IONOSPHERIC NETWORK ADVISORY GROUP (INAG)*

Ionosphere Station Information Bulletin No.20 **

* Under the auspices of Commission III Working Group III.1 of the International Union of Radio Science (INAG).

** Issued on behalf of INAG by World Data Center A for Solar-Terrestrial Physics, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302, U.S.A. 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.

1. Introduction

by

W. R. Piqgott, Chairman

INAG wishes to draw your attention to its next full meeting to be held at Lima on August 7-8, 1975 immediately before the URSI General Assembly (INAG-17, p. 11, INAG-18/19, p. 2 and p. 28-30). All interested in ionosonde problems are invited to take part and there will be an opportunity for further discussions during the General Assembly on the afternoon of Tuesday, August 12. The agenda for the meeting will include a full discussion of the new High Latitude Supplement of the Handbook, the future of INAG, the future of the INAG Bulletin and adoption of rules and clarifications discussed in past INAG Bulletins. This is also our last chance to discuss the interaction between the networks and the IMS. These points are expanded elsewhere in this Bulletin: *it is important that those not able to attend either send written notes to your Chairman or local INAG member or request your URSI representative to take part on* *your behalf.* INAG believes that it has been useful to you in the past and that something similar to it will be needed in the future. However, with the present economic crises the question is not whether INAG is needed but whether the cost of providing its service can be justified relative to other international needs. As you know, our URSI Working Group has to be established by a General Assembly and is automatically dissolved at the next General Assembly unless that Assembly decides to recommend that it be continued. This year INAG is in a particularly vulnerable position since the INAG Bulletin is mainly financed through URSI funds, which are under great pressure. No other Working Group involves URSI in this type of expenditure. This is a matter in which you, the users of INAG, must make the critical decision. *If you wish INAG to continue you should inform your National Committee and get them to discuss whether to back your request and what type of organization is most appropriate.* In many cases silence implies consent, in this case, URSI must discover whether there is a real demand for our INAG-type body to continue.

The vertical incidence network has special duties and opportunities during the IMS. One of the central problems of the INS is the interrelation between the ionosphere and magnetosphere for which conventional synoptic observations are very valuable. In unstable areas abnormal traces due to tilted or field aligned structures can give valuable information; e.g., changes in the position of the plasmapause and of particle precipitation can be measured using replacement layer traces or storm types of sporadic E traces, respectively. Data are also needed from zones which are not effected directly by these phenomena so as to separate out other causes of change in ionization structure.

While historically the vertical incidence network was largely developed for practical purposes, for many years relatively few URSI scientists have been directly interested in this type of problem and the task of keeping the CCIR in touch with changes in the science was mainly met by a few volunteers. Changes in emphasis in the interests of URSI which will be discussed at Lima may well alter this situation and promote more interest in the practical applications of our data. However, the concentration of some fields which use our data in IAGA and the increase of interest in the dynamics of the ionosphere by meteorologists raises the question of whether INAG should organize meetings in conjunction with IAGA or WMO as well as with URSI? The meeting held in conjunction with CCIR (INAG-17, p. 2-11) proved very valuable and enabled a number of people who normally cannot attend an INAG meeting to contribute. *Should we hold a repeat in 1976 in connection with the Interim Study Group 6 meeting in Geneva Feb. 16 - Mar. 3, 1976? INAG wishes to know whether a significant number would find it easier to attend an INAG meeting associated with these bodies than with URSI?*
Travel funds and time are very limited and we cannot consider these possibilities unless there is evidence for a real demand and real support is likely. *INAG would like to receive at Lima reports from any groups who have organized training or discussion meeting on Ionogram problems and, in particular, comments on outstanding problems and on methods of improving such efforts in the future.*

2. The Future of INAG

The future of INAG will be considered by URSI at Lima, particularly in view of the difficulties in financing the INAG Bulletin discussed elsewhere in this issue. Following the success of the URSI Special Committee on High Latitudes, a very active body, the World Wide Soundings Committee (WWSC) was set up in 1955 under the chairmanship of A. H. Shapley. This dealt with the detailed planning for the IGY-IGC and produced the first URSI Handbook of Ionogram Interpretation and Reduction. After the IGC, this body was dissolved and the responsibility for advising the network was delegated to an URSI V.I. Consultant - W. R. Piggott. Control with the network was maintained by correspondence with detailed discussions held under the auspices of the URSI-STP Committee and its predecessors. On the average a meeting was held about every eighteen months. A special meeting of vertical incidence soundings specialists, convened by URSI-STP in January 1969, drew attention to the need for more effective and active guidance for the VI network. The parent committee, URSI-STP, recommended to the General Assembly of URSI August 1969 (Ottawa) that INAG be set up and an INAG Bulletin published regularly. Since then INAG has successfully encouraged the network, revised the interpretation rules, published revised Handbook and prepared a High Latitude Supplement to the Handbook. There are, therefore, close parallels with the situations when the WWSC was dissolved.

It is now generally accepted that the dissolution of the WWSC was, on balance, a mistake which seriously decreased the effectiveness and value of the VI network. With a network which is now larger than in the IGY, it is important not to repeat this mistake, On the other hand it is clear that the major re-examination of network operation and the revision of the Handbook needed in 1969 is now complete and it is agreeable that the main attention of INAG should now be diverted to answering questions, monitoring the reliability of the network and acting as a liaison where new techniques need to be introduced. It is undesirable that basic rules are altered at frequent intervals but it is important that they are properly understood and employed. Misunderstandings on the application of the rules undoubtedly seriously decreased the value of much of the IGY and IQSY data. This must be avoided in the future and, in particular, during the IMS.

It thus appears to be timely to review the method of operation of INAG, to discuss whether it should continue and if so, how its work can be done most efficiently. *INAG exists to help you and we need your views in order to make sensible decisions. INAG invites comments by letter or at Lima so that a reasonable consensus of opinion can be identified.* We must stress that all INAG activities are two way - the operators or scientists raise the questions, INAG discusses them and sounds the general opinion, and then comes to decisions on what action should be recommended to you. It is effective because the users are sufficiently interested to cooperate.

