		62	62.6%	62	62.6%
5 to 10 yrs.	on members'		15	15.1%	15	15.1%
10 to 20 yrs.	questionnaire		18	18.2%	18	18.2%
no reply			4	4.1%	4	4.1%

Results of EIA Questionnaire on RFI:

EIA M-5.8 RFI SUBCOMMITTEE QUESTIONNAIRE

		Yes	No
Does your company have an "in house" RFI program for the design and testing of electronic equipment to be certain that it meets or surpasses RFI levels specified?		28	7
Does your company have an individual or group responsible for RFI coordination?		24	10
Have you been informed about the DOD Radio Frequency Compatibility Program?		24	10
Does your company have measurement facilities adequate to determine the electronic equipment spectrum signatures required by DOD-RFCP (MIL-S-449)?		22	8
Does your company use outside RFI consultants to handle all your RFI problems?		4	30
In bidding on electronic equipment and systems, does your company breakout and show the effort which will be expended for RFI proofing and compatibility?		12	20
If a system designers' guide to help insure electromagnetic compatibility is prepared by EIA, would you purchase it?		30	2
Of your company's manufactured electronic products, what percent are sold to the Military?	Over 75%	22	
	Over 50%	7	
	Over 25%	4	
	Less than 25%	4	
	Under 5%	1	

4th NATIONAL SYMPOSIUM REPORTS PROFIT TO ADMINISTRATIVE COMMITTEE

Herman Garlan, chairman of PTGRFI, sent the following letter to the members of the Administrative Committee:

"Our Fourth National Symposium on RFI held in San Francisco on June 28-29, 1962 under the able chairmanship of Peter Spencer was an unqualified success. After repaying the loan of $500, the Symposium showed an excess of income over expenditures of $1367. This amount has now been credited to the account of PTGRFI.

"It is a real pleasure to send you a copy of the Final Report covering the activities of Mr. Spencer and his committee in achieving this success."

INTERFERENCE CONTROL In RECEIVER DESIGN:

Research/Development, December, 1962, carries a 4-page article by Robert L. Collard, Design Engineer, Sparton Electronics, Division of Sparton Corporation, under the above title. It is a tutorial type article.

NOMOGRAM For TRANSFORMING EFFECTIVE ANTENNA NOISE FIGURE:

Technical Note 18-14, National Bureau of Standards, titled: "Quarterly Radio Noise Data March, April, May 1962 and Corrigendum for Technical Notes 18-1 Through 18-11" by W. Q. Crichlow, R. T. Disney and M. A. Jenkins, contains a nomogram for transforming effective antenna noise figure to noise field strength as a function of frequency. The frequency in the nomogram goes from .01 to 100 megacycles.

ITEMS OF INTEREST IN PROCEEDINGS OF THE IRE, DECEMBER 1962:

Properties of 400 Mcps Long-Distance Tropospheric Circuits

Under the above title is a paper by J. H. Chisholm, W. E. Morrow, Jr., B. E. Nichols, of the Lincoln Laboratory, M.I.T., Lexington, Mass., J. F. Roche, of Sylvania Electronics Systems Division, Amherst, N. Y., and A. E. Teachman, of Jansky and Bailey, Washington, D. C. The summary states:

"Summary - Measurements are reported on beyond-the-horizon propagation losses at 400 Mcps. Data are given on the losses and their variations from 98 to 830 mi beyond the horizon. The transmission loss between isotropic antennas varies from about 190 db at 100 mi to about 300 db at 800 mi distance. Also described are measurements of frequency-selective fading, space diversity, and variations in the angle of arrival of the signals."

The section on Lightning Interference is as follows:

"In general, it is considered that lightning has little effect on UHF communications. It is true, however, that the radio frequency spectrum of lightning extends into the UHF band. The energy levels are very low but are far from insignificant in relation to cosmic noise which, in the end, limits the useful gain of highly sensitive receivers at these frequencies. The results of observations made at Winston-Salem and Elberton (618 and 830 mi) show that lightning may cause some difficulty on marginal, long-distance tropospheric communication circuits.

"On one occasion, lightning bursts caused by a storm located over Winston-Salem were recorded at Elberton, a distance of 210 mi. On May 30, 1956, high-speed graphic recordings were made of lightning bursts caused by several storms ranging from 125 to 225 mi distant from Winston-Salem along the axis of the receiving antenna beam. At that time, the transmitter was not in operation. Four of the more spectacular bursts recorded are shown in Fig. 39. Each graphic presentation is for a time period of five sec and shows the bursts that are received simultaneously with the system using the 28-ft and 60-ft antennas. The time constant of the system was approximately 10 msec. During many hours of recording at Winston-Salem, there was only one period when signal enhancements were observed that could be attributed to scattering of the transmitted signal from ionized lightning trails. Several other investigators have reported results which appear to indicate that this phenomenon is possible.

