International Council of Scientific Unions

SPECIAL COMMITTEE
ON
SOLAR-TERRESTRIAL PHYSICS

77-4

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IMS NEWSLETTER

The calendar of IMS observational campaigns which has regularly appeared on the last page of these NLs gives at a glance the plans of many IMS participants. Hopefully, it has been used for coordination of work around the world. Beginning last month, we have added to it graphically the actualities -- a mark "V" at the day the rockets were actually launched. Thus the calendar can now also be used for coordination of scientific data analysis. Notice also that the time period covered by the calendar is now brought forward by one month each month, so that it covers the two preceding and the four coming months. We wonder how many groups post this graphical IMS calendar on laboratory bulletin boards?

JHA --- 77/03/31

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PROGRAM PLANS FOR April 1977 - June 1977

SPECIAL IMS SATELLITE PERIODS

Times of Satellite Conjunctions from SSC Report No 7, Oct 76, pg 15 and IMS NL 76-11. Complete table of satellites and orbit positions that define SSC Special Intervals reproduced on page 5 of this Newsletter.

Apr 2, 0700 UT to Apr 4, 0000 UT; May 25, 2200 UT to May 26, 1800 UT; May 30, 0100 UT to Jun 3, 1800 UT

At SSC suggestion, start and end times of "idealized" periods of interest have been extended by 6 hrs to allow for possible motion of the boundaries and cusp region or later adjustment of orbit parameters.

GBR Campaigns: (numbers refer to program details in IMS Bulletin No 2 or in references in these NLs)

--------Phenomena-related Campaigns--------

------ to Apr 30; A-32; L.G. Smith (Univ Illinois): Wallops Isl; ROCKETS (2)- 80-200 Km study, see 76-11
------ to Apr 30; #0327; Beghin/Avdushin ("IPOCAMP 2"); Heiss Island; ROCKETS - MR12, E-layer studies
------ to Apr 30; #0159; Chanin/Tulinov ("IPOCAMP 2"): Heiss Island; ROCKETS - joint with #0327
Apr 1 to Apr 22; #0400; Fitz; Poker Flat; ROCKET - Sergeant, field-widened interferometer
Apr 3 to Apr 8; B-10; Gentieu/Mentall; Ft. Churchill; ROCKETS (2) Nike-Tomahawk 18.1013GA & 18.1014GA
May 1 to May 14; #0400; Fitz ("Equatorial Wideband"); Kwajalein: ROCKETS (3) - scint meas with Wideband
May 1 to May 31; #0139; Berthellier; Pretoria; BALLOONS (2) - long flights, E-field experiments
May 26 to Jun 15; B-7; Matthews; Andoya;ROCKET-18.211UE/IE

------Quasi-synoptic Observations involving Balloons, Rockets, Aircraft, Selected Surface Campaigns------

Apr 19-22; May 17-19; Jun 14-16; Bauer (0004), Evans (#0171): IISN; SURFACE incoherent scatter radar net

--------Observing Plans for Temporary Surface Stations--------

------ to Apr 30; B-17; -----: Atlantic & Pacific; SURFACE - ship "Akademik Kurchatov", see note below
------ to May 31; #0304; Stuart; Multiple Sites; SURFACE- "Pulsations" program of magnetometers, NL 76-12
Jun 1 to Sep 30; #0011, #0429; Perrault, Hirosawa; Conjugate Points; SURFACE - note in NL 77-3, pg 4

Regional GBR IMS Program Details, Mar - May 1977

Past NL's have given detailed programs descriptions for some of the 1-line references above. These will not be repeated below unless the IMSCIE Office has received new information.

OCEANS

B-17; USSR ship Akademik Kurchatov, see 77-3, pg 2

HEISS ISLAND

#0327; Beghin/Avdushin, see Migulin's note in 77-2
#0159; Chanin/Tulinov, also in 77-2, pg 3 as above

ANDOYA

B-7; Matthews postponed launch now set for 26 May - 15 June 1977 (see NL 76-12, pg 3).

WALLOPS ISLAND

A-32; L.G. Smith, Univ Illinois, NL 76-11

FORT CHURCHILL

B-10; Gentieu & Mentall, auroral measurement of EUV; 500Å - 1300Å spectrometer, 2eV - 500eV electron energy analyser, photometers 8446Å, 7995Å. See also NL 77-1.

POKER FLAT

#0400; Fitz; "SPIRE" rescheduled to September 1977

#0400; Fitz; "Auroral Studies" background measurements of I.R. in the aurora . Field widened Michelson interferometer cooled by liquid He, 2-10u scheduled 1-22 April 1977.

IISN

This is a multinational program of coordinated incoherent scatter radar observations with a common plan for monitoring the same type of data at each participating site. Details on 1976 plans were given in IMS NL 76-3, pg 4. In general, common observations are scheduled for Regular World Days (Tuesday, Wednesday and Thursday near middle of each month) as announced in the IUWDS International Geophysical Calendar. For 1977 the following proposed schedule of dates and types of observations has now been accepted:

(1) Electric fields and their relationship to E region dynamics (also useful for thermosphere and tidal studies), Jan 18-19, Feb 15-16, May 17-18, Jun 14-15 (also chosen for tides), Jul 19-20, Aug 16-17, Oct 11-12 and Nov 15-16.

