PROFESSIONAL GROUP ON RADIO FREQUENCY INTERFERENCE

NEWSLETTER

Number 21 May 1962

PLANS FOR 4th NATIONAL PGRFI SYMPOSIUM:

Planning for the 4th National Symposium of PGRFI is now in its final stages. The Symposium, which will take place at the new Town House Motel, in San Francisco, on June 28 and 29, 1962, has as its theme "Design - The Answer to RFI". The material for presentation has been carefully selected from submissions of unequalled abundance and high quality. The program will include the following technical sessions:

Session I - "The New Government Specifications and Their Influence on Design" - Moderator: Leonard Milton, Filtron Company, Inc.

Session IIA - "Measurement Techniques and Equipments" Chairman: Fred J. Nichols, Genistron, Inc. - Coordinator: James Spagon, Filtron Company, Inc.

Session IIB - "Design Analysis" - Chairman: Albert R. Kall, Ark Electronics Corporation - Coordinator: Floyd V. Lewis, Sylvania Elec. Def. Labs.

Session IIIA - "Electromagnetic Interference Control Programs" - Chairman: Sidney Vogelman, Capehart Corporation - Coordinator: Guy Ottinger, Lockheed Missiles and Space Div.

Session IIIB - "Equipment Design" - Chairman: O. P. Schreiber, Technical Wire Products, Inc. - Coordinator: R. H. Stone, General Electric Company.

Session IVA - "Design Techniques for Interference Suppression" - Chairman: C. David Lundeen, Boeing Airplane Co. - Coordinator: Fred Barline, Lockheed Aircraft Corporation.

Session IVB - "Susceptibility and Near Field Effects" - Chairman: Ralph M. Showers, University of Pennsylvania - Coordinator: S. Perry Booker, Cooke Engineering Company.

Donald R. J. White, of White Electromagnetics, Inc., will speak at the luncheon on June 29th on the subject of "New Influences on Design Techniques Resulting from Electromagnetic Compatibility Requirements". In addition, two other talks will be delivered. The keynote address will deal with the importance of RFI considerations in preliminary design and with new concepts to be used in design to insure freedom from interference. The banquet speech will deal with the basic relationship (or lack of it) between engineering education and the requirements for an effective approach to signal compatibility.

1000 word summaries will be available for attendees. Advance program will be mailed to all PGRFI members.

WRITE-UP of IRE PANEL DISCUSSION:

A write-up of the PGRFI-PGMIL Panel Discussion, at the IRE Convention, by Ken Stein is reprinted by permission from Electronic News of March 29, 1962:

"The real payoff on the Defense Department's electromagnetic compatibility program will probably come within a few years with the writing of firm requirements for interference reduction into contract specifications.

"This statement was made yesterday by James M. Bridges, defense research and engineering, the Pentagon, Washington, who spoke as a member of a five-man panel at a session of the International Convention of the Institute of Radio Engineers.

"The session drew approximately 450 engineers to the Grand Ballroom here, many of them contributing to a lively question and answer period which followed the formal presentations.

"In reply to a question, Mr. Bridges told Electronic News he hopes to accomplish the writing of firm RFI specs into contracts within a couple of years.

"But we cannot do this until we have proper measurement standards, Mr. Bridges declared.

"He pointed out that MIL-STD-449A is a measurement technique, not a standard.

"Earlier, both military and commercial aspects of RFI had been discussed by a panel consisting of Brig. Gen. John A. McDavid, USAF, director of communications - electronics, Joint Chiefs of Staff; Maj. Gen. F. L. Ankelbrandt (USAF, Ret.), Radio Corp. of America, Camden, N. J.; Donald G. Fink, Philco Corp., Philadelphia and Richard Gifford, Communications Products department, General Electric Co., Lynchburg, Va.

"G. F. Metcalf of G. E., originally listed as a speaker, was replaced by Mr. Gifford. The session was chaired by Frederick R. Lack, Southport, Conn., a retired vice-president of Western Electric Company.

Describes Center

"A majority of the questions from the floor were directed to Gen. McDavid, who described DOD's Electronic Compatibility Analysis Center, Annapolis, Md., in his prepared talk.

"Staffed by engineers and mathematicians, ECAC is set up to conduct compatibility analysis with data in two major categories: Spectrum signatures, or specialized information indicating certain emission and susceptibility capabilities of particular electronic equipment relative to unintentional interference, and environmental data, Gen. McDavid said.

"Environmental data provides information on equipment deployment and operational characteristics, General McDavid explained.

"The major effort of the center is to establish techniques for analyzing existing and potential compatibility problems; evaluate the degree of degradation experienced by equipment, and to make recommendation directed toward the improvement of over-all system performance, the General said.

"During the question and answer period, several queries involved the use of ECAC information by the electronics industry, both by firms engaged in Government contract work and those not engaged in such efforts.

"The work of ECAC will be available to the industry, General McDavid said, but the specific means have not yet been decided. However, he added, it will probably be distributed in a manner similar to the DOD compatibility standard MIL-STD-449A.

"In addition, the General declared, defense contractors can visit the center to get detailed information and make full use of its facilities.

"With respect to non-military producers, he said: 'We feel we will have to get into non-Government compatibility requirements sometime in the future, particularly regarding possible interference with military counter-measures.

Military Needs Pressing

"The General pointed out, however, that military needs are more immediate.

"General McDavid predicted that a requirement to make spectrum signatures will be written into every military contract in the future, and added that a spectrum signature catalog will probably be published in the future.

"Speaking of the implications of the ECAC operation, General McDavid said he anticipated that the center's analytical results will not only 'provide an indication of over-all performance of existing systems, but will suggest techniques that might be employed to reduce or eliminate equipment degradation due to interference.'

"In addition, he said, compatibility analysis of equipment under development can be a design aid by pointing out which equipment characteristics need improvement.

"General Ankenbrandt, in his prepared talk, pointed out that the 'cost' of radio frequency interference to non-Government users is 'really not very great,' equalling about 5 to 10 per cent of the total capital investment involved.

"In the main, problems of interference can be worked around or through or over among non-Government users, General Ankenbrandt said.

"Engineering has solved the problems on a practical basis in this type of service, including mobile and broadcast, General Ankenbrandt declared.