"In order to obtain some statistical values of the character of these noise bursts caused by lightning on an active day, the recordings obtained for May 30, 1956, were processed for distributions of the amplitudes and durations of the noise bursts. A distribution of the time durations of the noise bursts is shown in Fig. 40. The median burst length is 0.75 sec, and for 1 per cent of the time the duration exceeds 2 sec. The distribution of peak power levels for the noise bursts is given in Fig. 41 which shows 255 simultaneous cases for the 28-ft and 60-ft antennas."

The Use of a Paraboloidal Reflector of Small Focal Ratio as a Low-Noise Antenna System

Under the "Correspondence" section, page 2483, is a letter by I. I. K. Pauliny-Toth, National Radio Astronomy Observatory, Green Bank, W. Va., I. R. Shakeshaft and R. Wielebinski, Mullard Radio Astronomy Observatory, Cavendish Laboratory, Cambridge, England. Part of the first paragraph is as follows:

"The recent developments in the design of low-noise amplifiers for very high frequencies have made it

necessary to consider ways of reducing the other contributions to the input noise of a receiving system. One of these is ground radiation received in the 'spillover' lobes of the antenna reception pattern and for a paraboloidal reflector of comparatively large focal ratio a typical value for the noise temperature attributable to ground radiation is 20° K....."

On the Two-Generator Method (e_n, i_n) of Noise Characterization

A letter under the above title by Harry F. Cooke, Central Research Lab., Texas Instruments, Inc., Dallas, Texas, "Correspondence" section, page 2520. The first paragraph states:

"A system of noise measurement first proposed by Rothe has been gaining popularity recently as a method for noise characterization of transistors at low frequencies. The form of Rothe's system most often used replaces the noisy fourpole with a noiseless fourpole plus a series-input voltage generator and a parallet-input current generator.

ITEMS OF INTEREST IN MICROWAVES JANUARY 1963:

Low-Noise Measurement with High-Noise Receivers

Under the above title is an article by Koryu Ishii, Associate Professor, Marquette University, Milwaukee, Wisconsin. The sub-title and first paragraph state:

"A closerlook at the mathematics of noise suggests that noise figure can be derived from power ratio. This principle is here applied in a novel method.....

"Easily measured scope displays obtained with high-noise test equipment can be used for accurate computation of low-noise figures. For example, the 5-db noise figure of a millimeter-wave klystron was determined with a 40-db auxiliary receiver. This technique is applicable to similar measurements of any low-noise component or system."

Special Coaxial Cables

Under the above title is a product survey by Alan Serchuk, New Products Editor. The sub-title states:

"Need more than a standard, RG-type cable? This month's product survey lists 65. They are arranged into 15 categories, covering such types as high-power, low-noise, phase-compensated and critical impedance coax."

Extracts of interest are as follows:

"How Noise is Reduced

"All cables, when flexed, generate noise voltages. Amplitudes up to 500 mv have been observed. Noise cannot be designed out of a cable but it can be reduced. This is done by applying a conductive coating (aquadag) between the insulator and the outer conductor. The coating carries off noise-producing static charges caused by friction between the dielectric and the braid. The coating may result in some additional attenuation.

"When specifying minimum noise level to the manufacturer, the user should also specify the amount of flexing the cable is expected to endure. It would help to learn how closely the manufacturer's testing procedures relate to the cable's operating conditions. Rigid and semi-rigid cables are less apt to generate noise than flexible cable.

"Three Ways to Improve Shielding"

"Coaxial cable is inherently shielded by its outer conductor. However, when carrying low-level signals or when operating in a high-field environment, this shielding may not be sufficient. Shielding can be improved as follows: If a second shield is woven over the outer conductor of a given flexible cable, shielding is improved by about 10 or 15 db. Insulating the two shields from each other provides about 20 db of total attenuation. If the two shields are replaced by a solid sheath, the attenuation will be perhaps 60 db greater than in ordinary cable.

"Still another shielding method is to use flat strips instead of wire to form the braided outer shield. This construction can also yield a copper saving of 20 to 30 per cent over a solid sheath construction....."

SAE BECOMING ACTIVE In EMC:

Because so many members of the Society of Automotive Engineers are mechanical engineers and do not have time to read electronic literature, SAE Committee AE-4 has been reactivated with the following scope:

"The SAE Radio Interference Committee (AE-4) provides a technical, coordinative and advisory function in the field of aeronautical radio interference. Electrical and electronic accessories in aircraft and aircraft propulsion systems are studied for compatibility within the systems and with various communications media. Engineering standards, specifications and technical reports are developed and issued for the general information of the Aerospace Industry.

"When problems arise within the Committee which overlap into areas not within the scope of the Committee, a liaison will be established with other technical groups actively cognizant in those areas."

As many members of PTGRFI, in turn, do not have access to the SAE communications, the following extracts from SAE correspondence and questionnaires are being reprinted for the information of members of PTGRFI to help in establishing more mutual understanding. The first extracts are from the letter of transmittal of the referenced questionnaire. Subsequent checking of appropriate letters has been omitted after being included in the first item.

