IONOSPHERIC NETWORK ADVISORY GROUP (INAG)*

Ionosphere Station Information Bulletin No. 2**

I. Introduction

The first issue of this bulletin appears to have filled a need. The number of requests for extra copies has been remarkable and has run us out of stock, at least temporarily! If you, like several others, see this copy accidentally and want to receive the bulletin in the future, please send your name and address to our Secretary:

Miss J. V. Lincoln
World Data Center A
Upper Atmosphere Geophysics
ESSA
Boulder, Colorado 80302, USA

As the issues will contain useful reference material, we propose to hold a small stock of issues for future participants in the network.

Our last issue was largely occupied by reporting the recommendations of the URSI/STP Committee on the future of the VI network. Copies of the full report are available to any of you who have not, as yet, received them and are interested.

In this issue we want to start discussions on some particular problems which have been raised with our members recently. These range over clarifications of the rules in the URSI Handbook of Ionogram Interpretation and Reduction, comments on queer ionograms, particular points to be brought to your attention since they seriously affect the value of the data to users, questions of whether certain rules should be altered, etc. We shall try to spread the more widely interesting topics over several issues and hope that you will feel encouraged to write to us with your points.

INAG members are often asked, "Are the data which we produce actually used and what are they used for?" We hope to give you some indications of the answer to this, partly by referring to the literature and partly from our knowledge of active research which is going on but is not yet published.

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* Under the auspices of the Solar-Terrestrial Physics Committee of the International Scientific Radio Union (URSI/STP Committee).

** Issued on behalf of INAG by World Data Center A, Upper Atmosphere Geophysics, Environmental Science Services Administration, Boulder, Colorado 80302, USA. The bulletin is distributed to stations by the same channels (but in the reverse direction) as their data ultimately flow to WDC-A. Others wishing to be on the distribution list should notify WDC-A.

Work is done in so many groups that it is not possible to be complete without spending more time than we have available. Thus our reports on this aspect should be regarded as giving samples for your information.

Many find that line drawings of ionograms are little help to analyzing actual ionograms, particularly when starting such analysis. However, the reproduction of ionograms so that they are readable is very expensive and the time needed to collect and annotate them can be very large. For this reason the Handbook gives references to ionograms reproduced in the Annals of the IGY, Vol. III, Part I (Pergamon Press, 1957). In the new addition we hope to give cross-references to the new Atlas of Ionograms which should be issued in the near future. In addition we propose to draw attention to particular papers in the literature where these give ionograms and their interpretation. Some care must always be taken with such material, since at least some scientists who study ionograms do not always use the internationally agreed nomenclature. We strongly recommend that you keep a set of standard ionograms with their interpretation and also, where possible, a set of difficult or curious ionograms. My own practice is to cross-reference these with the appropriate pages in the Handbook and to note, on the blank pages, the explanations given of particular points. Please do not forget, when asking for help from our members, that a sequence is very much more useful than a single ionogram. The latter may have several alternative explanations, depending partly on the equipment in use and the way it has been set up. The former often enables one explanation to be selected from these with good chance that it will be correct.

In closing, on behalf of INAG, I would like to thank all our contributors, our Secretary, and our ex officio member Mr. A. H. Shapley for all their work.

W. R. Piggott
Chairman, INAG and URSI/STP VI Consultant

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About INAG -- The first (October) bulletin told all about the formation of INAG and its objectives and background. We will not repeat it here except to reemphasize that INAG is advisory and that it hopes to nag the "network" into two-way interchange of information and discussion of problems. INAG members are W. R. Piggott, Chairman (UK), G. A. M. King (New Zealand), Dr. I. Kasuya (Japan), Dr. N. V. Mednikova (USSR), Miss J. V. Lincoln, Secretary (USA), Mlle. G. Pillet (France), G. M. Stanley (USA), Dr. J. Turner (Australia), and A. H. Shapley, ex officio (USA). The individual addresses are given in INAG-1 and the address of the Secretary is repeated on page 1 of this bulletin. All are hoping to continue to receive mail. We should also say here that this bulletin -- INAG-2 -- has again been put together by "ex officio" since the Secretary is away on a convenient holiday. Actually the finishing touches are being done by Tom Gautier, whom many of you know, for "ex officio" is off for a brief visit to Antarctica and vicinity. Thus responsibility and blame for the contents of INAG-2 are hard to place. --Ed.

II. Notes from or about Stations

College

The College, Alaska ionosonde, an updated C3, is presently recovering from a hasty move during the last summer. The ground occupied by the antenna and the building housing the transmitter was pre-empted by the University of Alaska for student housing. The new site is located about 13 km to the northwest of its previous location. In general, the station will operate in about the same way that it has in the past. There will, of course, be improvement in the quality of the ionograms as we are considerably further from one of our serious sources of interference (a local radio station at 660 kHz). Our operating parameters will remain the same for the present. Those parameters are 0.25 to 18 MHz, about 10 kw peak power, 50 microsec pulses, 60 Hz pulse rep rate, 30 sec sweep period, and soundings each hour at 01, 05, 15, 30, 45, 55, 59 and 00 with the sounding at 59 on low gain and the sounding at 01 on high gain and 250 km max range. The data from the ionosonde are sent to WDC-A at Boulder soon after the 1st and the 15th of each month. Unfortunately we are presently only scaling foF2 and M(3000) for 5 times each day. Questions concerning the data and the operation of the station should be directed to: Glenn M. Stanley, Associate Professor of Geophysics, Geophysical Institute, University of Alaska, College, Alaska 99701, USA. We hope that we may be of assistance to you.