"The real problem of RFI is in the 45 per cent of the spectrum available to the United States which is used by the military in defense, the General declared. In this type of equipment, we do not have stable services enabling the engineering out of problems, he added.

50% of Bandwidth Unavailable

"General Ankenbrandt had pointed out that some 50 per cent of the available bandwidth in the United States is devoted to non-Government services. The other 50 per cent is used by Government services, of which 45 per cent are military, he added. The remainder includes all other Government services, such as National Aeronautics and Space Administration, Federal Aviation Agency and other agencies.

"Costs of RFI have been 'tremendous,' General Ankenbrandt said, in terms of system degradation, development expenses, operating costs and the cost of redundancy.

"We suspect that Russia and her allies have similar problems, and are possibly more dependent than we are on radio communications, General Ankenbrandt said.

"The problem of obtaining valid spectrum signatures for non-Government transmitting facilities cropped up several times during the discussion.

"It was pointed out at one point that the Federal Communications Commission's budget is not adequate to provide such information. Data collection for a spectrum signature on a single radar system can cost $50,000, General McDavid said during the discussion.

"We have already scanned the FCC files for spectrum signature information. The information contained there is not adequate for gathering spectrum signatures, General McDavid declared.

"A steadily increasing 'blanket' of noise gradually creeping upward in frequency was described by Richard Gifford of General Electric Co.'s Communications Products department, Lynchburg, Va.

"The 'noise smog' over our metropolitan centers is definitely increasing, he declared, and means must be found to get data from the National Bureau of Standards, the FCC and Government and industry laboratories.

"Mr. Gifford called for standardization in the collection of interference data. He illustrated his talk with slides of typical noise situations in the high frequencies caused by interference from land mobile transmitters, industrial noise and automobile noise.

"Donald Fink, who also pointed out that background noise is increasing every year, called for techniques that would permit smaller guard bands between frequency assignments, more precise control of radio frequency and more efficient modulation techniques.

"He pointed out that in certain techniques, such as tropospheric scatter, the interference range of a transmitter greatly exceeds its useful service range.

Additional Highlights of the Panel Discussion on "ELECTROMAGNETIC COMPATIBILITY-ITS SIGNIFICANCE to OUR SURVIVAL"

The following are notes made of remarks by the speakers and have not yet been checked with them for accuracy:

Mr. Donald G. Fink - Philco Corporation, Philadelphia, Pa.

"The background noise and interference in the spectrum has been increasing with every year. In part this is due to noise over which the FCC and national policy does not attempt to assert jurisdiction. This is industrial noise and the type of incidental white noise radiation which are brought out from transmitters but which do not appear in the Rules and Regulations of the FCC with respect to the control of interference."

"And of course we must realize that the use of radio, the open spectrum, is not to be encouraged where non-radio uses, namely, controlled by wave guides or wires or light pipes, or whatever, will do the same job as well, possibly even cheaper, even though the conveninece and present patterns may have to be somewhat disrupted in making the change."

"Things have gotten to such a pass that the Congress has finally, if you read the papers as I read them, decided to make the public a partner in spectrum conservation...."

Mr. R. P. Gifford - General Electric Co., Lynchburg, Va.

"Man-made noise is our own petard. It is essentially a waste product of the age of electricity....."

".....we run the risk of some day smothering out the utility of that part of the radio spectrum that is most useful for mobiles services, as mentioned by Don, with a blanket of noise that appears to be creeping up continually in frequency."

".....In Europe there are verystringent controls on various elements of electrical equipment and these are items that we may have to start applying here in an ever tightening range over the next ten years in order to control this growth of man-made noise."

Gen. F. L. Ankenbrandt - RCA, Camden, N. J. -

"Now, what is the real problem, then, of RFI? As I see it, as a military man, I think it is clearly over on this 45 per cent side of the house, which the military use for the defense of the United States and the free world. Over on that side you don't have the stable services that you have in the non-

Government uses, you don't have the things that you can engineer yourself out of all of these troubles, or where you can shift frequency on an organized basis, and so on, nearly as well. Tremendous systems have come into being since World War II and they have had to be fitted in to a space where nothing was before essentially. Great flexibility is needed in these systems. Many of them are hastily installed, they are moved around frequently. The power is generally higher than in comparable commercial systems, where you are able to get a service on less power....."

Mr. J. M. Bridges - Defense Research and Engineering, Pentagon, Washington, D. C. -

".....If we can bear in mind the fact that these equipments do have to work together, that they have to be compatible, I think there are a lot of new technologies that are going to help."

".....we find the only way we can really do something about reliability in a problem of this kind is to specify it and not pay if they don't produce and I think we are going to do the same thing eventually in this business of all the things in this area, and I think within the next I hope very few years we will be putting them on a contract with firm specifications for this thing. I hope in a few years we will be putting firm requirements in our contract specifications."

Brig. Gen. John A. McDavid - Communications-Electronics, Joint Staff-Joint Chiefs of Staff, Washington, D. C.

"Then I think that the design standards that we are setting up for the military can become design standards for other than the military. An example of this is the radar engineering standards that we are preparing. It is under preparation. We don't really know how we are going to publish this yet but we just want to give you an idea of how the ECAC started and in a sense give you the complete answers as to how these things are going to be published. They will be published and if you keep your ear to the ground I am sure you will not miss them."

RECENT CHAPTER MEETINGS:

Los Angeles Chapter — January 18, 1962

"Commentary and Film 'Electromagnetic Interference Ashore'" - by Don Clark, USN Civil Engineering Lab.

"Trends in RFI Instrumentation" - by Richard R. Stoddart, Stoddart Aircraft Radio Co.

Los Angeles Chapter — March 15, 1962

"Electromagnetic Interference and the RFI Engineer's Responsibilities" - by George Burkhardt & Hal Schultz, Hughes Aircraft Co.

"Initiating an Electromagnetic Interference Control Program" by William Lash, Douglas Aircraft Co.

Philadelphia Chapter — February 20, 1962

"Recent Activities in RFI Control" - by A. R. Kall, Ark Electronics Corp., R. Sugerman, American Electronics Lab., F. Hamell, General Electric Co.