To start discussion your chairman would like to suggest that the following points may need consideration:

(a) Many effective discussions occur during training seminars. These are often wasted, so far as the network is concerned, because they are not properly collected, summarized and circulated. *Can we improve this situation?*

(b) INAG meetings provide both a forum and a provocation for discussion. The INAG structure was designed to make it easy for INAG members to promote discussions in all parts of the world. In fact, however, most such discussions have occurred when the Chairman has called the meeting. *Can we improve this situation? Should the Chairman attempt to organize more meetings and if so, who will pay the costs? Alternately do we hold too many meetings?* (See INAG Bulletins for details).

(c) The INAG Bulletin has been an essential factor in provoking discussion, getting different groups interested in particular problems and informing all stations of the decisions made. No other publication reaches more than a small fraction of the stations. *Can INAG be effective without the INAG Bulletin? If not, what is the size and publication rate for the greatest cost effectiveness? How can this be financed?*

(d) The IMS calls for a monitoring program involving synoptic ground based ionospheric measurements. *Can this be successfully completed without assistance from a body such as INAG? If not, is the INAG organization suitable as it stands or should it be altered to improve this aspect of its work; e.g., by more use of WDC's? Who will provide the effort needed?*

(e) Many of those who have provided URSI assistance to CCIR or who have worked on the practical applications of VI data are now retiring from old age. *Is there a need to promote new interest in these problems? If so, should this be done by INAG? How?*

-(f) With many of the applications of VI data now being actively discussed outside URSI, e.g., in IAGA and the WMO, would it be useful and desirable for INAG to hold meetings in conjunction with the meetings of such bodies? Should INAG itself be more closely linked with these organizations? If so, how? Your Vice-Chairman, J. Virginia Lincoln, will hold an ad hoc meeting of INAG during the Grenoble IUGG General Assembly Aug. 25 - Sep. 6, 1975.

This list of points is certainly not exhaustive and it would be helpful if you could add your own, preferably before Lima, so that an organized discussion is possible. INAG members and consultants in particular are requested to send their points to the Chairman as soon as possible.

3. INAG Bulletin

The future of the INAG Bulletin must be discussed at Lima, In the past the costs have been met partly by URSI and partly by WDC-A for Solar-Terrestrial Physics. INAG has been informed by the Secretary-General of URSI that the URSI contribution will cease at the end of 1975. Subject to General Assembly approval, the sum allocated for 1975 can, however, be spent over a longer period; e.g., by only publishing one or two bulletins per year. The financial position of WDC-A has been getting more difficult with time and it is unlikely that it will be able to help much longer without assistance for printing expenses. In particular, the duplication of the Spanish edition of the Bulletin is now critical though assistance beginning July 1975 is probable from the Pan American Institute of Geography and History (PAIGH). Some decisions and action must be taken at Lima.

It appears to be generally agreed that the Bulletin is an effective means of promoting discussion on network or ionogram problems and of getting rapid implementation of decisions agreed throughout most of the world. It has had a significant effect on the quality of the data produced by the Network and provides means whereby meetings can be organized and new problems identified quickly.

The number of problems raised in INAG meetings is still large but there is now rather little direct asking of questions by letter to INAG. Thus, *it may be that the Network is now on a sound basis and that the effort needed from INAG is decreasing. What is your view?*

4. INAG Meeting at Lima August 7-8, 1975
Provisional Agenda

1. Chairman s introduction - condition of network, response to INAG requests for opinions or test experiments.

2. Review of INAG activity since the URSI General Assembly at Warsaw 1972.

3. High Latitude Supplement to Handbook.

4. Clarification of problems raised by audience and INAG members.

5. Discussion on changes to Handbook rules proposed in the Bulletin.

6. Adoption of amendments to Handbook.

7. Future of network. (discussion)

8. Future of INAG. (discussion)

9. Future of INAG Bulletin. (discussion)

10. Report to URSI General Assembly.

11. Any other Business.

All who are interested in the production or use of vertical sounding data are invited to attend for all or part of the sessions. Discussions with small groups can be arranged on 9th or 10th or during URSI General Assembly. Some indication of the scope of the discussion is given below.

5. <u>Points for Discussion and Recommendation at LIMA Meeting of INAG</u>

Since the Warsaw meeting of INAG, there have been a number of points raised for discussion and, if there appears to be an adequate consensus of opinion, adoption by INAG at its meeting at Lima. It is INAG's policy to consider all points put to it, to explain the advantages and disadvantages of each and to recommend adoption, rejection or further discussion as appears appropriate. As far as possible formal adoption of new rules is made at URSI General Assembly meetings so that there are not too many minor changes at different times. The Agenda of the Lima meeting will include the following points:

1. To draw attention to and confirm INAG decisions made since the URSI General Assembly at Warsaw.

1.1 Adoption of corrections to Handbook as published in INAG Bulletin 16, Pp. 10-20. Points of substance are:

(a) New section 1.9 Computer output allowing use of capitals for computer output; e.g., foF2 reads FOF2.

(b) Addition of accuracy rules in total range of uncertainty form, new section 2.23.

(c) Revised Lacuna text **,** section 2.75.

Cd) Legalization of use of WWSC format for qualifying and descriptive letters, (mainly at Australian stations), section 3.

(e) Clarification of difference between qualifying letter A and qualifying letter E, section 3.1.

(f) Clarification of use of JA instead of JX when foEs deduced from ftEs, section 3.2 and 8.2, (see INAG-16, p. 15 and 20).

(g) Use of letter K, removal of restriction of particle E (night E) to disturbed days and clarification (see also below).

(h) Use of letter Y for large tilts in the F2 layer, section 3.2.

(i) Clarification of quartile rules usage, sections 8.4, 8.5.

(j) Withdrawal of para c letter A usage for fbEs greater than foF2.

(k) Replacement of letter R for range spread by letter Q in spread F typing.

1.2 To formally adopt the Amendments published in INAG-17, pp. 5—6. The main points are:

(a) New text for characteristic modes, p. 8 first paragraph.

(b) Clarification of use of foEs = (ftEs)-B, (ftEs) MB, or (ftEs)AA and additional consequential changes in use of JA for JX made in INAG-16, pp. 15, 20.