Natal

A C4 sounder is operated by the Brazilian Navy at the Instituto de Pesquisas da Marinha site, about 15 km southwest of Natal. The station was visited in September 1969 by an electronic technician from the Environmental Science Services Administration Research Laboratories, Boulder, Colorado together with an expert from the Comissao Nacional de Actividades Espaciais, Sao Jose dos Campos, Brazil. The latter organization is responsible for the scaling of the records. The sounder was repaired and calibrated. The nearby Brazilian Air Force rocket launching site makes heavy use of the ionosonde data. It is to be hoped that the visit will result in improved operation of the C4 sounder as well as indicate strong interest in the location.

Godhavn

[The following information (and that for Narssarssuaq and Thule, below) was supplied by Mr. Guldager of the Ionospheric Laboratory at the Technical University, Lyngby, Denmark]

We are trying to get an assistant for the Engineer-in-Charge (E.i.C.). It is very doubtful if the E.i.C. can do more work than he is doing now. He is only assisted by his wife (scaling) approximately 4 hours per day, and the VI-ionosonde work is only part of his job, although the most time-consuming. The Swedish J5 ionosonde has not been working well since its installation in 1964. It is now in better shape after a thorough overhaul by an engineer from the factory.

Narssarssuaq

The old modified C3 ionosonde is working well enough, but should be replaced with a new ionosonde, if we can get one. The present E.i.C. leaves the station next year after a 5 years' stay. He has one-half day assistance with scaling (wife) and one-half day assistance by a radio technician. The work load is almost as heavy as in Godhavn. The station will be moved to another site in Narssarssuaq in 1970 or 1971.

Thule

There is not too much work, but the village is very isolated. The E.i.C. has no assistant and no one with whom to discuss work. The C4 ionosonde has been working rather well on a small provisional antenna from September 1968 to the summer of 1969 with one ionogram per hour. The antenna pole (32 meters high) and the antenna system from Camp Tuto have been erected this summer. The ionosonde has been relocated to a site 1200 meters northwest of the village. The ionosonde is not yet in operation, as part of the antenna has fallen down, and faults in the ionosonde itself are being repaired. We have had a new E.i.C. on the station each year since its start in 1964. The living quarters have been improved. It is still too early to say if the new E.i.C. will be able to start operation and scale the ionograms. We will ask him to send the data to us until further notice, so he can get fast technical and scaling advice. This is, of course, not written to blame your (ESSA's) review department, as we know its small size and that it has too much work to do. When or if a regular operation and scaling has been achieved, we should like to send the data directly to WDC-A.

Raoul Island

Ionosphere recordings at Raoul Island were not obtained between 7 March 1969 and 20 November 1969. Failure of the ionosonde coupled with infrequent access to the island made this long break unavoidable. While the ionosonde (a Cossor Portable Mark II) was undergoing repair, the opportunity was taken to improve its performance. The changes made are described elsewhere in this issue.

Rarotonga

In October 1969 Tim O'Neill from Christchurch visited the Rarotonga Observatory in the Cook Islands. Reg Philips, the Observer-in-Charge, made sure Tim had a real Polynesian welcome and this probably colored Tim's first impressions of the Observatory in particular and Polynesia in general. In between the Polynesian nights a glaring light in the sky disturbed sleep enough to enable the work to get done and he returned to New Zealand with a good report on the work at the Observatory!

New Zealand Network Headquarters

Because of the long delay in publishing our data bulletins as annual reports, we decided to go all modern and computerize the system. Now, nine months later (extraordinarily suggestive) the system seems to be working. Data from the film is read at the stations and telephoned or telegraphed to Christchurch. Here it is punched on to paper tape and sent to Wellington where the D.S.I.R. has an Elliott 503 computer. The output sheets are then returned to Christchurch where they are reduced and reproduced by Xerox and offset printing processes. The final sheets are collated by hand and posted to their fate. On paper it's perfect; in fact not so good. Wellington is 200 miles from Christchurch and that means a three-day turnaround on the data. Also the printup is poor (faulty line printer) so that the photocopying is not marvellous. But with a new line printer due soon and streamlining of the copying process we will have reduced the lag from three years to six weeks (hopefully three weeks). Anybody know of a good hair dye? I don't really like being gray-headed yet.

Johannesburg

Bulletins of the South African Council for Scientific and Industrial Research now (August 1969 onward) include a new data parameter for the station at Johannesburg: the total electron content at noon. The calculations are from the integrations of the electron density real height profiles that are obtained from ionograms. It is assumed that the ionization lying above the peak of the layer is equal to that below, so that the values given represent twice the total ionization lying below the peak. The values are thought to be accurate to within $\pm$ 25 percent of the true values.

The Australian Vertical Incidence Sounding Network

In this first Australian contribution to the INAG bulletin, it seems appropriate to give a general account of the Australian vertical incidence sounding network. This should serve as an introduction to descriptions of the stations and equipments and reports on special ionospheric behavior in future bulletins. At present, there are 13 VI sounding stations in Australia and its Territories providing ionospheric data on a regular basis. All the data obtained at these stations can be made available through either the regular data exchange system or the World Data Centers. There are other ionosondes in Australia, mainly at universities, but these do not contribute to the regular pool of data.