"Subject: Radio Interference Measurement and Suppression

"Dear Sir:

"A special panel of the SAE Committee AE-4 recently completed a study of the several methods of measurement, suppression limits, terms and definitions and design requirements that might be encountered in a hypothetical aeronautics system including sub-systems such as ground support equipment, power packages and electrical and electronic accessories.

"Twenty-three Government specifications relating to radio interference were tabulated. Admittedly the imaginary system was tailored to encompass this formidable collection of documents but it dramatically illustrates the situation a systems manager might be required to solve when considering a new program.

"Real work is initiated by such a preponderance of paper. Dissimilar terms, variations in measurement methods, the use of up to six different parameters to define limits and a lack of agreement on fundamental definitions and pertinent wording requires extensive coordinative work between the contractor and the branch of the Military Services involved. A need for cooperative engineering action by Industry and the Military Service is indicated. Delineation and agreement in many areas is clearly required.

"As a result of this study, the Committee has prepared the attached questionnaire for circulation to persons in the Aerospace Industry and the Military Services. Also enclosed is an agenda and announcement of a meeting to be held in Chicago on October 30, 1962. The primary objective of this meeting is to develop a program on the subject of 'Radio Interference' to be presented at an Engineering Forum in connection with the Spring Aeronautic and Space Engineering meetings next April....."

Questionnaire

The attached statements and list of Government specifications relate to the subject of radio interference.

It is proposed that the SAE Committee on Radio Interference prepare industry standards, technical information reports and recommended practices on terminology, definitions, methods of measurement and limits of suppression under different measuring parameters as a cooperative engineering contribution to the Aerospace Industry.

Please indicate your association, experience and interest with each item by checking the appropriate letters.

A - Am familiar with item.
B - Am not familiar with item.
C - Believe industry documentation would be useful.
D - Do not believe industry documentation would be useful.
E - Would actively participate in committee work.
F - Have no interest.

Multiple checking may be used, e.g. B-C-E would signify that you are not familiar with the item but believe industry review and documentation would be useful and you would participate in the committee's action on the item.

1. Specification Review:

The following block of Government specifications are inter-related under a complete aeronautic system. Definitions, terms, limits and methods vary and in some cases are contradictory. It is proposed to relate these variables and clarify the contradictions with the preparation of an SAE Aerospace Standard for Radio Interference Definitions and Terminology and an Aerospace Information Report for Methods and Limits of Measurement, Radio Interference.

Please indicate your interest by checking the appropriate letters:

	A B C D E F
MIL-STD-202B	Test methods for Electronic and Electrical Components Parts (SIGC-BUSHIPS-USAF)
MIL-STD-220A	Method of Insertion-loss Measurement(SIGC)
MIL-STD-285	Attenuation Measurement for Enclosures
MIL-STD-449A	Measurement of R. F. Spectrum Characteristics (SIGC-BUSHIPS-USAF)
MIL-STD-704	Characteristics and Utilization of Aircraft Electrical Power
MIL-E-4473C	Shielding of Components Containing Magnets for Air Shipment
MIL-E-4957A(ASG)	Electromagnetic Shielding Enclsoures (BUWEP-USAF)
MIL-E-5007B) MIL-E-5009B) MIL-E-5010B)	Aircraft Turbojet Engines, Qualification and Acceptance (USAF-BUWEP-ATC)
MIL-I-6051A	Interference Limits and Methods of Measurements, Electrical and Electronic Installation in Airborne Weapon Systems and Associated Equipment
MIL-I-6181D	Interference Control Requirements, Aircraft Equipment (SIGC-BUWEP-USAF)
MIL-T-9107	Preparation of Test Reports (USAF)
MIL-S-10379A	Radio Interference Suppression for Vehicles (sub-assemblies) (EOT-SIGC-USAF)
MIL-I-11683A	Radio Interference Suppression for Engine Generators and Miscellaneous Engines (EMTOQ-AMC-SIGC-BUSHIPS-USAF)
MIL-C-11693	Capacitors, Feedthrough, Suppression, AC-DC
MIL-I-11748B	Interference Reduction for Electrical and Electronic Equipment (SIGC)
MIL-S-12348	Radio Interference Suppression, Railways and Maintenance of Ways Equipment (SIGC-BUDOCKS-USAF-BUSHIPS)
MIL-C-12889	Radio Interference Reduction for Capacitors, paper dielectric AC-DC, hermetically sealed
MIL-S-12944	Resistors, suppressors, ignition interference
MIL-F-15733	Filters, Radio Interference
MIL-I-16910A	Radio Interference Measurement, Methods and Limits
MIL-I-26600	Interference Control Requirements, Aeronautical Equipment

2. Susceptibility Limits

A need exists for a technical study of susceptibility requirements which would realistically recognize cases which may not be compatible with published limits. This would include solide state devices (SCR and transistor circuits), thermal and low signal level circuits (temperature measuring, fire control and telemetry), different limits for high and low impedance circuits and the degree of susceptibility of electrical and electronic devices to short duration noise.