1.3 To add any further corrections found since and to correct INAG-16, p. 16, section 8.33, insertion. Replace 'The phrases equal to' by 'The'.

1.4 To discuss and, if approved, confirm the decision of the INAG meeting at Geneva to adopt the name Particle E for the phenomenon traditionally called night E and to recommend that the Handbook be amended accordingly, (INAG-17, pp. 7-8), and decide whether the definition should be expanded to include the physical definition, INAG-17, p. 8.

1.5 To discuss the proposals of the INAG meeting at Geneva on the use of letter P. (INAG-17, p. 6).

(a) As descriptive letter to denote perturbation of value by man-made phenomena.

(b) Replacement of letter S by P as a spread F type to denote the presence of spur types of spread F.

1.6 To discuss the use of capital instead of lower case letters for Es and spread F types.

2. To consider the four recommendations of the Kaliningrad Symposium 1971 and to decide whether these should be amended and adopted or rejected by INAG. These recommendations (INAG—12, pp. 20, 21 and INAG—13, pp. 2-3) imply additional work at stations or by administrations and INAG has therefore allowed time for the network to decide whether they are practical or not. *So far only those in favor have expressed an opinion — is there any opposition? THIS IS YOUR LAST CHANCE TO AMEND THESE RECOMMENDATIONS.*

3. To discuss spread F typing (INAG-17, Pp. 6, 7, sections 10, 11, pp. 15, 16; INAG-18/19, pp. 10-12; INAG-12, pp. 5-6; INAG-.15, pp. 3-6, and p. 9).

4. To discuss representation of oblique traces on f-plots and in particular whether the old WWSC rule on the use of Q (q) be reintroduced, (INAG-18/19, pp. 5, 6).

5. To consider points raised on Lacuna text, (INAG-18/19, p. 7).

6. To receive reports on special experiments, methods of analysis or other responses to INAG requests. See in particular Chairman's introductions to INAG Bulletins and Reports on Geneva, London and Kaliningrad meetings (INAG-17, pp. 2-11; INAG—14, pp. 2—11; INAG-13, pp. 2-6).

6. <u>High Latitude Supplement</u>

INAG wishes to thank the many contributors to the High Latitude Supplement which is now being edited and should be available for Lima. A very large number of difficult ionograms have been received which deserve fuller discussion than is possible in the Supplement. The Chairman hopes to be able to discuss these in future issues of the Bulletin.

The most common source of difficulty is the distinction between particle E (night E) and retardation type Es. The problem is particularly severe when the lower part of the F layer is significantly tilted at the time when the particle E is forming - a fairly common situation. Retardation of the F trace is then often confused with several superposed traces or, at the other extreme, shows a turn up in height which varies much more rapidly with frequency than would normally be expected. This will be discussed more fully at Lima. It is your Chairman's opinion that a significant number of particle E traces are being incorrectly ascribed to retardation Es in such circumstances.

The large number of ionograms sent show that it is very common for the F layer to have an abnormally dense tilted tail when particle E is present. While this complicates the recognition of the retardation of F trace it also frequently increases the height differences between corresponding points on the o and x mode traces. A jump in the x-mode height with time relative to the o-mode trace is a good additional indication of the formation of a thick lower layer and hence a good indication of the presence of particle E. In general, most groups are not paying sufficient attention to the second order trace when distinguishing between particle E and retardation Es and are not including the particle E critical frequency when clearly present. Remember the higher frequency end of an Es-r trace is partially reflecting and cannot give a second order trace, the corresponding part of a thick layer trace is totally reflecting and can give a second order trace, if the sensitivity is sufficient. The low gain ionogram is also very valuable for distinguishing between particle E and retardation Es—if the gain level is sufficiently decreased particle E can still show retardation whereas the retardation Es trace will cut off at the point where the layer ceases to be totally reflecting.

Some groups are not paying sufficient attention to the presence of overhead multiple order traces in distinguishing between flat and auroral type Es. If such traces are present, a flat Es is definitely present. It may have an auroral Es superimposed and the shape the pattern shows whether foEs is more likely to be due to Es-a on Es-f.

7. Reports from World Data Centers

World Data Center A for Solar-Terrestrial Physics, Boulder, Colorado, is preparing a detailed catalog of all of its holdings in vertical incidence data. Data prior to the IGY will be included. In a consolidated table for each station year-by-year will be given the monthly data held as ionograms, f-plots, daily work sheets, monthly tabulations and hourly composites N(h). The format of the data such as microform, punched cards, magnetic tape in addition to paper tabulations will be included, The number of characteristics routinely reduced will be included.

In addition, the number of electron density profiles available per month will be presented by station in a separate table. The holdings of special projects and special ionogram films will be listed.

Errata to the Master Station List for Solar-Terrestrial Physics Data at WDC-A for Solar-Terrestrial Physics, Report UAG-38, issued December 1974, are given in the following table:

Station	Corrected Information		Station	- Corrected Information	
Arkhangelsk	Add B01		Maynard	Close date	7/1975
Baddow	Open date	11/1940	Mirny	Close date	1/1973
Bandoeng	Close date	9/1945	Palau	Close date	6/1944
Barbados	Close date	6/1967	Penang	Open date	3/1944
Burghead	Open date	1/1941	“	Close date	8/1945
Calcutta	Open date	7/1944	Pt. Arguello	BO1 34.60	N
Cape Parry	Add BO1	70.17N 234.37E		RangoonClose date	2/1945
Chita	Close date	5/1963	Sachs Harbour	234.85E Open (11/1974)	
Ft. Norman	Close date	(10/1958)	Shikuka	Close date 121941	
Hankow	Open date	9/1941	Slutsk	Add BO1	59.70N 30.5E
Heiss Is.	Open date	1/1938	Snainton	Add BO1	54.211 O.OE
Hiratsuka	Open date	12/1940	“	Open 8/1944Close 9/1944	
Inverness	Open date	10/1951	Sondre Stromfjord	Add B01	67.02N 309.2SE
Kaminoge	Close date	8/1945	Terre Adelie	Open date	(12/1949)
			Watheroo	Open date	1935

8. Notes from Stations Antarctica

The following is an abstract of a letter to the Chairman from J. R. Dudeney, Head of the Ionospheric Group of the British Antarctic Survey:

“As you may know, the British Antarctic Survey operates three ionosonde stations in the Weddell Sea sector of Antarctica. These are: South Georgia (54˚16’S, 36˚30'W), Argentine Islands (65˚1S’S, 64˚16'W) and Halley Bay (75˚30'S, 26˚40’W). All three run a routine ¼ hourly sounding programme, with expanded height scale ionograms (for E-region studies) at the half-hour. The data are published through WDC-C1. We are currently reviewing our policy towards operating these stations in the post IMS period and would greatly appreciate your views on the following questions:

1. *Will there continue to be a need for a synoptic network of ionosonde stations, located in key sites, after the IMS; if so, for what purpose?*
2. *Do you consider any of the three stations operated by the survey to be located in a key site; if so, why?*
3. *Is the data from these stations of special interest to your group?”*

Please send your comments to the Chairman for collation.