The Ionospheric Prediction Service, which is a division of the Australian Bureau of Meteorology, operates nine of the stations, viz, Brisbane, Canberra, Casey, Cocos Islands, Hobart, Mawson, Norfolk Island, Townsville and Vanimo. The Department of National Development operates stations at Mundaring and Port Moresby in association with other geophysical observations, and the Department of Supply operates the station

at Woomera for rocket range purposes, and at Salisbury, near Adelaide, in conjunction with research. There is close cooperation between IPS and the groups in the other Departments operating VI stations; in fact, for a number of years, IPS has processed and distributed the data from Port Moresby and Mundaring as part of its regular data processing system, and it is intended that Salisbury and Woomera data will eventually be processed in the same way.

In most cases, there have been small changes in the locations of the stations and the equipment used. The details of these changes have been given in the data bulletins. Generally, the changes do not prevent the data before and after being combined for most analyses. However, there are three cases which deserve special mention. The station at Watheroo was moved some considerable distance to Mundaring in 1959; the station at Wilkes was moved a few miles and the name changed to Casey in 1969, and the station at Macquarie Island was destroyed by fire early in 1959 and never re-established.

The stations operated by IPS each have a staff of one full-time operator who operates and maintains the equipment, extracts the data from the ionograms and carries out other work (which varies from station to station). The operators are permanently located at the stations, except at Casey, Cocos Islands and Mawson which, because of their remote location, have their operators replaced each year. There is a small group in the Central Office of the IPS in Sydney which directs the operations of the stations and provides technical and engineering backup. The IPS operates its own radio telephone network for communication between the stations and the Sydney office. Thus, there is a fair degree of central control of and support for the stations in the IPS part of the network.

Slough, Singapore and Port Stanley

During the last 12 months the ionosondes at Slough and Singapore have been adapted to record ionograms on 35 mm film instead of 70 mm paper. A similar change will be made at Stanley during January 1970. New aerial systems are under construction at Slough and Port Stanley and at the latter station a new ionosonde with increased transmitter power will go into operation during the first quarter of 1970. The Spread F parameter fxI has been scaled from nighttime ionograms at Slough for the past year and from Singapore and Port Stanley ionograms for part of this time. These data will be published in the monthly bulletins.

Fort Archambault

The "Groupe de Recherches Ionosphériques" (France) is now operating a new ionospheric station in Central Africa for the study of the equatorial electrojet, in connection with the magnetic network handled by ORSTOM (Office de la Recherche Scientifique et Technique Outre-Mer). The new station is located a few kilometers from Fort Archambault (Tchad Republic). Its geographic coordinates are 9°12.0'N - 18°21.8'E, and the station is not far from the magnetic equator. A vertical ionosonde SP 35/16 started to operate in January 1969 and equipment for ionospheric drifts measurements (method D1) is being set up, with some difficulties because of 18 spaced receiving antennas to be adjusted.

III. Notes from WDCs

World Data Center A - Upper Atmosphere Geophysics, Boulder, Colorado, USA

In the last three months we have received 48 requests for vertical soundings data. To satisfy these, 4528 station months (units) of data were distributed -- either as copies of ionograms, electrostatic copies or microfilm of daily hourly tabulations, f-plots or N(h) profiles.

	Individual Requests	WDCs
Ionograms	210 units	57 units
Hourly values	3983*	446
f-plots	34	78
Medians**	18	0
N(h) profiles	3	0

* includes 320 for the NASA National Space Science Data Center

**of course essentially all medians are published sooner or later

The user types were as follows:

Foreign	11
Private firm	7
University	7
WDC exchange	11
ESSA Boulder	5
Other U.S. Government laboratories and archives	7

Data from July 1957 to date were requested; the station months in these requests are indicated below:

Period	Station Months of Data
1957-59	645
1960-63	680
1964-65	747
1966-68	622
1969	501

Of course, the ESSA prediction group uses the data from every station supplied, and data are sent to other WDCs (and received from them) in accordance with the Guide. In this period the latter amounted to 1333 station months of data and included virtually all stations which report directly to WDC-A. The other requests included the following stations:

Adak	College	Maui	St. Johns
Ahmedabad	Concepcion	Mexico	Taipei
Anchorage	Grahamstown	Miedzeszyn	Trivandrum
Bangkok	Grand Bahama Island	Narssarssuaq	Wallops Island
Boulder	Godhavn	Okinawa	Washington
Byrd	Huancayo	Ottawa	White Sands
Canton Island	Kodaikanal	Puerto Rico	Wilkes
Churchill	Leningrad	San Francisco	Yamagawa

A new station bulletin has been received giving data for January through June 1968 from La Habana, Cuba.

Ionograms for parts of June, August, September 1967 and May, June, July 1969 have been received from Seoul, Korea.

World Data Center C1 - Ionosphere, etc., Slough, Bucks, UK

WDC-C1 at Slough was moved into roomier quarters several months ago and improved working facilities are now available to visitors. Plans are underway to computerize the compilation of the catalog in 1970. Catalog production will be speeded up and further changes in format are envisaged so as to improve its usefulness.

All data for the years 1967 and 1968 and for part of 1969 for the stations Slough, Singapore and Port Stanley are now stored in punched card form and will ultimately be transferred onto magnetic tape.

Following Miss Lincoln's visit in 1969, a faster exchange of data between Centers A and C1 has been organized.