Washington, D. C. Chapter — December 19, 1961

"Scoring Criteria for Determining RFI Damage to Communication - Electronics System" - by Dr. R. J. White, White Electromagnetics, Inc., Bethesda, Md.

Washington, D. C. Chapter — March 20, 1962

"EIA Moves to Simplify RFI Specifications" - by Delmar C. Ports, Jansky and Bailey.

Electronic Daily Prints Editorial on "THE RFI WAR":

Electronic Daily has given permission to reprint the following Editorial from the March 28, 1962 issue, by Robert Haavind, and titled "The RFI War":

"One war now being waged that deserves support if the war on rfi. the battle lines in this fight against increasing spectrum contamination will be drawn at today's panel session on 'Electromagnetic Compatibility - Its Significance to our Survival' at 10 am in the Grand Ballroom of the Waldorf. Let's hope that the design engineer, and just as important, his management, take some time today to sit in on this vital discussion.

"Discussions of rfi are not new. People have been talking about doing something about it for a long time. But as of now it appears that plenty of action can be expected in the near future, particularly from the military. Higher and higher power radar and communications systems, bounce techniques, and a steadily increasing stream of electronic equipment into operation throughout the world all have added to the congestion of the airwaves.

"The solution to the problem is obvious. Rfi can be beaten with better design practices, more engineering time, more and better test equipment and better components. All of these things cost money, however, and unless the desired results are absolutely demanded by users, the manufacturers of equipment will continue to cut corners.

"One stumbling block to adequate rfi performance has been the lack of detailed data on spurious emission. The present DOD electromagnetic compatibility program should make a good start in the direction of correcting this deficiency. Once detailed requirements can be spelled out in system and equipment specifications, manufacturers will have to prepare to meet them. Some of the key problems they will face in doing this should be spelled out at today's panel.

"One problem that still must be solved is the establishment of a supreme national authority in the rfi field. At present the special interests of government, military and civilian communications are being protected by separate groups.

"As international communications techniques advance the worldwide integration of spectrum allocation and rfi requirements will also require attention. The best method of coordinating all national activities for present and future public interest is to assign a directorate charged with this single responsibility.

"This directorate must be given the power to enforce necessary requirements despite opposition of powerful private interests in some cases. In addition it must be backed by the technical competence to make far-sighted judgements. This calls for laboratory facilities with the best possible equipment and skilled specialists.

"These are requirements that call for the backing of the highest officials and financial investemnt sufficient to accomplish the necessary task. As the title of today's panel suggests, these are not just spur-of-the-moment demands, but are rather a necessary step to avoid an impossible electromagnetic snarl in the future. Big problems must be faced both by government and industry if this job is to be done, but the stakes are so high the long-continued talks must now be translated into immediate action."

Radio Frequency Interference and Industrial Heating Equipment:

Under the title, "Radio Frequency Interference", R. B. McDowell, president of McDowell Electronics, Inc., has written a 78 page, loose-leaf, book confined to interference caused by radiation from both induction heating equipment and dielectric heat sealing equipment.

Chapter (I) outlines the hazard problems caused by radio frequency interference to aircraft navigation instruments, how these instruments function, and how they can be affected by fundamental or harmonic signals radiated from industrial electronic heating equipment.

Chapter (II) contains the FCC Rules and Regulations, Part 18 covering Industrial, Scientific and Medical Services.

Chapter (III) outlines the suppression techniques and includes information on How to Construct a Screen Room; Circuitry Suppression Techniques, and How to Eliminate Other Sources of Radiation Amplification.

Chapter (IV) outlines the test procedure, step-by-step, that is necessary for certification and gives actual illustrations.

Copies of the above book can be obtained from R. B. McDowell, McDowell Elec., Inc., 105 Forrest St., Metuchen, N. J., Price $3.50.

MICROELECTRONICS DESIGN DECISIONS:

Under the heading "Some Practical Shielding Solutions", Electronic Design, February 15, 1962, carries one column of a 3-page article on several shielding methods for microcircuits.

RADIO FREQUENCY INTERFERENCE CONTROL:

Under the above title was an article in the Rochester, N.Y. Section's bulletin "The Communicator" by Frank Ellis, General Dynamics/Electronics, February, 1962, issue. It is a 4-page article which discusses the basic need for imposing interference limits on all electronic equipment and the reasons for it, and the advantages of working with engineers from the early design stages through the first unit stage and the performance of tests to supplement calculations of interference levels.

MEET MR. RAFRIN:

Electro International, Annapolis, Maryland, has personalized RAdio FRequency INterference in their advertising as "Mr. RAFRIN." It is obvious that Mr. RAFRIN is going to lead a very interesting life. One of their advertisements is on page 61 of Electronic Design, March 1, 1962.

COPING WITH RFI and INTERACTION in SILICON-CONTROLLED-RECTIFIER CIRCUITS:

In Electronic Design, March 1st, 1962, is an article by Etto E. Von Zastrow, Application Engineer, Rectifier Components Dept., General Electric Co., Auburn, N.Y., under the above title. The sub-title states:

"Radio frequency interference, a problem everywhere it appears, also can plague engineers working with silicon-controlled rectifiers. Here are some circuit tips and suggestions for alleviating the nuisance."

NOMOGRAM for RESISTOR CURRENT-NOISE INDEX:

Under the above title is a nomogram by J. G. Curtis, Senior Applications Engineer, Corning Electronic Components, Corning Glass Works, Bradford, Pa., in the March 15, 1962 issue of Electronic Design. The first paragraph states:

"Measurement of the resistor-noise index is simplified by this nomogram. Several such nomograms can be constructed for various nominal values of resistance using the simple template described below."

HEWLETT-PACKARD DISCUSSES "COMMON-MODE PICKUP":

In the Hewlett-Packard Journal, Feb. 1962, Vol. 13, No. 6, is a discussion of the high rejection of hum and noise in their new digital voltmeter. That part, which is especially applicable to those interested in this subject, is as follows:

"The Noise Problem

Hum pickup and other noise on the measured signal can reduce the reliability of reading of digital voltmeters of the commonly-used successive approximation or ramp types. Since these types of circuits measure the input signal at a specific instant in time, they will be in error by the magnitude of any noise present at the instant of measurement. A third type of digital voltmeter, the continuous-balance type, is likely to 'hunt' for, but never reach, an answer when noise signals are present at the time of measurement.