Cocos Island

At the end of September 1974 the vertical incidence ionosonde program was terminated. The station had been in operation since November 1961. The ionograms and scaled data are available on loan upon request to “Assistant Secretary, IPS, Box 702 Post Office, Darlinghurst N.S.W. 2010 Australia”.

Fortaleza

The operation of a NOAA-owned ionosonde by the Brazilian Navy at Natal has terminated. The custody of the ionosonde has been transferred to the Instituto de Pesquisas Espaciais (INPE), and it has been moved to Fortaleza, Brazil, some 300 miles northwest along the coast. The need for work on the equipment has delayed the initiation of routine observations at Fortaleza by several months. The exact dates relating to the change of location will be noted in a future INAG Bulletin.

Northwest Territories, Canada

NOAA-owned ionosondes have been deployed to two auroral zone sites in the north of Canada: Sachs Harbour (on Banks Island), and Cape Parry, both in the Northwest Territories. They were operated in December 1974 and January 1975 in support of Operation TORDO, a cooperative program to investigate plasma convection in the magnetospheric cleft. The scientific investigators were from the Los Alamos Scientific Laboratory, the University of Alaska Geophysical Institute, the University of Texas at Dallas, and the Sandia Laboratories in Albuquerque. The success of the operation has led to further plans by the University of Alaska Geophysical Institute to operate the ionosondes one month out of every three for the next two years, which will include the IMS interval. One of the stations may be moved to better bracket the magnetospheric cleft position, and a third station may be added to further refine the measurements. Ionogram film from these stations will be archived at WDC-A for Solar-Terrestrial Physics, Boulder, Colorado, and the first of the films are already in hand.

Sottens

The ionospheric sounder in Sottens had to be taken out of service at the end of October 1972 for technical reasons, such as HF radiation from high-power transmitters operating in the vicinity, which would have necessitated a relocation of the facility, In the meantime it has been decided to take the ionosonde out of operation permanently, and to refrain from making any further investments in this field. The ionosonde, a model 1005W from Magnetic AB in Bromma, Sweden, was installed in 1969. Any readers of this Bulletin interested in buying this ionosonde may write for further details to:
General Directorate of PTT, Radio and Television Division, Operations and Studios, Viktoriastrasse 21, CH - 3000, Bern 33, Switzerland.

9. Antarctic and Southern Hemisphere Aeronomy Year (ASHAY)

A second progress report on ASHAY planning was issued in April 1975. The addresses for National Contacts, International Organization Contacts, and Steering Committee of ASHAY are given. The Working Group reports include plans, recommendations and membership lists. Working Group 1: Aeronomic

Effects in the South Atlantic Anomaly has J. A. Gledhill as reporter. Working Group 2: Low Latitudes F Region in the South American Sector has R. Woodman as reporter. Working Group 3-4: Auroral and Subauroral Aeronomy has K. D. Cole as reporter.

Questions concerning ASHAY should be directed to: Prof. S. M. Radicella, Convener of SHISG, Observatorio Astronomico, "Felix Aguilar", U.N.S.J., Avda. Benavidez 8175 Oeste, Marguezado, San Juan, Argentina.

10. Training Programs

Attention is drawn to the list of training programs published in INAG-15, pp. 14—15. Some of these are annual and application to attend should be made to the organizers soon. INAG requests groups who are planning training programs to inform it at or before the Lima meeting so that details can be published in the next INAG Bulletin, planned for the Autumn. *An Australian Training meeting is due in 1975, will it be held?*

Periodically NOAA/EDS in Boulder, Colorado has conducted both formal and informal classes on ionogram interpretation and reduction. The most recent of these was given in November 1974. The main purposes of this particular instruction class were to update the skills of NOAA scalers at Maui and Wallops Island, to teach the skills to our newer people and to visiting scientists at Boulder, and to train field personnel for ionogram scaling at associated sites. The training consisted of a two-week course of instruction and practical application of the principles described in the URSI Handbook of Ionogram Interpretation and Reduction) second edition, 1972. The classroom instruction was given by Lucile S. Hayden and was recorded on audio tape. These recordings along with examples and illustrations are to become an instructional tape series for training at WDC-A for Solar-Terrestrial Physics, Boulder, and other field sites. If sufficient interest is shown in this type of training, thought will be given to the development of a video tape series that could be used internationally. A video tape series should provide a splendid and economical method of training people thoroughly and consistently in the URSI recommended procedures for interpretation and reduction of ionograms. Video tape would provide ease of updating and could be bi-lingual.

11. Proposed New Ionosonde

Mr. Gosta Rosen, the designer of the widely used Magnetic AB ionosonde, has informed INAG that his company is proposing to develop and produce a new ionosonde, specification below. This ionosonde is based on the Finnsounder (INAG-7, p. 16) and the development will be made jointly with Finland. We are informed that Finnsounders have been deployed at Sodankyla and Nurmijarvi. It will use the successful Finnish stepped frequency synthesizer and control and calibration units with an improved transmitter and receiver. The cost will depend partly on the likely demand for these equipments, those interested are invited to write to:

Gosta Rosen

Gosta Rosen Elektronik AB
Karlsbodanagen 25
Box 20034 S16120
Bromma 20
Sweden

As has been stated before, INAG is not in a position to test or judge commercial ionosondes but circulates material sent to it for the information of the network. Previous notes on new ionosondes will be found in INAG-2, p. 11; 3, pp. 10-11; 4, p. 14; 6, p. 14; 7, p. 16; 13, p. 17; 14, p. 16; 15, pp. 15-19; 15, p. 19; 17, p. 4; 18, p. 32; 18, p. 35.