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Solar eclipse, March 7, 1970 -- A reminder that a total solar eclipse will take place on this day. The full time span of totality at the earth's surface is 1605 to 1911 UT. The path of totality is from the mid-eastern Pacific Ocean, over the southern part of Mexico, crossing northern Florida, the east coast of the USA, off into the Atlantic Ocean. Eclipse effects in the ionosphere occur throughout the zone of partial eclipse and sometimes for an hour or so after the eclipse is over. There are many special astronomical, aeronomy and ionospheric observations planned for this eclipse and several involving rockets and satellites. The International Geophysical Calendar (do you have a copy?) marks March 7 as a "World Day" for ionospheric and other stations in or near the eclipse zone.

Article by INAG Chairman -- Since Mr. Piggott does not edit these bulletins, it is not immodest to call attention to his 7-page article in the June 1969 issue of the ITU Telecommunication Journal. The title is "The Acquisition and Use of Ionospheric Data for Prediction and Other Practical Applications." Here is the abstract: "Possible ways of improving the contact between scientists and engineers on problems of HF communication are discussed and proposals made for new methods of obtaining the data needed to improve HF communications. The paper is based on the Report of a small Working Group of the International Scientific Radio Union (URSI)." If he runs out of reprints, you can find in URSI Information Bulletin No. 167 the text of the original document prepared for the 1968 CCIR Study Group VI (Ionospheric Propagation) meeting held in Boulder. Or ask the INAG Secretary for help.

IV. Ionogram Interpretation Problems

Low F Layer

During the IQSY, a number of stations, mainly at high latitudes, reported difficulties in identifying the F layer at night owing to the minimum vertical height being abnormal. What is seen is a slow variation of foF2, usually a slow decrease, accompanied by a more rapid fall of h'F from its normal value between about 200 to 300 km to values near 100 km. It often then rises rapidly to the normal height. This can be confused with some types of storm Es and night E which occur at the same height. A study of the f-plots, ionograms and height changes shows that the ionization is physically continuous with the normal F layer despite the abnormal height and hence it is clear that the critical frequency and virtual height should be tabulated as foF2 and h'F respectively.

The question of distinction between F layer and E region phenomena needs some comment. The critical points are as follows:

(a) This type of F layer shows a smooth variation of foF2 with time, in contrast with Es and night E which vary irregularly.
(b) The group retardation near foF2 is much greater than for normal or night E, though often less than that for an F layer at its normal height.
(c) The phenomenon is mainly a quiet day phenomenon and is not accompanied by abnormal increases in spread F.
(d) The phenomenon is most common when foF2 is small; most cases reported to me showed foF2 less than 1.5 MHz. In contrast, the storm types of Es and night E usually show much higher peak values.

We may expect the same problem to be met again in a year or two and invite comment on past observations now so that a consensus of informed opinion can be established and everybody treat the phenomenon in the same way.

Blanketing Sporadic E

The blanketing frequency, fbEs, is now widely used by radio propagation groups for the prediction of reflection by sporadic E and screening of F modes at oblique incidence. Serious difficulties can arise when fbEs is greater than foF2 so that no F traces can be seen since there is then no criterion to decide where the layer is effectively totally reflecting. The standard rule for this case is to replace the numerical value by letter symbol A. This, of course, means that most of the highest values are non-numerical, contribute to the median, but cannot be easily used for probability calculations. Some groups directly interested have tried the device of cancelling the accuracy rule restriction on the use of E in this case. The value of fbEs is then given as (foEs) E.A., keeping some indication of the numerical value. This procedure causes serious troubles in the determination of the median; the first median is reasonable but for the second

median the E values have to be treated as lower than the smallest numerical value, instead of being high values as when replacement letter A is used. This gives meaningless medians, a worse situation than losing high values. Thus this solution is not acceptable.

The solution we suggest for discussion is to make letter A qualifying as well as descriptive. It would have the same significance in median as the current usage of replacement layer but would be used when accuracy rules could not be applied. The instructions would then read: When fbEs is higher than foF2 so that no F layer traces are seen, write foEs qualified by letter A and described by letter A. For second medians such values are taken to the high end of the unqualified values. Thus current practice would be conserved, those who need numerical values would have them and the medians would be unaltered by the change in procedure -- an important point.

Of course, it is possible to suggest other improvements at the same time, e.g., one could construct rules using the second or third order Es traces which would minimize the effects of partial reflection if this was thought worthwhile. However, responses to circulars from the VI Consultant show that there is a strong feeling that analysis rules should not be altered if this can be avoided so that it is probable that the majority view would be to make the least changes feasible to meet the need.

Your views would be valuable to enable us to come to a decision acceptable to both the users and the network.

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Discussions within INAG -- The members of INAG are beginning to have correspondence among themselves, particularly on the necessary or desirable revisions to the URSI Handbook. Some of the topics are how to make the Handbook rules and discussion concerning auroral ionograms clear, consistent and correct -- Es-a, Es-r, Es-s, night E, "high E", also how to handle foEs, fbEs under auroral conditions. The problem of handling "L" conditions consistently is also under discussion. From an editorial point of view there is the question of how much detailed information on the derivation of N(h) profiles should be included in the Handbook and how much on suggestions for useful research projects which can be done at stations (ideas from stations will be welcome). All this discussion and work concerns the preparation of a second and revised edition of the Handbook in 1970. We understand Mr. Piggott and Dr. Rawer spent several days together on this in December. In the next INAG bulletin, we hope to be able to say that the revised Handbook -- and also the new Atlas of Ionograms -- is well along in the publication process. Any points of unusual interest we will preview in these INAG bulletins.