"The most frequent source of noise is power line pickup or hum which results from having two grounds in the system - one at the signal source and the other at the voltmeter. This effect is known as common-mode pickup, because one end of the equivalent humgenerator is common to both sides of the input signal pair. Common-mode pickup will cause a voltage to appear at the voltmeter input which can easily be as large as the signal itself, resulting in a completely erroneous reading. A voltmeter with a conventional floating input can reduce common-mode pickup to some extent, but it is limited in its effectiveness by the capacitance between the measuring circuit and the instrument chassis. Current injection from the voltmeter power supply is also a problem with this type of instrument. Use of a heavy ground bus or shield usually will not reduce common-mode pickup appreciably and may even increase it, due to magnetic pickup from the ground loop formed.

"The new voltmeter, however, incorporates a shield or 'guard' which completely isolates the floated measurement circuit from the main chassis. In effect, the guard breaks the common-mode loop. By operating the guard at the ac or dc potential at the source, the common-mode rejection (defined as the ratio between the common-mode signal and the voltage it causes to be superimposed on the source) exceeds 120 db at 60 cps and 160 db at dc. This performance applies for impedances as high as 1000 ohms between source ground and the low side of the voltmeter input.

"Besides its advantages in hum rejection, use of the guard circuit also results in a voltmeter than can be used directly withgrounded recording equipment without loss of the floated and guarded properties of the voltmeter input.

"Additional Noise Rejection

The effect of noise, common-mode, or single-ended, which is unavoidably superimposed on the signal is minimized by another feature of the voltmeter. This is that the voltmeter is designed to make its measurements by means of an integrating process. The amount of rejection that this process achieves for noise is substantial, although it varies with the noise frequency and the amount of time used for integration or averaging. Assuming that the peak noise does not exceed the dc signal level, averaging results in at least 20 db rejection at 55cps (0.1-second sample period) and, because the integral of a complete sine wave is zero, noise rejection is essentially infinite at 60 cps and other decade frequencies. The instrument's rejection of superimposed noise is shown in Fig. 4. For common-mode noise, the combined effect of guarding and averaging results in a rejection of more than 140 db at all frequencies. This can be demonstrated in a graphic way by noting that 100 volts of common-mode pickup causes less than 10 microvolts change in reading."

NARROW BANDWIDTH ANTENNA CUTS COSMIC NOISE:

In an article title "Space Communications" by George V. Kedrowsky of the Astro-Electronics Division, ASR&D Labs., Fort Monmouth, N.J., the following paragraph appears under the above title:

"Cosmic noise is most prevalent below 250 mc, while solar noise extends noticeably beyond 30,000 mc. As the frequency goes up, the brightness-temperature of the galaxy decreases. The major sources of galactic noise are the Milky Way and the sun. By using narrow-bandwidth antennas and the highest possible frequency, you can eliminate most of this interference.

"As receiver noise increases with frequency, it is a major factor in the selection of the operating frequency (Fig. 3). Solid-state amplifiers have greatly reduced the internal noise of receivers and should reduce it even more as design techniques are improved. Eventually the limiting factor will be the antenna temperature, which is determined by the external noise sources and the earth's black-body radiation entering the near radiation envelope of the antenna.

"For the near future, a system noise temperature of 40 deg K at 1.5 mc appears feasible.

"In our early attempts at space communications, tiny satellites had to be used that could carry only the barest minimum of equipment. The state of the transistor art at the time limited the available light-weight transmitters to less than 200 mc, and the available low-noise receivers were good only to about 600 mc.

"Today, we have efficient transmitters (fully transistorized except for the last stage) that operate up to 10 kmc. Such units have been used, for instance, in our lunar probes. Using

solid-state masers, we have built receivers with extremely low noise figures that work at over 1000 mc."

POWER COMPANIES PLAGUED by VOLTAGE CHANGES:

The power companies are finding increasing problems in the lack of a voltage standard for electronic equipment. The trouble seems to be that power companies cannot guarantee a voltage closer than 115 volts plus/minus 10 volts, and even then surges and faults will occur of greater magnitude. At present, electronic equipment has rated operating voltages varying from 110 to 120 volts which means possible damage to sensitive instrumentation which has no voltage regulation. If a piece of equip- has a printed voltage rating of, say 110 volts, and a surge went to 128 volts, the owners will come back on the power companies for any damage. Yet, on the same circuit, will be equipment rated at 120 volts. The power companies are wondering if the electronic industry could not decide on some common voltage standard and then they will know what to work to.

DETECTION of STATIC CHARGES in the OPERATING ROOM:

B. K. Sweeney Mfg. Co., Denver 16, Colorado, has published a ten-page Bulletin B-H-1170 on the generation of static in operating rooms. An excerpt is:

"Small static charges...are cumulative and may rapidly become high enough to be an explosion hazard in a flammable atmosphere. All objects that are properly grounded are positive in polarity...because the electron is negative by nature and a static generator actually is a generator of free electrons. Therefore, if all objects are properly grounded (positive), all electron-flow will be to ground and never allowed to build up on any surface."

FCC USING COMPUTER for INTERFERENCE CONTOURS:

The FCC is purchasing a computer to be used in its Washington, D. C. office to process applications in AM, FM and TV broadcasting. Among other uses will be automatic plotting of service and interference contours and the quick retrieval of information on all existing and pending communications facilities.

WHITE ELECTROMAGNETICS ISSUES TWO NEW BULLETINS:

White Electromagnetics, Inc., 4903 Auburn Ave., Bethesda 14, Md., has issued two new technical bulletins, as follows:

Vol. 2, No. 1 The Microwave Radiometer, January 1962, Part 1 - Some theoretical considerations and applications.

Vol. 2, No. 7 The Antenna as a filter element - December 1961

Copies of these bulletins can be obtained from Jane Stockham WEI Librarian, at the above address.

DR. H. L. HULL made DIRECTOR of FREDERICK RESEARCH:

Dr. Harvard L. Hull, President of Hull Associates, Chicago, Ill., has been elected to the Board of Directors of Frederick Research Corporation, Wheaton, Maryland.