Technical Specification

Stepped Ionospheric Sounder 7412

1. Specification

1.1 Transmitter

Frequency range	0.5 - 20 MHz
Step resolution	200 step / octave
Output pulse power	5 kW can be increased by optional power amplifier
Pulse rate	50/60 Hz Synchronized to line frequency
Pulse width	10 - 70 µ secs.
Sweep mode	Logarithmic

1.2 Receiver	Synchrodyne
Output	Balanced diode mixer
Bandwidth	Selectable 10, 50, 100 kHz
Gain	Selectable in three steps (Gain Running)

2. Build up

The sounder will be built in two main units in the way that the transmitter will be built as a separate unit. This gives two advantages. The sounder will be easier to transport when it occasionally is to be taken on certain expeditions. It is also easier to separate the RF-power-circuits from oscillator- and control-circuits. This will eliminate different kinds of feed-back.

The units will be built as 19” standard. Standard hardware will be utilized.

Display units:

Two displays will be supplied. One for the recording camera will be the Tektronix type 604. As monitor scope we will use the memory display unit Tektronix type 603.

As an alternative we will also study a new display unit supplied by Hewlett Packard type no. 1332A.

12. Dartmouth College Ionosonde

Dartmouth College Radiophysics Laboratory designed and built four inexpensive ionosondes in 1967 for the purpose of studying travelling disturbances using an unmanned network. These have proved remarkably reliable even though operated unmanned at the rate of one ionogram every two minutes for five years. One operated for 23 months before requiring any maintenance, apart from film changes at weekly intervals. The power output available was 2 kilowatts and excellent ionograms were produced. However, the lowest frequency used was rather high for observatory purposes. Modification to less frequent operation is trivial, but a different camera would be needed for 35 mm film.

Prof. Millett G. Morgan is now considering small scale production of these equipments based on the specification attached, with, if desired, the possibility of a lower minimum frequency. The price, at January 1975 prices, per instrument is estimated at approximately $10,000 U.S. with delivery within one year after order (if sufficient interest exists to start production).

Further particulars can be obtained from:

Prof. Millett G. Morgan
Radiophysics Laboratory
Dartmouth College
Hanover, New Hampshire 03755 USA

SPECIFICATIONS:

General	
Input power	525 W, 115 v, 60 Hz
Size	52” high, in 19” rack
Tuning range	1.6 to 20 MHz
Record Format	16 mm motion-picture, normally 1 record/2 minutes
Timing accuracy	10 seconds/2 weeks; timer can be battery-operated
Frequency sweep	logarithmic, 2.0 to 20 MHz; 1.6 to 2.0 MHz not calibrated; 20 sec duration
Height sweep	linear, normally 750 km
Height marks	50 and 500 km intervals
Frequency marks	1 MHz intervals, with mark at 2.5 MHz

Transmitter	
Peak pulse power	2 kW
Pulse repetition frequency	100 Hz
Pulse shape	Gaussian
Pulse width	60 µ sec at half-voltage points
Receiver	
Sensitivity	2 µ v for 6 dB signal/noise
IF bandwidth	30 kHz
Recovery following transmitter pulse	300 µ sec
Max signal at antenna terminals without overloading	3 volts p-p

13. Tilts at Mid—Latitudes

The analysis of mid-latitude ionograms is based on the assumption that tilt effects are usually small. This assumption results directly in the normal rules for ionogram interpretation, in particular, that the lowest trace seen from a given layer is most nearly overhead and that the lower frequency edge of a spread critical frequency is most likely to give the overhead critical frequency. The assumption applies for the great majority of ionograms taken any where in the world so far as basic analysis is involved, but this should not be allowed to hide the fact that significant tilts, up to about 15°, can be present on occasion even at mid-latitude stations. Such tilts are most often found near sunrise, near sunset and when large travelling disturbances are present. Large tilts are also found occasionally during periods of ionospheric storm. In extreme cases some typical auroral zone phenomena have been seen at latitudes down to the magnetic equator!

At present there is relatively little general interest in mid-latitude tilt phenomena though these are being studied intensively at a few stations. For this reason the international rules take note of tilt (letters H, N, V, Y) when it is likely to be sufficiently great to introduce errors in the observed parameters which are great enough to invoke the use of the accuracy rules, (Handbook p. 27-31, 36-48). The detection of tilt effects depends on the care with which ionograms are reduced, careful operators report considerable numbers of examples, less careful almost none. The purpose of this note is to draw your attention to the phenomena which also provides a method of increasing the interest in the ionograms and hence the accuracy of your data.

The presence of quite small tilts can have a disastrous effect on electron density-height analyses and the measurement of M(3000)F2 (Handbook, p. 42, 43) and it is very desirable to compare values from a closely spaced (not more than 15-minute interval) sequence of ionograms when the highest accuracy is required. Special care is needed at sunrise and sunset and careful

checks on the amount of tilt present (e.g., from $h'_1 - h'_2/2$ where the subscripts refer to trace order) should be made before the results are accepted.