V. Experiences with a Cossor Portable Ionosonde

Raoul Island, the northernmost of the Kermadec Islands, is a little dot on your map somewhere about 700 miles northeast of New Zealand. Among the orange trees, where a small staff mans a meteorological and seismological station, there is a typical inverted V ionosonde aerial. With only one scheduled ship calling each year to change the staff and resupply stores, etc., it is sometimes difficult to have the repairman call.

After five years of successful operation, our little Cossor ionosonde longed for a return to civilization and so on March 1969 it just simply refused to work anymore. No amount of coaxing by radio telephone encouraged it to get up and go again, so there was nothing to do but return it to civilization where a larger lab and extensive testing facilities were available. By chance a boat which sails monthly between New Zealand and the Cook Islands was to divert and call at Raoul Island in September -- some two months before the scheduled resupply ship. The call was made, and the ionosonde in its packing case successfully traveled the precarious "flying fox" journey down from the cliff top and was taken on board. A few days later the ship arrived at Rarotonga in the Cook Islands where the local "ionosphere man" Reg Philips mysteriously spirited the case into an Air Force plane leaving for New Zealand the next day. Two days later, leaving many puzzled but cooperative customs officials, we took possession of the "patient."

Of course at the time all our staff were absolutely flat out and there was no one left to "operate." This came about because other field stations were about to have their annual staff changes too and we had about six people in training. Fortunately one of them, Trevor Mulligan, was destined for Raoul Island where he would operate the ionosonde (among other things), so we soon had him on the job.

The "operation" was successful and while the patient was "on the table" it was decided to try a few transplant jobs at the same time. The following changes were made:

(a) Changed C106 1000pf in VFO to 100pf. This reduced capacitive loading on the keying pulse line and squared up the keying pulse.
(b) Reduced R50 grid stopper on V15 from 1 meg to 100K to improve modulator pulse shape to the output tube.
(c) Removed C89 in grid circuit of V19 mixer to increase RF drive. (This change may increase spurious responses in some cases.)
(d) Replaced R78 - 300 ohm cathode resistor in cathode follower driving the frequency marker mixer V23 -- with a choke of 0.8 microhenries (same as L21 and L27) in series with 47 ohms. This improves the uniformity of frequency marker signals.
(e) Replaced V25 with two Si diodes and used socket for additional circuitry: see below. The added circuit is triggered by the old marker pulses and generates markers of constant amplitude and duration.

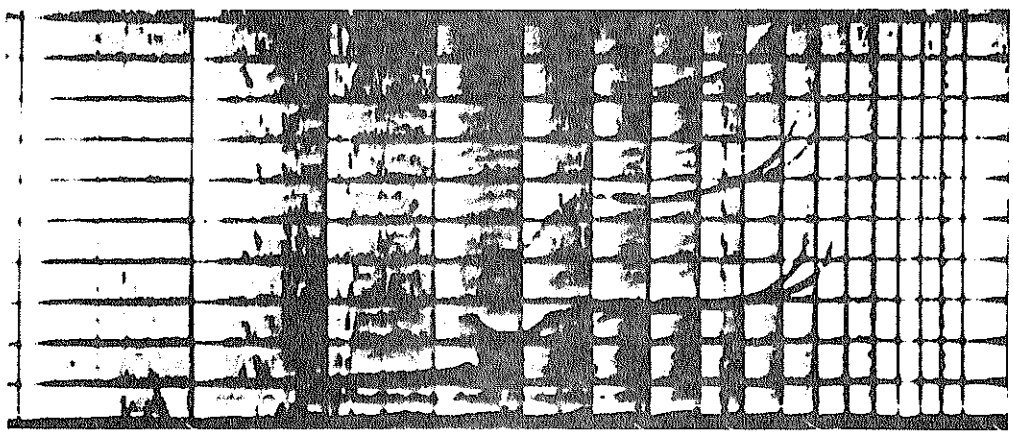
(f) Added 2mfd on 1800 volt line -- this is a compromise value to reduce jumps in the time base due to sudden mains voltage changes and yet allow the 1800 volt line to stabilize before the start of the recording interval.

(g) Replaced a few tired electrolytic capacitors and set the 1800 volt up to the correct voltage. This improved the CRT trace mainly through improved control over astigmatism. This adjustment is just as important as focus -- pity the control is so inaccessible.

(h) Ran out of time.

Power output checks indicated a peak pulse of at least 2KW over most of the band. A quick field check of output is possible with a 600 ohm 1 watt resistor in place of the transmitter aerial -- if the peak RF output is around 1KW, this resistor will be quite hot at the end of the recording interval. (But wait until all power supplies are off before you touch it!)

An example of the kind of record we got on a quick test in Christchurch is attached. At this time the VFO was not properly tuned so the frequency markers are misplaced, and the markers are shadowed by a little overshoot (which was later eliminated, and there is still some astigmatism). However the general quality of the h'F trace is very good for this ionosonde -- clear daytime multiple echoes show adequate overall sensitivity. The intermittent weak "layer" at 60KM is an echo from mountainous country in direct line of sight of a low angle lobe of the aerial. This return is a useful monitor of ionosonde performance and can be seen only if things are going pretty well even with much more expensive machines.