EDWIN S. KESNEY joins RAY PROOF CORP:

Edwin S. Kesney has joined the staff of Ray Proof Corp., Stamford, Conn., a subsidiary of United Nuclear Corp., as sales manager for radio frequency shielding products, with the responsibility for basic improvements in the state of the art as applied to R. F. shielding of both build-in and prefabricated structures. Mr. Kesney was formerly assistant sales manager of Ace Engineering & Machine Co., Inc., Huntingdon Valley, Pa.

R. W. HANFORD joins WHITE ELECTROMAGNETICS:

Richard W. Hanford, formerly a member of the Technical Staff of Advanced Military Systems, RCA, has joined White Electromagnetics, Inc., Bethesda, Md., as vice president and Technical Director.

A. L. ALBIN joins FAIRCHILD CAMERA:

A. L. Albin has joined the Defense Products Division of the Fairchild Camera and Instrument Corporation, 300 Robbins Lane, Syosset, Long Island, New York, as manager of a newly formed Radio Frequency Interference Compatibility section. Prior to joining Fairchild, he was technical director of the System's Engineering Division of Filtron Corporation, Long Island, New York, and previously was an associate engineer at the Armour Research Foundation of the Illinois Institute of Technology in Chicago.

NOISE in PRECISION POTENTIOMETERS:

In a report on the three-day meeting of the Precision Potentiometer Manufacturers Association, last January in Hollywood, Florida, the April 1962 issue of Electromechanical Design carries a discussion of a G. E. Noise Study, as follows:

"Last year G. E.'s Armament and Control Section sponsored an investigation of precision potentiometer noise - its causes, its insidious nature and its effect on the computing system. Hildebrant reported that portion of the investigation conducted at G. E.'s General Engineering Lab. (Schenectady) dealing with causes of electrical noise in the sliding contacts of precision wire-wound pots. Noise in this case was defined as spurious variations in the resistance characteristic of the potentiometer.

"The noise characteristics of the pots were measured according to Specification MIL-NAS710 except that a visicorder was used in place of an oscilloscope to obtain a permanent record of noise. All pots throughout G. E. studies employed Karma type wire and Paliney 7 brush material. Although the investigation, Hildebrant pointed out, did not yield earth-shaking revelations or even attempt to consider all types of potentiometers or even come up with methods of corrective action, it was a good beginning because new and sound explanations came forth for erratic noise behavior. Here is Hildebrant's summary of the important aspects of the report as it pertains to noise in precision pots.

"1. Not all pots are noisy, Even in noisy ganged assemblies, some cups always remain quiet.

"2. The source of the noise is the contact between the brush and the resistance wire.

"3. If the position of the brush is disturbed, or if the surface of the winding is cleaned, the noise will disappear temporarily.

"4. The noise appears to be characteristic of certain areas of the resistance wire. If some action is taken to eliminate the noise temporarily, it always reappears in the same area of the wire. However, it is possible that the noise will continue to spread if conditions remain unfavorable.

"5. The amount of noise is affected by both temperature and humidity. At very high humidity, noise usually disappears completely. At low humidity, noise usually increases in intensity and in area. Production experience has shown that noise usually increases with decreasing temperature.

"6. There is considerable handling and handcrafting involved in the assembly of a potentiometer. Further, no one person makes a complete assembly; each worker is responsible for only one or two operations.

"These six items are fairly well substantiated facts and any plausible explanation for the noise must satisfy the limitations imposed by each of these.

"Table 1 lists possible causes of noise. While it is probably true that each of these items has, at one time, been shown to be the cause of noise in a particular pot, the results of these tests have eliminated most of these from consideration in explaining the pot failures G. E. had under test. None of the 'mechanical design effects' appear to be of primary importance since noise of this type can be stopped by cleaning or lubricating the potentiometers.

" 'Metallurgical effects' were not satisfactorily eliminated, but the fact that a lubricant solved the problem would seem to indicate that the structure or composition of the wire would not be sufficient to explain the results obtained. However, flaws in the wire surface still must be considered.

" 'Chemical effects' seem to be the most obvious reason for noise. The effects of humidity temperature and mechanical abrasion by brushing all points to a surface reaction film as responsible for noise. Although organic polymer has been shown to be responsible for problems on certain noble metal contacts, the noise experienced in G. E. 's tests was associated with specific areas of the nickel-chrome wires rather than the brush. In addition, these wires are generally covered with an organic lubricant and, yet, most cups are quiet throughout the life of the potentiometer. Inorganic films appear to be a much more likely candidate for trouble."

"Means of Alleviating Noise

"The results of G. E. 's work indicate three possible directions which could alleviate the noise problem:

"1) A change in the wire material to more noble metals.
"2) A better cleaning procedure for the wire before final assembly.
"3) Selection of a suitable lubricant and a system for resupplying fresh lubricant to the potentiometer at certain intervals.

"If a suitable technique can be developed for effectively cleaning the contact surface of the resistance wire before final assembly, a substantial reduction in noise rejects will be achieved. Cleaning does not mean washing off superficial films by solvent action but rather the removal of a small but finite amount of bulk material from the wire surface. This material removal is designed to eliminate such factors as corrosion films, traces of the wire drawing compounds and superficial 'skin' which can result from heat treatment during wire processing. According to Mr. L. H. Brown of LMED, a buffing process had been developed and used by G. E. when LMED made potentiometers. This is an excellent starting point.

"Once a proper contact surface has been prepared on the wire, the next problem is to provide a suitable lubricant and a means for resupplying the oil as it is depleted. The results obtained with the Versilube F-50 silicone have shown this to be a promising approach for lubrication, especially since this oil is effective over an extremely wide temperature range. Some wear evaluations comparing the performance of this oil with other contact lubricants will be required before a positive recommendation can be made.

"The extensiveness of G. E. 's studies on noise is a measure of the extent to which they feel that some problems can only be solved by this kind of cooperation between user and manufacturer. Moreover, G. E. tabulates - on a weekly basis - the percent rejection of pots in various phases of their use as well as the percent rejection of potentiometers versus the type and kind of failure. In this way they inform each vendor of his rejection rate and the manner in which his potentiometer failed."