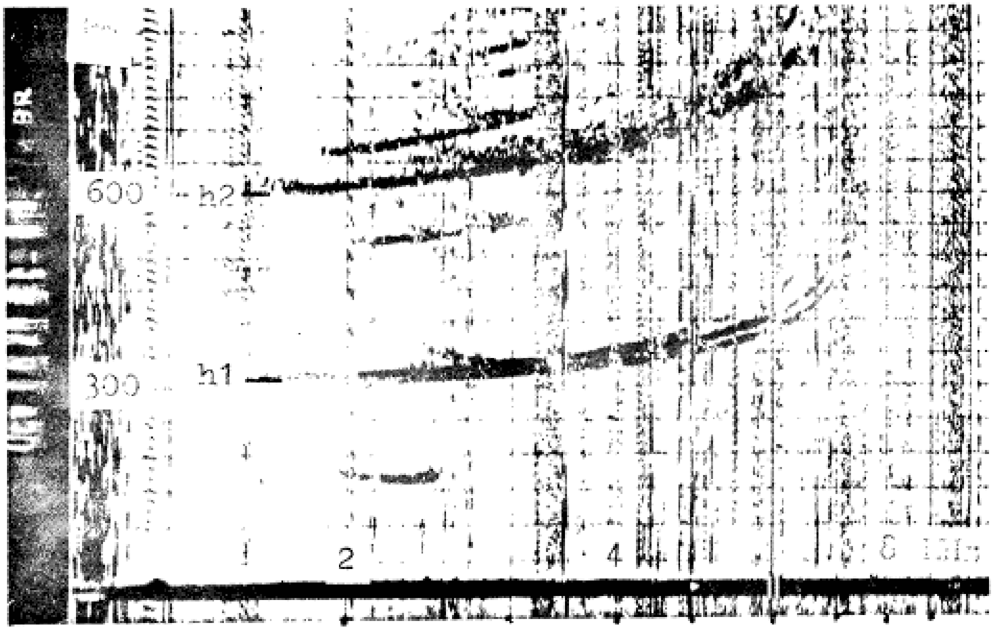
The attached note from Mr. G. Cairns (Brisbane) is intended to stress the point that significant tilts can be found at mid-latitude stations and that due care should be taken so that their effects are not overlooked.

<u>Note on Tilts at Mid-Latitude Stations - G. G. Cairns, IPS, Brisbane</u>

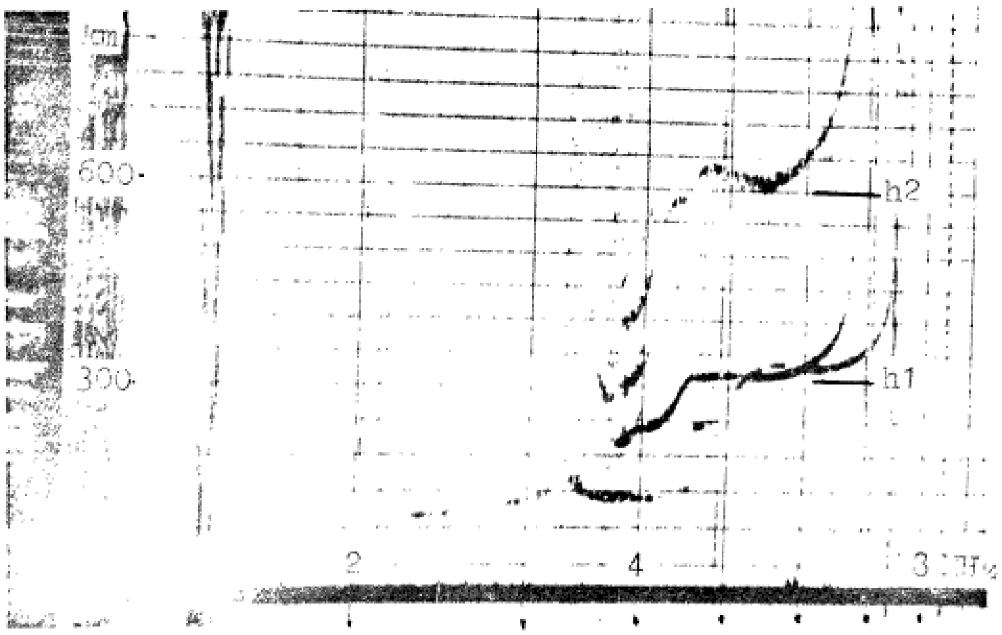
Section 2.71, p. 38 of the U.R.S.I. Handbook of Ionogram Interpretation and Reduction, second edition, November 1972, deals with the identification of large scale tilts. Figure 2.7 illustrates changes in pattern when a large perturbation approaches the observing station. However, the tracings in Figure 2.7 are of ionograms recorded at Ellsworth, Antarctica, on April 21, 1958 during an extremely large and relatively slow moving ionospheric disturbance (G. G. Bowman, Planet. Space Sci. 1969, Vol. 17, pp. 777-796) and such large scale tilts showing the marked differences in virtual heights, h_1, h_2, h_3 ... of the multiple traces would be an extremely rare occurrence at mid-latitude stations.

The ionograms accompanying this note were recorded at Brisbane (S27.53). The difference (h_2 -2h_1) in virtual heights indicates a tilt of about 10° in both cases although in the first ionogram the tilt is more obvious at frequencies below 4 MHz. In this ionogram an Es layer at 155 km, showing what appears to be a retardation effect at 1.7 MHz, suggests the presence of an ionospheric disturbance. Likewise in the second ionogram satellite traces in Fl region indicate the presence of a disturbance.

Chairman



Ionogram 1. Brisbane, October 16, 1974, 2001 hours.



Ionogram 2. Brisbane, October 30, 1974, 1430 hours.

14. Particle E (night E)

A number of questions have been raised by operators involving cases where particle E (night E) has been clearly identified on one or more ionograms of a sequence but the remainder are controversial. Some of these are based on the idea that particle E should be slowly varying in time. While this does occur at many stations, it is more usual for there to be rapid changes from retardation type Es to particle E or vice versa or from auroral type to particle E or vice versa (occasionally slant to particle E or vice versa at a few stations).

The principal scientific use of particle E is that it shows particle activity overhead as opposed to particle activity near the station. Thus, one needs positive evidence that it is present, doubtful cases are usually better ascribed to Es. The criteria are given in the Handbook. A cannon situation when the particle activity moves away from the station, is for a clear particle E trace, showing good retardation at foEs (=foE-K) to become a flat trace or trace showing weaker scattered signal near foEs. The former is particularly common when absorption and hence fmin is relatively large. There is a distinct decrease in the solidity of the trace near foEs when particle E turns into retardation Es or auroral or slant Es and usually there is a distinct change in the shape of the retarded section of trace.

Note that at many high latitude stations, the incidence of particle E varies considerably with solar activity; e.g., at Halley Bay it was almost unknown in the IGY and little seen at the last maximum period, but has been common in the IQSY and subsequent low activity years. The reverse behavior can also occur.