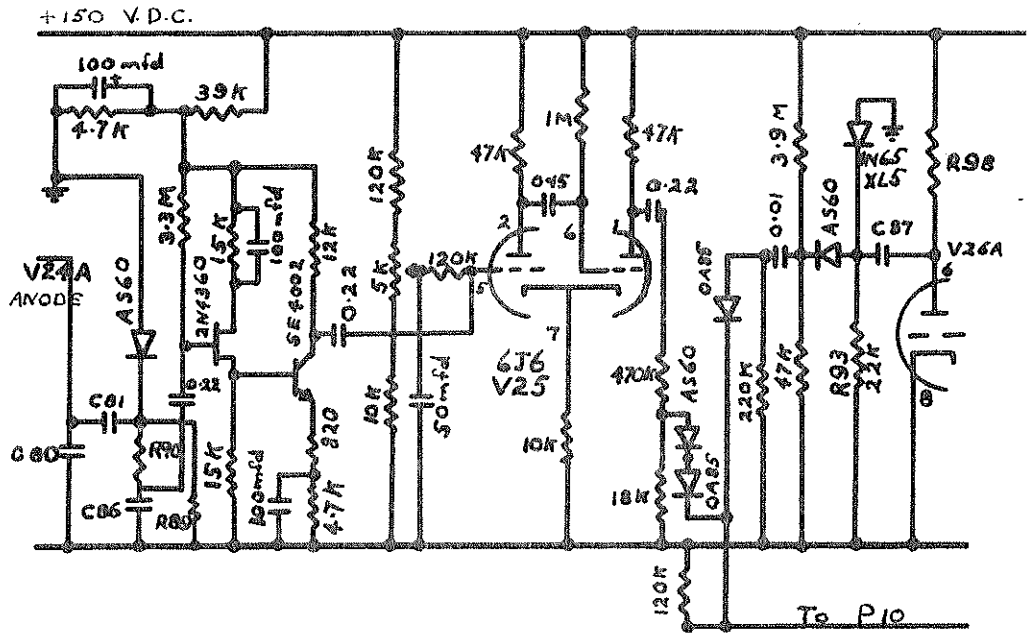


The modified frequency marker circuit consists of an FET/transistor pair which amplifies the rather rounded waveform appearing on C86, and this drives a monostable tube circuit using the socket which was previously V25. The output is a large square pulse and an appropriate portion is tapped off through a diode gate where it is combined with the (also)

modified heightmarkers. The AS60 has a very high reverse resistance (and eliminates the overshoot mentioned above) whereas the point contact oA85 presents negligible capacitive loading to the fast heightmarker waveform. The height marks appearing across R93 have sharp tops but rather wide skirts on the waveform. The additional biased diode eliminates the wide skirts and gives a sharper marker signal.

An adjustment is provided to set the triggering level of the frequency marker monostable. Because the triggering signal is not of constant amplitude, this must be set carefully to ensure that the high frequency markers are present without getting double markers at the low frequency end.

[contributed by A.C. Stanbury, New Zealand]



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Visits to VI Stations in Africa -- Arrangements are being made for an expert in ionospheric sounding work to visit several of the stations in Africa. The visit would be under the auspices of UNESCO, which has been helpful so often in aiding international cooperation in geophysics. INAG member Miss G. Pillet has been chosen as the expert for this trip to advise on ionogram interpretation, data analysis or applications, and all kinds of problems which arise in ionosonde work. The need for such visits has been recognized within URSI for some time, with the most recent expression being the Working Group Recommendation 5, which was reprinted on page 7 of INAG-1. We will ask Miss Pillet for a summary of her visit to print in a future INAG bulletin and also ask Mr. Piggott for a fuller article on the objectives of these visits and plans for trips by other experts.

VI. Who Uses VI Data?

The "Notes from WDCs" gives a partial answer to this question. Also the prediction groups -- should we call their work ionospheric "climatology"? -- are always hungry for data. And more and more the short-time forecasting groups are asking for VI data in increasing quantity and with increasing timeliness. Hopefully we can get some short articles from some of these groups for future bulletins.

Perhaps the most satisfying use of the data, though, is in scientific papers in the technical journals or presented at scientific symposia or conferences. We have not had time to do a systematic search of the recent literature but here are a few:

"Mixed Polarization Echoes in Multihop Ionosonde Reflections from the F Region" by T. E. VanZandt and T. N. Gautier, presented at the Fall meeting of US National Committee for URSI, Austin, Texas, USA, December 1969. Cited ionosonde data for Canton Island, Maui, Boulder, White Sands, and Huancayo.

"A New Analysis of Eclipse Effects in the Equatorial F-Region" by N. J. Skinner, Journal of Atmospheric and Terrestrial Physics (JATP) 31, 1333 (Nov. 1969). Used data from Ibadan and Maiduguri.

"Development of Ionospheric Absorption Associated with Stratospheric Warmings in 1958 and 1963" by K. Sinno and M. Higashimura, JATP 31, 1353 (Nov. 1969). fmin from 47 selected stations in the northern hemisphere.

"A Seasonal Effect in the Mid-latitude Slab Thickness Variations during Magnetic Disturbances" by M. Mendillo, M. D. Papagiannis and J. A. Klobuchar, JATP 31, 1359 (Nov. 1969). foF2 at Ft. Belvoir for magnetic storms of June 1965, and February 1968.