3. Squibs, Fused-wire and Pyrotechnic Devices

This is an expansion of the susceptibility limits under Item 2. It is a special case which would require specific consideration of noise field strengths and time of duration as well as the more generally recognized parameters connected with the usual electrical and electronic circuitry.

4. Line Stabilization Networks

An Aerospace Information Report and possibly an Aerospace Standard would be produced which would explain the purpose and intent as well as the differences in circuitry and definitions presently existing on this device. Also included would be a method for measuring the characteristics (input impedance vs. frequency) of the various networks now considered "standard".

5. Short Life Equipment

Many devices are now designed for "one shot" applications. In some cases, the device does not possess the life expectancy to completely run a spectrum signature test. Recognition of this limitation and the preparation of an adequate measuring technique is required.

6. Conducted Interference

Special cases exist where the input voltage rating of the device under test is lower than the required conducted interference test voltage (3 volts rms over 50-15,000 cps in MIL-I-26600). A technical explanation and recommendation meeting this seeming paradox would assist designers and managers.

7. Tutorial Information

Radio interference is becoming an important "incidental" to fundamentally mechanical designs. It is proposed that the Committee issue Aerospace Information Reports on the major areas of interest to designers and development people who are primarily with an electro-mechanical device. These areas would include the application of filters, feedthrough capacitors, electro-magnetic shielding, wire dressing, etc.

8. Engineering Forum

The Committee is planning to sponsor an Engineering Forum at the Spring Aeronautic and Space Meetings next April. A program is being developed under the following general headings:

1. Impact that new Government specifications will have on future design planning.
2. Importance of radio interference consideration in early stages of design.
3. Measurement techniques.
4. Preparation and dessemination of tutored information to designers.
5. Specialized technical subjects (filters, shielding, wire and cable dressing, etc.)

In order to assure an interesting and diverse program, the Committee is asking for suggestions on subject matter and areas of interest not covered in the tentative program.

Please indicate whether you are (are not) interested in this program. Your suggestions for improvements to the program may be addressed directly to the Chairman of the Committee.

9. Suggested Projects

Please list briefly any phase of radio interference that you would consider a suitable project for Committee action. The Committee will welcome and acknowledge all suggestions for improving the understanding of radio interference in its many areas.

Upon completion of the questionnaire, please mail one copy to the address below. It is important to the future program of the Committee that you indicate your interests in the subject of radio interference.

Charles M. Dean, Chairman
Society of Automotive Engineers, Inc.
Committee AE4, Radio Interference
485 Lexington Avenue
New York 17, New York
c/o Mr. Henry Martin

NAVY RADIO RECEIVING FACILITY MOVED TO SUGAR GROVE

Navy Communication Facility Will Use West Virginia Site

Plans to relocate radio receiving facilities from their present location in the U. S. Navy Communication Center, Cheltenham, Maryland, to Sugar Grove, West Virginia, were announced today by the Department of Defense.

Radio reception at the Cheltenham site has suffered increasing degradation of performance because of the rapid metropolitan expansion into Prince Georges County and the growth in conflicting activity at Andrews Air Force Base. Sugar Grove, on the other hand, offers a quiet, isolated location, ideal for receiving high frequency radio signals.

The relocation plan would permit partial utilization of the facilities at Sugar Grove, originally designed for establishment of a 600 foot radio telescope, work on which has been terminated because of advances in related fields of science and technology not foreseen.

The new plans contemplate activation during Calendar Year 1964. It is expected that 80 military and 10 civilian posts will be required to man the new facility. The reduction in operations at Cheltenham, Maryland, would release 47 military and 5 civilian personnel from duties presently performed there. This involves only a small proportion of the present manpower at that station.

Other uses of the Sugar Grove site are under study.

FCC REORGANIZES FIELD ENGINEERING And MONITORING:

Field Engineering and Monitoring Reorganization

By Order, the Commission changed the name of its Field Engineering and Monitoring Bureau to Field Engineering Bureau and reorganized its present four divisions (Field Operating, Engineering, Monitoring, and Inspection and Examination) into three divisions -- Field Offices, Monitoring Systems, and Engineering and Facilities -- under a continued Office of the Chief of the bureau. The change will be effective March 1.

The Field Offices Division will consist of three branches -- Operator and Examination, Inspection and Measurements, and Investigation and Certification. The 24 district offices, 4 suboffices, 2 marine offices and 3 mobile TV units will report to the division head.

The Monitoring Systems Division will also have three branches -- Operations, Methods and Review, and Contracts and Liaison. The monitoring stations (now 18) will report to the division chief.

The Engineering and Facilities Division will likewise have three branches -- Standards and Facilities, Antenna Survey, and Equipment Construction and Installation. The latter activity will continue to be located at Powder Springs, Ga.