With more attention being paid to particle E it is becoming clear that it is much more widespread than was expected and that mid-latitude particle E is not necessarily associated with magnetic disturbance. The Weddell Sea - South Atlantic group of stations report much particle E at virtual heights between 150 and 180 km. *It would be interesting to hear whether this is also seen in other areas.*

The possibility of expanding the definition of particle E to include its physical definition will be considered at Lima. *Do you want the clarifications made in the INAG Bulletin on this collected as a revision to the Handbook?*

15. d—type Es

The introduction of d—type Es as a distinct type has resulted in increased interest in it and there are now a considerable number of reports of its presence at stations at times when high absorption was absent. The original main reason for including it was its use for identifying high absorption conditions - the increased ionization in the D region generates a total or gradient reflection from the steep lower edge of the abnormal zone. As stated in the Handbook, the trace can also be generated by the mode of reflection changing from 0-mode to z-mode at the higher magnetic latitudes and many of the exceptional traces reported appear to be of this type. With stations having high sensitivity, it is possible to obtain a stable weak partial reflection below 90 km. giving a weak trace present. on most ionograms. There has been much controversy about this trace, some authors finding that it varies with meteoric activity. Such traces have been described as meteoric Es in the literature for this reason. When the signal-to-noise ratio is very good, foEs for this trace can be regularly larger than that usually given by any other type of Es This has caused much confusion in Es statistics; e.g., the CCIR maps of Es are based on this mode of reflection in Europe. The increase in man-made interference, due to the increase in use of the MF and HF bands with time, has made it more difficult to record meteoric Es but advanced systems of improving the signal-to-noise ratio now enable it to be detected fairly easily.

It is therefore worth-while to draw attention to the need to keep the distinction between strong and very weak Es type traces. Unless the very weak traces are ignored in the determination of foEs, as laid down by the weak trace rule, foEs and fbEs statistics are badly distorted (meteoric Es is never totally reflecting and fbEs Is therefore an EE value except where an o-z mode changeover occurs and is interpreted to give a numerical value of fbEs).

For stations seeing meteoric Es type traces, strict application of the rules would imply a ‘d’ entry in the Es—type table for nearly all ionograms. This high incidence shows clearly that high sensitivity is available so that the data should not be misleading. Pending fuller discussion it seems best to keep the rules as they stand at present but it is necessary to be cautious In using ‘d’ entries as an indication of high absorption.

INAG would like to know whether this phenomenon is causing difficulties at stations or to scientists using Es—type data. A discussion on d-type Es will be held at Lima.

26. Ionospheric Drift Measurements

Subgroup 3.2.1 of URSI Commission III proposes the following periods for coordinated simultaneous ionospheric drift or wind measurements in 1975:

1975 - January 27 - February 14
April 7 - April 25
September 1 - September 19
November 3 - November 14

Additional measurements should be concentrated on the weeks including the Priority Regular World Days of the International Geophysical Calendar.

17. Dark Moon Geophysical Days and Airglow and Auroral Periods

Optical measurements of the upper atmosphere are most efficient when there is no moon. They need support from other ground based disciplines, in particular, ionospheric measurements by ionosonde incoherent scatter and at high latitudes riometer. The IUWDS has therefore established periods for intensive study similar to the Regular World Day and World Geophysical Intervals for use particularly in regions where optical studies are made. These periods are called Dark Moon Geophysical Days (DMGD)(two successive days at 28 day intervals on average) and Airglow and Aurora Periods (seven days each quarter including the appropriate DMGDs). These will be found in the 1975 Calendar. The necessity for no moon means that these days cannot in general overlap the Priority Regular World Day (PRWD); e.g., in 1975 only 5 out of the 13 DMGD periods overlap with the 12 PRWDs. However it has proved possible to overlap with Regular Geophysical Days (RGDs).

INAG wishes to inquire whether this system is working effectively, in particular:

(1) *Are stations making sufficient observations to meet the needs of the Airglow and Auroral disciplines?*

(2) *Is the extra loading needed when these days are not PRWDs causing any difficulties?*

The use of the middle Wednesday of each month as a Priority World Day has considerable logistical advantages - it is easy to remember, gives data representative of the middle of each month and has been widely adopted. It should not be abandoned lightly.

Please let INAG know by letter or postcard or at LIMA:

(i) *Do you make extra observations on DMGD?*

(ii) Do you make extra observations on Airglow and Auroral Periods? (iii) Are you compelled to choose between extra observations on PRWDs or DMGDs?

(iv) Are you compelled to choose between extra observations in World Geophysical Intervals (WGIs) or in Airglow and Auroral Periods?

A reply headed "Dark Moon Inquiry" and listing Questions 1, 2, 3, 4 with reply Yes or No is all that is required. For those stations who do not change their operating procedure on Calendar Days no reply is necessary. The object of the inquiry is to see whether the establishment of these new Days and Intervals is causing difficulty in our networks.

18. Monsee Station Directory

MONSEE is preparing a Directory of stations active in synoptic observations for the IMS and has issued the following questionnaire. *Please make certain that a reply has been sent from your organization so that this Directory can be as complete as possible.*

Additional copies of the questionaire can be obtained from the SCOSTEP Secretary.

The last page of this Bulletin may be removed and used for your reply.