"Sporadic-E Ionization Over Ahmedabad Through the Half Solar Cycle 1954-1957" by K. M. Kotadia, JATP 31, 1137 (Sept. 1969).

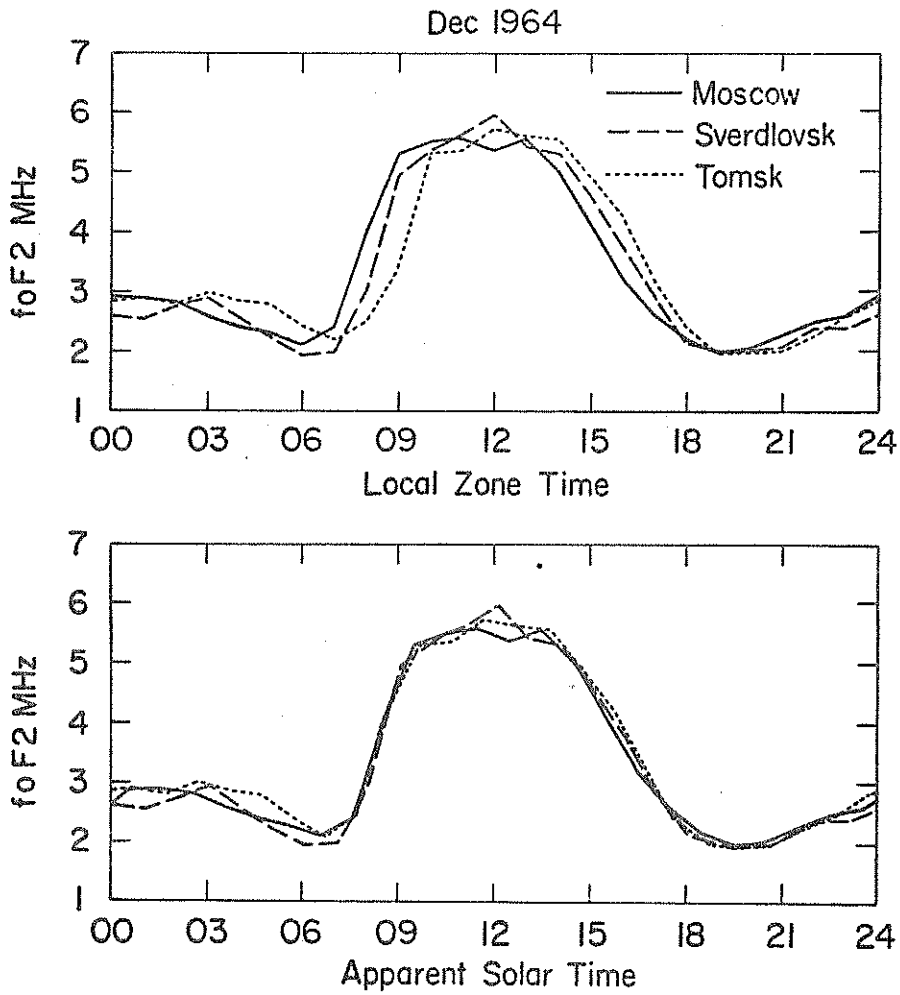
"Electron Content Measurements by Beacon S-66 Satellite during the May 20, 1966, Solar Eclipse" by M. Anastassiadis and D. Matsoukas, JATP 31, 1217 (Sept. 1969). Includes foF2 from Scaramanga (near Athens).

"The Hysteresis Variation in F2-Layer Parameters" by M.S.V. Gopal Rao and R. Sambasiva Rao, JATP 31, 1119 (Aug. 1969). Monthly median foF2 from 1954 to 1964 for 42 stations. M(3000)F2 for 18 stations. Specifically mentioned are Huancayo, Ahmedabad, Formosa, Yamagawa, Wakkanai, Kokubunji, Washington, Slough, Churchill, Lindau, Kodaikanal, and Leopoldville.

VII. Notes by INAG Members

Glenn M. Stanley

Although the time listed on ionograms is zone time (and correctly so), many researchers studying the ionosphere should consider the importance of the solar zenith angle at the station and should use apparent solar time or solar zenith angle as a time base for investigations rather than station (zone) time. In a recent study (reported at Spring USA URSI 1968, Commission III) it was shown that for a very quiet ionosphere foF2 appeared to differ by as much as 2.5 MHz between Tomsk and Moscow during the morning and afternoon hours when station time was used as a time base, but when apparent solar time was used the difference disappeared. The accompanying sketch shows the effect. The quiet ionosphere was obtained by considering only those periods when the three-hour K-index was ≤1+ and was ≤1 for the preceding three-hour period. Monthly averages of these data were then used to obtain foF2 in the sketch.



VIII. More URSI Recommendations

Here are two more recommendations mentioning ionosonde work which came out of the 1969 (Ottawa) XVI Assembly of URSI. Any suggestions for specific work will be treated in a later INAG bulletin. [Source: URSI Information Bulletin No. 172.]

Recommendation III.12 -- Long-distance Propagation in the Ionosphere

URSI Commission III, considering the need for studies of long-distance propagation in the ionosphere without intermediate ground reflections; recommends that the attention of the URSI-STP Committee be drawn to the importance of obtaining data about the height of both the bottom and the peak of the F layer.