Simplification of the bureau's name was on Commission initiation; the functional division set-up was recommended by the Booz, Allen & Hamilton organization survey of the FCC for the Bureau of the Budget.

A COMPARISON Of R-F SHIELDING MATERIALS:

Electronic Industries, December 1962, page 106, has a page and a half article under the above heading by Norman H. Cale, Metallurgical Engineer, Anaconda American Brass Co., R & D Center, Waterbury 20, Conn. A Table of comparative db attenuation data on commonly used RFI shielding materials is given from 500 Kc to 10,000 Mc. The materials tested were: Galvanized steel 22 ga.; aluminum sheet 0.026 in.; copper mesh No. 22; electro-sheet copper 1-oz.; electro-sheet copper 4-oz.; electro-sheet copper 7-oz.; and copper sheet ETP 16-oz.

ATMOSPHERIC RADIO NOISE, ARTICLE On:

Journal of Research, National Bureau of Standards - D. Radio Propagation, November-December 1962 carries an article titled: "Conversion of the Amplitude-Probability Distribution Function for Atmospheric Radio Noise From One Bandwidth to Another" by A. D. Spaulding, C. J. Roubique, and W. Q. Crichlow, Central Radio Propagation Laboratory, Boulder, Colorado. The sub-title states:

"The amplitude-probability distribution function of atmospheric radio noise can be predicted with reasonable accuracy for a given bandwidth using only the first two moments of the noise measured at that bandwidth. This paper presents a method for predicting this distribution function for any specified bandwidth from the moments of the noise measured at a particular bandwidth."

SHOTGUN MICROPHONES:

During President Kennedy's first televised press conference, viewers were attracted by a curious device sitting on the stage beside the lectern and resembling a machine gun.

The new device was a unidirectional microphone, Model 643, designed and manufactured by Electro-Voice, Inc., of Buchanan, Michigan. Because of its shape and operation, it is sometimes referred to as a "shotgun mike". It consists of a microphone element located in a large housing in the base of a seven foot tube. The long tube has nothing to do with the pickup of sound on axis but it serves to cancel out unwanted sound along the path of pickup, such as ambient noise and reverberation.

EASY-To-USE NOMOGRAPHS ELIMINATE FILTER CALCULATIONS:

Electronics, November 30, 1962, carries a four-page article under the above title by W. C. Sanders and B. E. Packham, Electronic Systems & Products Division, Martin Company, Baltimore, Maryland. The subhead and first two paragraphs state:

"Charts enable engineers to pick component values for constant-K and m-derived filters quickly and accurately. Technique handles both simple and composite designs.

"Filter design using standard equations usually involves long and tedious calculations. These nomographs make the design of constant-K and m-derived filter sections simple and fast.

"The nomographs have been made on the assumption that the input and output impedances to the filter sections are equal. The frequency range is from 1 cps to 500 Mc and impedance terminations from 3.5 ohms to 30 megohms. Values of m, for the m-derived sections, are plotted from 0.2 to 0.9. Composite filter design has been taken into account in the nomographs."

PROTECTING The SCIENCE Of RADIO ASTRONOMY:

SCIENCE, the magazine of the American Association for the Advancement of Science, in its 14 September 1962 issue, carried a 6-page article by John W. Findlay, deputy director of the National Radio Astronomy Observatory, Green Bank, West Virginia, under the above title. The sub-title and first paragraph are as follows:

"New uses of space may harm radio astronomy unless there is effective international protection.

"During the last few years radio astronomers of many countries have become concerned that their science may be in danger. The danger is that the radio spectrum will become so filled with signals that no space will be left for radio astronomers to use. This article describes and assesses this danger, tells something of the measures which have already been taken by international agree-

ment to protect radio astronomy, and describes what radio astronomers hope for in the future."

Over one page of the article is devoted to the kinds of radio interference which may be particularly damaging to radio astronomy.

READY-REFERENCE DATA SIMPLIFIES ANTENNA DESIGN:

Electronics, December 21st, 1962, carries an article under the above title by R. S. Gordon and K. W. Duncan, Sylvania Electronic Systems, East, 100 First Ave., Waltham, Mass. There are twelve types of antennas discussed. The sub-title and text are as follows:

"Tabulation of characteristics of fundamental antenna types as to function, application, formulas and operational considerations that suggests many new design possibilities.

"Comprehensive performance information on a broad range of antennas has only recently been assembled in literature. It is still a lengthy task to extract operating data for practical engineering problems. The most useful data in early stages of a design is a tabulation of possible antenna choices in terms of function, application, and formulas describing their performance.

"Many fundamental antenna types have been analyzed and their operating characteristics have been confirmed experimentally, but the data is spread over a large number of texts and professional publications. The material in this reference was assembled, and in some cases developed, to summarize this information and present it so as to offer the greatest utility for engineering practice. This is not intended to substitute for a detailed and rigorous literature treatment of any of the antennas, but to provide a concise survey of the possibilities available for a particular application.