NEPTUNE ORBIT OBSERVATORY:

A 2-page article under the above title in the December, 1961, issue of Analog Science Fact-Fiction does not seem to think much of earth satellite observatories. The final paragraph states:

"The Neptune Orbit Observatory would be far better than Earth-satellite observatories not only because of escaping the Sun's flood of similar radiation - but because Earth itself would be a shrieking, howling bedlam of radio transmissions."

"MORE on TVI"

Under the above title appears an article by Ed Geary in the March 15, 1962 issue of 10-4 Magazine, as follows:

"The problem of TVI (television interference) has diminished lately with the improvement of TV sets, as well as more efficient engineering of Citizens Band equipment. However, there are still situations in which TVI has to be remedied.

"Television interference may be caused by practically anything that uses electricity: amateur or CB radio; diathermy equipment; police and fire department radio equipment; aircraft radio; automotive ignition systems; commercial broadcasting stations; electrical motors; and even FM receivers. These and other causes have been known to burden the TV viewer with interference.

"Numerous cases of TVI are caused by either improper adjustment or inadequate design of the TV set, which can be traced back to a lack of selectivity in the television receiver. Manufacturers of most popular makes of TV receivers are aware that their products do not have the necessary degree of selectivity to operate in areas of high interference.

"In order to correct this problem many manufacturers of television sets will furnish owners with an electronic device known as a high-pass filter. Depending upon the year your TV set was purchased, these filters may be obtained free of charge by writing to the firm that made your set.

"If your TV set was purchased too many years ago to merit a free filter the manufacturer will charge a slight fee. High-pass filters can also be purchased at most well-equipped television dealers.

"Installation of a high-pass filter on your TV set is a fairly simple matter, as there is no rewiring or soldering to be done The filter connects to the back of the set between the antenna and the TV receiver.

"When writing to the manufacturer of the unit to request a high-pass filter be sure to give the model and serial number of your TV set and fully explain the nature of the interference

THREE-WEEK COURSE in RADIO PROPAGATION at BOULDER:

The Central Radio Propagation Laboratory, the Graduate School of the National Bureau of Standards in association with the University of Colorado, Boulder, Colorado, offer a three-week course in radio propagation, July 16-August 2, 1962. Two lectures are scheduled of interest to PGRFI:

10. Sources of Noise I
C. Gordon Little, Chief, Upper Atmosphere and Space Physics Division, NBS.
Antenna gain and noise temperature. Thermal noise, cosmic, solar, and planetary noise. Polarization and characteristics of various types of noise. Signal/noise and noise fact

11. Sources of Noise, II
William Q. Crichlow, Chief, Radio Noise Section, NBS.
Atmospherics and man-made noise.

For additional information write: Edmund H. Brown, Education Director, Boulder Laboratories, National Bureau of Standards, Boulder, Colorado.

LISTING of TESTING LABORATORIES:

At the Administrative Committee meeting, at the time of IRE Show in New York, the subject of listing the laboratori which would do testing and suppression work for outside cli was discussed. It was the opinion of many members of the Administrative Committee that such a listing, appearing in publication of PGRFI, would tend to convey approval of thos listed; also, it was felt that, if such a list was published, i should not be published more than once a year. It was felt that one of the requisites for listing would be the permaner association of a professional or registered engineer with a laboratory. A request is, therefore, made herewith to all those laboratories which have already sent in their data to send in the name of the registered engineer, or engineers, are permanently connected with the laboratory.

NAVY RFI HAZARDS PROGRAM EXPLAINED:

Under the title "Navy Radio Frequency Radiation Hazar Program", Glenn Heimer and K. Howard, Radiation Haza Group, Bureau of Ships, wrote a 3-page article for the Ap 1961, issue of Safety Review published by the Navy Depart ment, Office of Industrial Relations, Washington, D. C.

RF ENERGY STILL a HAZARD to BLASTING

On April 23, 1962, one out of three sticks of dynamite

detonated prematurely in an excavation for a water pipe in Concord, Mass. The work was being done directly under the glide path for Hanscom Field, Bedford, Mass. The Concord Journal had this to say about the explosion:

"A theory has been advanced that the possibility of an aircraft passing overhead at the moment and using its radio for landing instructions could have activated the charge, which is electrically touched off, and caused the explosion. This, however, is but a theory."

FCC To CHANGE RULE 15.206 ABOVE 70 MC/S:

In the Matter of Amendment of Part 15 - Incidental and Restricted - Radiation Devices -- Docket No. 14580

Notice of Proposed Rule Making

1. Notice is hereby given of proposed rule making to amend #15.206 of the Rules of the Federal Communications Commission as shown in the attached appendix to specify the details of operation above 70 Mc/s.

2. The limits on radiation of electromagnetic energy set forth in #15.206 attached are the same as those which are now in effect. The changes are in the maximum duration of each transmission and the minimum silent period between transmissions specified in paragraph (a) (3) of the proposed rules.

3. Under the rule now in effect, the duration of the transmission is limited to one second. Whether the duration of the transmission is one second or less, it may not be transmitted a second time until 30 seconds have expired. The proposed rule shortens the required quiet period to 10 seconds and reduces the maximum transmission period to 1/2 second.

4. The Commission believes that the rule as revised will more adequately accommodate signalling devices ordinarily operated on an unlicensed basis under #15.206, without increasing the interference potential of such devices. It appears that such devices could be operated effectively, and produced at no greater cost, if the maximum duration of the transmission is limited to 1/2 second. The reduction of the interval between transmissions, on the other hand, should be one of considerable convenience to the user of any such device.

5. The existing rule provides that the device must be equipped with automatic controls to maintain the required duty cycle. At least one manufacturer who has equipped his certificated product with such controls has also equipped it with an external slide switch which can be positioned to by-pass the controls and thereby obtain continuous operation. Any such arrangement is in conflict with the spirit and purpose of #15.206. Paragraph (a) (4) of the proposed rules is intended to prevent the certification of any device equipped with such external control.

6. The Commission anticipates that the proposed new requirements will apply to devices manufactured approximately two months following adoption of the final order. Low power communication devices which were manufactured prior to that time may continue to be operated under the present rules.