Recommendation III.22 -- Intensive Observations of Movements during Storms

URSI Commission III, considering (a) that the behaviour of the F layer during storms constitutes one of the major unsolved problems of the ionosphere; (b) that an intensive series of observations of the movements that occur at the height of the F layer during a storm would provide very valuable data; recommends:

(1) that a week during which a magnetic storm is expected be selected under the auspices of Commission III;
(2) that during this week special observations be made at frequent intervals of the behaviour and movements of the ionosphere in areas affected by the storm;
(3) that where there is a high concentration of observatories, as many as possible of them participate in the programme;
(4) that the techniques used include ionosondes and devices for the measurement of drifts;
(5) that relevant data from other sources be used, such as geostationary and topside sounder satellites, and observations of aurora and airglow;
(6) that the data obtained be used also in studies of atmospheric waves.

IX. Something about IUCSTP

In INAG-1 we referred several times to IUCSTP -- The Inter-Union Commission on Solar-Terrestrial Physics. Perhaps not everyone knows about IUCSTP and the programs it is involved in. To be fully informed, you should study STP Notes which are supposed to be available through your national scientific organization. Even some of us who are closely involved are unclear about all aspects of IUCSTP because the program and the organization are always evolving, keeping up with the needs of science and the improving methods of international cooperation.

To put it in oversimplified terms: IUCSTP is a creature of ICSU, The International Council of Scientific Unions. Its President is named by ICSU with Vice Presidents representing URSI, IUGG, IAU, IUPAP and COSPAR. The scientific members are selected from nominations from all these organizations to ensure that all of these scientific fields are covered: solar activity; particles and fields in interplanetary space; particles, fields and waves in the magnetosphere; external geomagnetic field; ionosphere; and aeronomy. IUCSTP has selected 12 projects for attention in these first years and has designated Working Groups to foster progress in these fields by appropriate methods of international cooperation. The 12 projects and their Chairmen and Co-Chairmen are:

1. Monitoring of the Solar Terrestrial Environment: A. H. Shapley; N. V. Pushkov
2. Proton Flares: Z. Svestka; P. Simon
3. Disturbances in the Interplanetary Magnetic Field Configuration: H. Carmichael; T. Obayashi
4. Determination of the Characteristics of the Magnetosphere: J. P. Heppner; V. A. Troitskaya
5. Conjugate Point Experiments: J. G. Roederer; R. Schlich
6. Electric Fields in the Magnetosphere: G. Haerendel; C.-G. Fälthammar
7. Magnetic Storms and Polar Disturbances: D. J. Williams; J. A. Jacobs
8. Low-Latitude Aurorae: G. Weill; S.-I. Akasofu
9. Basic Structure of the Upper Atmosphere: F. S. Johnson
10. Dynamics of the Upper Atmosphere: C.O. Hines; E. A. Lauter
11. Ion Chemistry of D and E Regions: S. A. Bowhill
12. Sudden Ionospheric Disturbances: J. W. King

IUCSTP has several other functions. It is the clearinghouse for international symposia in all aspects of solar-terrestrial science, and is heavily involved in preparations for the multi-union symposium scheduled for Leningrad in May 1970. IUCSTP guides and monitors the international exchange of data through the WDCs in the solar-terrestrial sciences, and it was playing this role in issuing STP Notes No. 6, The Guide for International Exchange of Data in Solar-Terrestrial Physics. IUCSTP Working Group 1 guides the monitoring work and the data exchange.

URSI, just as do the other scientific unions mentioned, participates in IUCSTP activities. Scientists active in URSI are members of IUCSTP and the Working Groups and are active participants in the scientific work carried out under IUCSTP auspices. The URSI participation is coordinated by an URSI/STP Committee, which also guides similar and related work more directly under URSI auspices. The URSI/STP Committee meets almost once a year or sometimes oftener, and so is able to provide more active coordination than the URSI General Assembly itself, which meets every three years. The other scientific unions involved, and also COSPAR, have equivalent mechanisms for coordinating the more specialized aspects of solar-terrestrial programs.

Thus IUCSTP and several of its programs are interested in ionospheric vertical sounding work, both systematic and special work. Our regular work is part of the monitoring of the solar-terrestrial environment. Sometimes we participate without realizing it in other IUCSTP projects through the regular data exchange; some of you are more direct participants, such as in the conjugate point work mentioned in INAG-1. All this is loosely organized international cooperation which has -- in IGY, in IQSY and already with IUCSTP and the IASY -- led to important advances in solar-terrestrial physics and the "classical" scientific areas of which it is composed, including ionospheric studies. IUCSTP is our bridge to all the non-specialized scientists who are interested in our work. It is a two-way bridge.

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Southern Hemisphere Ionospheric Studies Group (SHISG) -- A group of ionospheric scientists from Southern Hemisphere countries met in Ottawa during the XVIth (1969) General Assembly of URSI to discuss the possibility of establishing a way of communication and coordination of efforts among colleagues and organizations in our hemisphere. A Southern Hemisphere Ionospheric Studies Group (SHISG) was established with a convenor and national contacts that should collect the information in each country. A bulletin will be issued approximately every six months. It will be edited by the convenor. The first issue, to be mailed during March 1970, will contain a summary of information about: organizations, research groups, coordinates of observation sites, equipment used, schedules, lines of research and responsible investigators in the Southern Hemisphere.

For additional information, please write to: Prof. S. M. Radicella, Convenor SHISG, c/o Departamento de Aeronautica, Universidad Nacional de La Plata, Calle 1, esq. 47, La Plata (Bs. As.), Argentina.