The STP Data Categories most likely to interest INAG Bulletin readers are as follows:

Data Categories in Solar-Terrestrial Physics

(From ICSU Guide to International Data Exchange, 1973)

A. Solar and Interplanetary Phenomena (other than flare-associated events treated in ~)
- A.1 Sunspot Positions, Areas, and classification
- A.2 Sunspot Numbers
- A.3 Solar Magnetic Fields
- A.4 H-c Observations (other than flares)
- A.5 calcium Plages: Positions. Areas, Maximum Intensities
- A.6 combined and Special Optical Observations (Solar Maps, Prominences, Filaments)
- A.7 Optical Observations of the corona
- A.8 Total Radio Flux Measurements
- A.9 Radio and Radar Maps of Solar Disk
- A.1O Radio East-West Scans of Solar Disk
- A.11 Solar X-ray and UV Background Levels
- A.12 Energetic Solar Protons and Solar

- C.3 Solar Radio Events, Fixed Frequency
- c.4 Solar Radio spectrograms of Events
- c.5 Solar X-ray Observations
- c.6 Sudden IonospherIc Disturbances — Ground-Based Observations
- c.7 Solar Protons and Electrons — Direct Measurements
- c.8 Solar Protons — Riometer
- c.9 Solar Protons — Ionospheric Vertical Incidence Soundings
- c.iO Solar Protons and Electrons — VHF Forward Scatter
- c.ii Solar Protons — Other Types of Measurements
- c.12 Solar. Ionospheric, or Aeronomical Rockets Launched During an Event
- c.i~ cosmic Ray Ground Level Increases

D. Geomagnetic Variations

El ectrons

A.13 Solar Wind

A.14 comet Tails, Interplanetary Scm-tillations, Zodiacal Light

A.15 Sporadic Radio Emissions from Jupiter

A.16 Monitoring of Total Solar Radiation

A.17 Interplanetary Mangetic Fields

A.18 Interplanetary Electric Fields

B. Ionospheric Phenomena (other than flare-assocate events treated in C)

B.1 Ionosphere Vertical Soundings

B.2 Topside-Vertical Incidence Soundings and Satellite Probe Data

B.3 Incoherent Scatter Soundings

B.4 Oblique Incidence Soundings

B.5 Ionospheric or Aeronomical Rockets

B.6 Total Electron content — Satellite Beacons

B.7 Absorption — Method A 1 (Pulse echo)

B.8 Absorption — Method A 2 (Riometer)

B.9 Absorption — Method A 3 (CW Field-strength)

B.1O Ionospheric Drifts

B.11 Ionospheric Scintillations from Satellite Beacons

B.12 Ionospheric Back— and Forward—Scatter

B.13 Whistler and VLF Emissions

B.14 Atmospheric Radio Noise

B.15 Partial Reflection Data

B.16 Reference Ionospheric Models

c. <u>Flare—Associated Events</u>

c.i H-c Flares

C.2 Solar Magnetic FIelds In Active Regions and Their Short-Term changes

D.1 Standard and Rapid-Run Measurements

D.2 Magnetospheric Micropulsatlon Phenomena

D.3 Space Magnetism

D.4 Magnetospheric Particles

0.5 Measurement of Magnetosphere by Whistler and VLF Emissions

E. <u>Aurora</u>

E.1 All-sky camera

E.2 Visual Observations

E.3 Other Optical Techniques (e.g., spectra)

E.4 Radio and Radar Observations

E.5 Satellite Measurements and Imagery

F <u>cosmic Rays</u>

F.1 Neutron Monitors and Supermonitors

F.2 Ionization chambers

F.3 Meson Telescope (cubical, crossed, narrow angle and wide angle)

F.4 Balloon Measurements

F.5 Aircraft and Ship Measurements

F.6 Satellite Measurements

G <u>Airglow</u>

G.1 Ground-Based Observations

G.2 Satellite Observations

H <u>Miscellaneous</u>

H.1 Noctilucent clouds

H.2 Meteorological Rockets

H.3 Atmospheric Ozone

H.4 Special Interdisciplinary Projects

H.S Record of Sounding Rocket Launchings

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1975a **Questionnaire for MONSEE Station Directory**
(Ground-Based Monitoring Observations for STP)

Please fill out one per instrument at each station for which you have information. Use comments section (item 5) to amplify answers when necessary.

Mail to:
SCOSTEP Secretary, c/o National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D. C., U.S.A. 20418

Please respond by June 1975.

1. STATION AND OPERATION

1.1 Preferred Station Name:____________________

Current Geographic Coordinates:
1.2 Latitude (to hundreths of degree, e.g. S27.58):____________________
1.3 Longitude (to hundreths of degree EAST, e.g. E320.85):____________________

1.4 Alternate Names for Stations:____________________

1.5 Date Observations Started (or planned): Month/year (e.g. 5/1957):
____

1.6 Has Station Moved Since Then? Yes ☐; No ☐. Give date and old coordinates in item 5.

1.7 Has Operation Been Intermittent?: Yes ☐; No ☐. Give dates in item 5.

2. INSTRUMENT AND OBSERVATIONS

2.1 Name of Instrument (e.g. C-4 ionosonde, La Cour magnetometer):
____

Types of Monitoring Observations:
2.2 Brief Identification:____________________
____
2.3 STP Data Categories (A1, B6, etc.):____________________

2.4 Short narrative description of instrument, observing schedule and practice, chart speed, etc.:____________________
____
____
____
____
____

2.5 Observations are: Regularly scheduled ☐; Occasional ☐.

2.6 What is form of the "raw" data retained at the station or network headquarters? (e.g. film, photographic paper, strip chart, tables, digital or analog magnetic tape, drawings, computer printouts) (list one or several forms):____________________
____
____

(over)

3. REDUCTIONS OF OBSERVATIONS ARE:

3.1 ☐ Regularly scheduled; normally available after ___ months

3.2 ☐ Special purpose; usually available after ___ months

3.3 ☐ None -- original records serve need

3.4 What is form of the reduced data? (list one or several, as appropriate, e.g. tables, magnetic or paper tape, film, photographic prints, photographic paper, graphical plots, microfilm, computer printouts, etc.):________________

4. DATA EXCHANGE

4.1 ☐ If (some) data are routinely published by institution or elsewhere, please give publication name, availability, type of data, etc.:________________

4.2 Data are regularly sent to World Data Center A ☐; WDC-B ☐; WDC-C ☐ at the following location:________________

4.3 ☐ Data are available on request.

5. ADDITIONAL COMMENTS (e.g. auxiliary equipment, participation in organized network, gaps in operation (from 1.6), former station location (from 1.7), etc.):

____

☐ More on separate sheet.

6. ADDRESSES

6.1 Name and full mailing address -- <u>information about station</u>:

Name________________

Institution________________

Street________________

City________________State________________

Country________________Mail (ZIP) Code________________

6.2 Name and full mailing address -- <u>information about data</u>:

☐ same as above; ☐ different, as follows:

Name________________

Institution________________

Street________________

City________________State________________

Country________________Mail (ZIP) Code________________