7. This proposal to amend #15.206 is issued under the authority of ## 4(i), 301, 303 (f), and 303 (r) of the Communications Act of 1934, as amended, and in accordance with the provisions of #4 of the Administrative Procedure Act.

8. Any interested person who is of the opinion that the proposed amendment should not be adopted in the form set forth herein, may file with the Commission on or before May 28, 1962, written data, views, or arguments setting forth his comments. Comments in support of these proposals may also be filed on or before the same date. Comments or briefs in reply to the original comments may be filed within 10 days from the last day for filing said original comments or briefs. In reaching its decision on the rule changes which are proposed herein, the Commission will not be limited to consideration of comments of record, but will take into account all relevant information obtained in any manner from informed sources.

9. In accordance with the provisions of #1.54 of the Commission's Rules, an original and 14 copies of all statements, briefs, or comment filed shall be furnished the Federal Communications Commission.

Federal Communications Commission
Ben F. Waple - Acting Secretary

Attachment: Appendix - Adopted: March 28, 1962 - Released: 3/29/62

APPENDIX

Section 15.206 is revised to read as follows:

#15.206 Operation above 70 Mc/s.

(a) A low power communication device may be operated on any frequency above 70 Mc/s, provided it complies with all of the following conditions:

(1) The radiated field on any frequency from 70 Mc/s to 1000 Mc/s does not exceed the limits specified for receivers in #15.62.

(2) The radiated field on any frequency above 1000 Mc/s does not exceed 500 microvolts per meter at a distance of 100 feet.

(3) The device is provided with means for automatically limiting operation so that the duration of each transmission shall not be greater than 1/2 second and the silent period between transmissions shall not be less than 10 seconds.

(4) The device shall be so constructed that there are no external or readily accessible controls which may be adjusted to permit operation in a manner inconsistent with the provisions of this paragraph.

(b) A low power communication device manufactured before 1962, may be operated on frequencies above 70 Mc/s if it meets the radiation requirements of paragraph (a) and is provided with means for automatically limiting operation to a duration of one second, not to occur more than once in 30 seconds.

INTERFERENCE CONTROL TECHNIQUES:

Under the above title, Sprague Electric Company, North Adams, Mass., has brought out a 32-page booklet known as Sprague Technical Paper No. 62-1, by the Staff of the Interference Control Field Service Department. It touches on all the high spots of interference control. It has 19 Figures and 27 Charts. Copies may be obtained by writing to Sidney L. Chertok, Manager, Advertising and Sales Promotion.

DESIGN of LOW NOISE TRANSISTOR CIRCUITS:

In the Letters Section of Electronic Design, March 29, 1962, pages 36-37, is a discussion of William A. Rheinfelder's three-part article on "Low Noise Transistor Circuit Design". Mr. Rheinfelder gives some interesting reasons for apparent discrepancies.

THEORY and EFFECTS of WHITE NOISE DISCUSSED:

Solitron Devices, Inc., Norwood, N.J., has issued a 16-page manual on white noise diodes. In the manual is a discussion of the theory and effects of white noise as produced by the "Soundvister" diode. Graph traces characteristic of the four basic noise diode types and two classifying circuits are described as well as specifications for nine different white noise types and for two random noise amplifier models.

ELIMINATING PICKUP NOISE in TEST EQUIPMENT:

In the April 12, 1962 issue of Electronic Design appears Part I of an article under the above title by George Golick, Kearfott Div., General Precision, Inc., Little Falls, N.J. The sub-head states:

"A specialist in fairly complex military test systems takes an admittedly elementary approach to pickup noise in the belief that it will be of most immediate benefit to engineers. In Part 1, he defines the sources of noise pickup and tells how each can be minimized. In Part 2, he will show how the engineer can use wiring diagrams to pass solutions on to the technician, and how a complex system can be wired

for minimum pickup."

FILTRON PUBLISHES RF INFORMATION BULLETIN:

A Radio Frequency Information bulletin is published by the Filtron Co., Inc., 131-15 Fowler Ave., Flushing 55, N.Y., on various aspects of their work in this field. Copies of the bulletin may be had by writing to Mr. J. Arlt at the above address.

STATUS of SPECTRUM SIGNATURE MEASUREMENTS:

A 17-page paper by H.M. Sachs, of the Electromagnetic Compatibility Analysis Center, Annapolis, Maryland, under the above title, was presented at the DOD Seminar on Electromagnetic Compatibility Program Technical Problems, Fort Huachuca, Arizona, on 14 February 1962. Copies of the paper may be obtained by writing to Mr. Sachs at Annapolis.

Impulse Noise Blankers - A Positive Approach to the Ignition Noise Problem in Mobile Radio Receivers:

Under the above title, J. A. McCormick, G.E. Communications Product Development, Lynchburg, Va., presented a paper at a meeting of the Washington Chapter of PGVC. It was subsequently published in the April issue of Communications Horizons Magazine. Copies may be obtained from Mr. McCormick, Manager, Mobile System Sales, Mountain View Road, G.E., Lynchburg, Va., and requesting G. E. publication ECX-87.

WESTERN UNION SPENDS MONEY on RFI:

According to Electronic News, April 16, 1962: "Western Union Telegraph Co. here has spent some $3 million to solve RF interference and station siting problems for relay stations in its $56 million coast-to-coast microwave beam system, Electronic News was told last week."

BIBLIOGRAPHY ON AURORAL RADIO WAVE PROPAGATION:

The National Bureau of Standards, Boulder, Colorado, has published a bibliography under the above title. The introduction states:

"The present compilation is presented as the third of a series of bibliographies in preparation by Meteorological and Geoastrophysical Abstracts for the Boulder Laboratories of the National Bureau of Standards.

"Several such bibliographies, all on the general subject of electromagnetic (radio) wave propagation in the atmosphere or ionosphere, are being published in the NBS, Technical Notes Series. The first bibliography entitled "Bibliography on Ionospheric Propagation of Radio Waves (1923-1960)" was published in October 1960, as NBS, Technical Note, No. 84, and is available from United States Department of Commerce, Office of Technical Services, Washington 25, D.C. (PB 161585). Price $7.00. It contains 1404 references, mostly annotated. The second: "Bibliography on Meteoric Radio Wave Propagation", containing 368 items, was published in May 1961 as NBS Technical Note No. 94 (PB 161595). Price $2.75.