"For all antennas types, a lossless condition has been assumed; thus making efficiency depend on specific materials of construction and individual environment. Note that gain values are all above an isotropic radiator and where values are shown as typical, they were obtained from reported or observed data."

RFI TEST CONCEPTS For COMPLEX SYSTEMS:

Under the above title is an article by R. B. Schulz, Boeing Company, Seattle, Washington, and A. Eckersley, United Control Corporation, Seattle, Washington, in the January 4, 1963, issue of Electronic Design. The sub-title states:

"Test methods are not spelled out in the military specifications for electromagnetic compatibility of subsystems. Concepts suggested here will aid the engineer who must demonstrate compliance with these specifications."

RADIO FREQUENCY INTERFERENCE REPORT 1963 - 1970:

Under the above title, Signal, January, 1963, contains an article by Jean Jolkovski, president, GLM Associates, Inc., of slightly over one page. The future prediction part of the article is as follows:

"There will be much similarity between frequency surveillance techniques and aircraft control techniques, although the amounts of data are orders of magnitude apart.

"In the time ahead while plans are being drawn for an integrated frequency surveillance net there will be interim improvements in measuring instruments in the field of RFI. Broadband spectrum analysis will replace single frequency devices in an attempt to move closer to real-time analysis and practical solution.

"It is interesting to note that the biggest problem in RFI reduction will lie in the domain of data processing. We now have 300 mc wide spectrum analyzers, but the data output saturates the human who is assigned to observe. Instantaneous comparison of all emissions with an assignment chart transcends human capability. The next seven years, then, will see the application of new design techniques to reduce interference at the receiver and the integration of RF and digital equipment for analysis and control.

"Interestingly enough, we have the capability to perform the individual tasks within the present art. We require application rather than true development. New devices may accelerate our progress to a frequency assignment utopia; it would appear, however, that we can move far in this direction without innovation."

THE TEMPLETON CASE:

The increasing interest in "The Templeton Case" a story about a mysterious interference signal to a TV station, QST, January 1963, has caused Paul B. Schreiber and his engineers to make a thorough investigation. Any member of PGRFI, who would like a reprint of the story and the solution, which they found, can obtain a copy by writing to Templeton Case, % Technical Wire Products, Inc., 129 Dermody Street, Cranford, New Jersey.

MINIMIZING INTERFERENCE From LORAN On 160 METERS:

Under the above title, QST for January, 1963, carries an article by Herbert Hoover, Jr., president of the American Radio Relay League, 38 LaSalle Road, West Hartford, Connecticut. The first two paragraphs are as follows:

"Amateur activity on the 160-meter band has experienced a substantial increase in the last year or so, primarily because of improved transmitting conditions during the present phase of the sun-spot cycle. Furthermore, there is every reason to believe that 'top band' activity will continue to grow as conditions further improve during the next few years.

"One of the discouraging things about operation on 160 meters is the ear-splitting interference from loran in this part of the spectrum. The interference is especially bothersome during contacts between the East and West coasts. West Coast stations, for example, must listen for the East on 1800-1825 kc., which is the same part of the spectrum used by the West Coast loran transmitters. Conversely, East Coast stations must listen for the West on 1975-2000 kc. through the heavy interference from close-by loran transmitters in the same part of the band. The situation is not as bad as it might first appear, however, because a considerable amount - if not all - of this type of interference can be eliminated within the receiver. But before going into some of the methods of minimizing the interference, a brief mention of the nature of the loran signals themselves is in order."

HOW TO CHOOSE TRANSISTORS FOR LOW NOISE:

In Electronics, January 11, 1963, page 50, is a reference sheet by John L. Wilkerson, Hughes Aircraft Co., Los Angeles, California, under the above title. The first three paragraphs state:

"The guesswork in choosing the proper transistor for low-noise circuits is eliminated by the method outlined here.

"Since noise figure is a function of emitter current - and there is an emitter current that gives minimum noise - a transistor with optimum noise figure can be chosen based on emitter-current characteristics.

"The method consists of finding an expression for the noise figure, differentiating it with respect to emitter current, and setting the result to zero. The solution is the best emitter current for least noise."

FAIL-SAFE SQUELCH CIRCUIT Adapts to Changing Noise Levels:

Under the above title, Electronics, January 4, 1963, carries

a 4-page article by H. G. Michael, Space Craft, Inc., 8620 South Memorial Parkway, Huntsville, Alabama. The sub-title states:

"Here is a squelch circuit designed for point-to-point vhf and uhf receivers. It is self-adaptive to changing noise levels and receiver gain. It has smooth, noiseless, on-off transition ideal for use in remote unattended receivers, in aircraft, or in mobile communications."

STANDARDIZING NOISE-FIGURE MEASUREMENT:

Under the above title, Electronics, January 4, 1963, carries a 2-page article by Thomas E. Gausman, Electronic Tube Division, Sylvania Electric Products, Inc., Emporium, Pa. The sub-title and first paragraph state:

"Long sought r-f amplifier technique gives 95 percent repeatability.

"Noise-figure measuring technique having 95 percent repeatability was recently devised by the Noise Advisory Group of the Electronics Industry Association. This group, a subcommittee of EIA's Joint Electronic Devices Engineering Committee, (JEDC), will present complete specifications in a forthcoming JEDC publication..."

Armour Proceedings, Availability of

In response to many inquiries as to the availability of back issues of the Proceedings of the Armour Conferences, John J. Egli, USSCEL, Fort Monmouth, N. J. has very kindly supplied us with the following information:

USSCEL still has about 15 copies of 3rd Conference
60 " " 6th "
20 " " 7th "

Requests, by companies only, should be made to SEL-RA/GFE

ASTIA can furnish copies, Unclassified, as follows:

1st	Conference	AD-76-686
3rd	"	AD-234-211
4th	"	AD-234-212
5th	"	AD-235-099
6th	"	AD-253-015
7th	"	(Number not available)
	Classified	
5th	"	AD-321-150C
6th	"	AD-322-472C

Department of Commerce has the following:

1, 3, 4, 5, 7 and 6th is being sent.
(Can be ordered by title)

The Proceedings of the 2nd Conference seem to be entirely out of print. It has 368 pages.

Voltage Breakdown Vs Altitude:

Research/Development, January, 1963, carries an article by Frank L. Bonem, Associate Editor, under the title "Developing High Altitude Miniature Connectors". This article describes the work of the Amphenol-Borg Electronics Corporation in trying to develop such a connector. Extracts from the article are as follows:

"Any reduction in air density is accompanied by a reduction in its dielectric strength, and at higher altitudes, entrapped air in an electrical connector will have a tendency to leak out, thus lowering the inside air density and reducing the voltage safety factor. If the entrapped air contains moisture, a decrease in temperature causes condensation on the dielectric surfaces, leading directly to electrical failure. Even if the initially trapped air were dry, altitude cycling could result in external moisture being drawn in, resulting in similar effects....

"One interesting observation while testing components under vacuum was the discovery of the pin-hole leaks in Teflon wire insulation."

NEW PRODUCTS:

Strip-Line Wiring Used in Low-Noise UHF Front End

Electronic Design, December 6, 1962, page 22, has a 2-column story under the above title. The first two paragraphs are:

"A low-noise front end for a dual-channel uhf receiver has been built with strip-line, rather than coaxial, circuitry.

"The equipment consists of a high-level single-side-band modulator with two outputs, and two balanced mixers. It forms the front end of a tropospheric-scatter direction-finding system. The receiver was developed by engineers of Aircraft Armaments, Inc., Cockeysville, Md."

Spectrum Analyzer Measures Power Density

Microwaves, December, 1962, page 26, has an article which describes G.E.'s new portable broad-band analyzer. The first two paragraphs are:

"A portable broad-band analyzer that displays the power density spectrum as well as the video spectrum, originally developed for checking ECM jammers, is available for laboratory and production line test applications. A frequency range from 45 to 11,000 Mc is covered by seven plug-in heads.

"Designed by General Electric's Light Military Electronics Dept., Utica, N. Y., the unit directly measures absolute power density in watts per megacycle to $\pm$ 1 db, and detects 'holes' as small as 1 Mc in all bands."

Practical Brushless Motor Developed

A brushless motor, claimed to be the first one developed for practical use by industry, is now being produced in fhp ranges and up to 2 full hp by Lamb Electric Division of Ametek Inc., Kent, Ohio. Lamb is calling the new motor the "Komlectro brushless motor" to emphasize that it commutates electronically without brushes or a commutator. The new motor uses transistors, or in some cases, silicon controlled rectifiers, to change current direction, a function normally performed by the replaced commutator. When current passes through the main motor windings, a magnetic flux is created which produces a voltage in the unit's feedback winding. This voltage provides the switching action in the transistors or rectifiers. The circuit consists of a center tapped main winding to act both as an oscillator coil and as the main winding. A feedback winding is added to provide for alternate switching of the transistors. In addition, a starting winding is inserted as is common in all single-phase induction motors. Advantages reported for the new motor include: 1) no cyclic limitations, 2) no limiting centrifugal force on speed (no commutators to possibly fly apart), 3) elimination of brush life problem, 4) no arcing problems between brush and commutator, 5) reduced electrical noise and radio interference, 6) reduced acoustical noise, 7) elimination of bulky a-c supply, 8) reduced maintenance, 9) longer motor life, and 10) wide variation of speed control characteristics.