"Similar bibliographies in preparation on "Radio Astronomy" and on "Tropospheric Propagation of Radio Waves" will be published in 62.

"The present compilation is made up of about 300 abstracts or titles from the literature published during the period 1893-1961. It is thus only a portion of the international literature on radio-auroral research. Omissions of pertinent papers are involuntary and it will be greatly appreciated if brought to our attention so they may be included in future supplements.

"Auroral effects on radio waves were known before Oscanyan, in 1929 (C-222), actually observed the influence of visible aurora on radio communication. International research lagged until 1938, when Harang and Stoffregen discovered and identified auroral VHF scattering. Whereas at first the disturbances attending the aurora were considered only as a nuisance to radio communication, the auroral effects have now been exploited as a new and enhanced mode of communication and a tool for further exploration and research into the physical characteristics of the atmosphere.

"For the most recent systematic discussion of the "Radio Aurora", the reader should consult Chapter 6 of the new (1961) book "Physics of the Aurora and Airglow", by J. W. Chamberlain of Yerkes Observatory. This excellent review of the subject was received after the present bibliography had been completed and indexed; hence it has been added as a supplementary item (C-297)."

"Additions and corrections should be addressed to: Malcolm Rigby, editor, Meteorological & Geoastrophysical Absts., P. O. Box 1736, Washington 13, D. C."

Copies may be obtained by writing to the U.S. Dept. of Commerce, Office of Technical Publications, Washington 25, D. C. and ordering Technical Note No. 128, PB 161629, of the National Bureau of Standards, Price $2.75.

AFCEA holds RFI Meeting:

In the January 1961 issue of SIGNAL, the monthly Journal of the Armed Forces Communications and Electronics Association, appeared an article by George Turner, cheif, Federal Communications Commission (FCC), Field Engineering and Monitoring Bureau, Washington, dealing with the problems of tracing causes of radio interference.

Using the article as a starting point, F. V. Sloan, engineer in charge District 12, Field Monitoring Division, San Francisco, suggested to the Board of Directors of the San Francisco AFCEA chapter that a committee be formed to assist the local FCC office in tracking down the sources of radio interference.

Colonel H. L. Davis, Jr., chapter president endorsed the recommendation.

A committee of fifty was recruited from interested members in the military and industrial organizations.

The first task was the compilation of a directory listing each member of the committee under the caption of the type of interference with which he is most familiar. These directories will receive wide distribution.

NEW PRODUCTS:

Sprague Brings Out Universal Automotive RF Suppression Kit:

Sprague Electric Company, North Adams, Mass. has brougt out an effective radio frequency interference suppression kit for mobile and marine radio installations which is known as Type SK-1 Suppressikit. The kit contains 5 basic components and does not interfere with engine efficiency. Additional information may be obtained by writing to Sidney L. Chertok, at the above address.

New Diversity Carrier Telegraph:

A new 16-channel, transistorized Voice Frequency Diversit Carrier Telegraph Terminal Designed to "get the message through" is announced by Northern Radio Company, Inc., 147 W. 22nd St., New York 11, N. Y. Designated Northern Radio Type 235, Model 3 (Military Designation AN/FGC-61A), it employs several ways of boosting the transmission and reception reliability of telegraph, teleprinter or telemetering signa over channels subject to fading or other attenuation (such as long distance point-to-point radio).

Stoddart Brings out RF Step Attenuators:

The Stoddart Aircraft Radio Co., Inc., 6644 Santa Monica Blvd., Hollywood 38, Calif., has brought out new RF step attenuators from DC to 3 Gigacycles. They are designed for use with standard 50-ohm coaxial cable circuits and are avail able in either two or three turret models. The two-turret model provides attenuation in 1.0 db steps from 0 up to 70 db

and the three-turret model provides attenuation from 0 to 71 db in steps of 0.1 db.

White Motor Brings Out Ignition Suppression Package:

The White Motor Company has developed a special ignition package to provide maximum protection against abrasion, corrosion, water damage and to reduce ignition interference with two-way radios. It can be ordered for initial installation or for replacement.

New Spectrum Signature Adapter:

Electro-Magnetic Measurements Company, 50 Baiting Place Road, Farmingdale, Long Island, New York, has brought out a new spectrum signature adapter in one display unit for all currently used radio interference meters. It has four plug-in tuning heads from 455 KC to 160 MC and gives a spectrum display of received pass-band. It is claimed that it meets the requirements of the new Military Collection Plan for Spectrum Signatures. Inquiries should be directed to David Fidelman, Director of Engineering.

Empire Brings Out New Microwave Signal Generators:

Empire Devices, Inc., Amsterdam, N. Y., has brought out a series of four Microwave Signal Generators covering the frequency range of 900 MC to 11,000 MC, designated as follows: Models SG-11 (900 to 2200 MC), SG-12 (1800 to 4400 MC), SG-13 (3800 to 7600 MC) and SG-14 (7000 to 11,000 MC). All models provide internal and external pulse modulation and linear frequency modulation, as well as internal square wave modulation. Output power for each of the units is 1 milliwatt minimum, over an output range of 0 DBM to minus 127 DBM.

New Process for Silver Plating to Aluminum:

Pack Process Company, 10 Avenue C, Newark, New Jersey, has a new process for direct silver plating to aluminum. Technical data may be obtained by writing to A. Wasserman, Technical Director, at the above address.

CORRECTION:

In Newsletter No. 20, mention was made of a new Handbook on Radio Frequency Interference, on page 9, and no further identification was made of it. What happened was that the identification was cut off and then not pasted on the make-up sheets-so here is what was left out:

Volume 1 may be obtained by writing to Frederick Research Corp., 2601 University Blvd., West, Wheaton, Maryland, as well as information on those still to be published.

NOTE:

We have done a little more quoting, than usual, in this Newsletter as other Professional Groups seem to be doing the same. It is creating editorial problems, but, we editors feel, it is a time-saver to the readers. Hence, we welcome suggestions as to how we can make them still of more value.

Rexford Daniels, Editor
PGRFI Newsletter
Monument Street
Concord, Mass.