NEW PUBLICATIONS:

RF Interference Control Handbook:

Howard W. Sams & Co., Inc., Indianapolis 6, Indiana, has brought out a 224-page book under the above title. The Library of Congress catalog card number is 62-21404 and the price is $6.95. The chapter headings are as follows:

Chapter 1. Theory of RF Interference
Chapter 2. Interference Measurements
Chapter 3. Interference-Measuring Equipment
Chapter 4. Measurement Problems
Chapter 5. Electrical-Circuit Noise
Chapter 6. Semiconductor-Circuit Interference
Chapter 7. Switches and Contactors
Chapter 8. Suppression Techniques
Chapter 9. Suppression in Rotating Machinery

Chapter 10. Suppression in Ignition Systems
Chapter 11. Suppression at the System Level

Aircraft Reflections at VHF and UHF:

The National Bureau of Standards has made a translation from the German of a paper by Dr. J. Grosskopf, Fermeldetechnisches Zentralamt der Deutschen Bundespost, under the above title. It discusses interference patters from 100 Mc/s to 10 Gc/s and for operational or experimental path distances between 30 and 700 kilometers. The publication is Technical Report No. 5565 and may be obtained from the National Bureau of Standards, Boulder Laboratories, Boulder, Colorado.

JAMES M. BRIDGES TALKS TO MANAGEMENT ON EMC:

James M. Bridges, Director, Office of Electronics, ODDR&E, spoke before the Boston Chapters of PGMIL, PGCS and the Lex/Con Chapter of AFCEA with New England members of PGRFI invited, on January 16, 1963, at Hanscom Field, Bedford, Mass. His talk was directed at the impact of the DOD EMC program on industry and what management would have to do to benefit from the program. High-lights of the talk are as follows:

"It is extremely important that there be a better understanding throughout the military, industry, and the engineering profession of the serious nature of the problem, its complexity and the actions being taken throughout the DOD to cope with it...

"In recent years, electromagnetic compatibility has become a problem of major operational, management and engineering significance to our armed forces. In fact, to the tactical commander of military forces employing different types of weapons, detection systems and communication equipments, all radiating electromagnetic energy in the same general geographical area, often in the same part of the r.f. spectrum, the problem could become so serious as to threaten the overall operational effectiveness of his forces....

"This evening I want to tell you a little about what this program is and what its objectives are. But more particularly, I want to discuss what its implications may be to the industry developing and producing military electronic equipments and systems that radiate or receive electromagnetic energy....

"OBJECTIVES OF DOD EMC PROGRAM:

"The first, and most urgent, is to determine quantitatively the amount of operational degradation resulting from mutual interference that might be encountered in currently envisioned operational situations....

"The second objective is the development of improved frequency management methods and procedures....

"The third - and in the long run perhaps the most important - objective is the establishment of information sources that will provide the developer of a new weapon or equipment with a complete definition of the electronic environment in which his weapon or system will be required to operate, and the development of specifications, engineering methods and test procedures that will make it possible and feasible for him to design initially so that his equipment or system will operate compatibly with the other electronic devices in its operational environment.

"The DOD EMC Program, directed toward the achievement of these three primary objectives, has two major divisions; one operational in nature and the other research and development oriented.

"The operational area of the Program includes the following major efforts:

1. Collection of Spectrum Signatures.
2. Assembly of an Environmental File.
3. Development of Propagation Profiles.
4. Prediction of the EMI Situation that May Exist in Specified Operational Areas.

"On the research and development side of the Program, several things are going on.

1. Development of Improved Measurement Techniques and Test Equipment.
2. A Component Development and Improvement Program.
3. Development of Engineering Specifications and Standards Applying to EMC.
4. Development of Simulation Methods and Equipment.
5. An Educational Program to inform personnel at all levels of operations and management in both the military and industry of all aspects of EMC.....

"Now in addition to the four specific needs of the EMC Program that I havejustdiscussed - data file, simulation methods and equipment, specifications and standards, and improved instrumentation and test equipment - three management tasks remain to be performed before we can actually contract for specified EMC performance.

"First, we need to educate many people in the military services and in industry, from management levels down, concerning all aspects of the electromagnetic compatibility problem - its nature; its importance to our national security; and the management, engineering and operational factors involved in its solution.

"In our reliability-improvement program, the educational effort was for a long time confined mainly to technical people, and, it was not until the top management people in both industry and the military departments were fully informed, that progress really began. We should learn from this experience to start our educational campaign on EMC at the highest levels of management.

"Second, I think that industry (as it generally did in the reliability program) should immediately begin to centralize responsibility for EMC at management level within company organizational structures....

"Third, I believe that companies in the defense electronics business could profitably introduce training courses in EMC for design engineers.

"Let me earnestly assure you that the problem of electromagnetic interference is of great concern to us in government, and we are very serious in supporting the EMC Program as a measure to cope with it...."

Editorial Note:

This is the first issue of an expanded Newsletter - expanded, that is, to try to inform PGRFI members as to what is going on in the whole EMC field. Your editor would greatly appreciate being informed of other EMC activities and any new disciplines which may be being drawn in.

Rexford Daniels, Editor
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Concord, Massachusetts