(2) Thermosphere (also useful for high time-resolution measurements of E-fields), Mar 15-16, Sep 13-14.

(3) Tidal studies (also useful for E-field studies), Apr 19-22 and Dec 6-9 (both intervals coordinated with meteor radar studies).

To assure access to the various radars during alert periods, two of the intervals listed above under (1) and (2) are subject to declaration as "Alerts". Such special periods to include one magnetic storm during which observations will be aimed at E-field penetration at middle and low latitudes with high time-resolution observations of the F2 region. The other alert will be for a magnetically quiet period with observations devoted to a complete profile program with a one day extension.

Timing for coordinated IISN observations at some stations are as given here: Arecibo, begin Tues at 1000 UT - stop Thursday at 0000 UT; Chatanika, begin Wednesday at 0000 UT - stop Thursday at 0000 UT; and Saint-Santin, begin Tuesday at 0300 UT - stop Thursday at 0000 UT (special programs performed on Thursday). General purpose programs are used at Chatanika and Arecibo for tidal, thermospheric and electrodynamic studies. Saint-Santin has selected three basic programs: complete profiles (100-500 km), F2 region profiles (200-500 km) and E+F1 (90-180 km) profiles.

ASHAY

The Atlantic and Southern Hemisphere Aeronomy Year (ASHAY) is now into its fifth observational period, 13 to 26 March 1977. Tasks carried out under this program are: observations at 5577A and 6300A from Cachoeira Paulista (22.7°S, 45.0°W), vertical and oblique incidence ionograms from SANAE and Grahamstown, ionospheric data from Tsumeb, airglow measurements from aircraft and cosmic ray observations. More details can be obtained from Prof. J.A. Gledhill, Dept. of Physics, Rhodes
(continued on pg 3)

(Continued from pg 2)
University, P.O. Box 94, Grahamstown, 6140, Rep. of S. Africa. Information on times of ASHAY data collection programs during IMS are given in this Newsletter under Actualities, below.

ACTUALITIES

KIRUNA

MPI-Garching successfully launched a Nike-Apache rocket "Firefly" (not previously announced) on 14 March 1977 at 1738 UT. Peak altitude 240 km. Payload consisted of 4 ejections experiments of which 2 worked and 2 failed.

#0183; Haerendel, et al, "PORCUPINE II" successfully launched at 1922 UT, 20 March 1977. Peak altitude 458 km. Preliminary evaluations indicated that most experiments worked well. See IMS NL 77-3, pg 3, for more details and map for this launch.

EGLIN AFB

#0400; Fitz ("STRESS") program completed with the launch of all rockets. Details, IMS NL 77-1, pg 3.

FORT CHURCHILL

B-9; Zipf successfully launched 14.500UA, 31.001UA and 31.002UA on 15 and 26 Feb and 8 March, respectively.

B-14; Whalen, Bernstein, Kellogg, McNamara, Koehler and Harris launched a partially successful Nike-Black Brant VB on 5 March 1977. Whalen, Koehler and McNamara successfully launched a Black Brant IVB on 8 March 1977. The experiments are briefly described in program details in 76-11 (originally announced for Jan 77 window). Not previously announced, Venkatesan (see #0315 below) launched simultaneous Black Brant VI's to drop auroral X-ray sensor packages to usual balloon altitudes. These were successful. Data is not yet available.

B-12; Hays/Sharp, successful launch of Astrobee, 19 March. Details in 77-1, pg 3.

#0315; Venkatesan cooperative balloon program with Parsons & Berkey was unsuccessful. After long wait without aurora and clear visibility, launches were attempted on 19 and 21 March. The first balloon did not fly and the instrument package was recovered. The second launch was partially successful but the balloon did not reach its designed altitude. Observations of aurora from the ground using the Image Intensified Closed-Circuit TV were successful on the 21st. Another program of joint launches will be scheduled for Fall 1977 with details to be announced.

WOOMERA

B-15; Carver, launched Aerobee 170, 13.123IS, successfully at 2106 UT, on 21 Feb 1977. Experiment details in NL 77-2, pg 3.

ASHAY

The five designeted special observational intervals for the Antarctic and Southern Hemisphere Aeronomy Year have now passed. In 1976, these were: (1) March 21 - April 3; (2) June 17 - 30, (3) Sept 15 - 29; and (4) Dec 8 - 26. An extension of the original plan added (5) March 13 - 26, 1977. Details of planned programs, contacts for collected data and descriptions of achieved programs have been published in SHISG/ASHAY WG-1 News Letters compiled by Geldhill (#0457).

Data from satellite AE-C was obtained for intervals (1) and (2) and the Japanese National Report of Space Research at the 19th COSPAR meeting described outstanding results from the TAIYO during interval (1). Anomalous phenomena were recorded over the S. Atlantic geomagnetic regional anomaly. Write Gledhilll for details (address on pg 2 above).

NEW PROGRAM ANNOUNCEMENTS

K. Wilhelm, MPI fur Aeronomie, has discributed an announcement of an extensive rocket program planned for Autumn 1977 at Andenes, Norway. The two campaigns are called "IMS Substorm" and "2nd High Latitude Campaign". A handbook with comprehensive descriptions is in preparation and more details will be provided in a later NL. Among participants/experiments to be combined in different payloads are: Grabowski (IPW) and Pedersen (ESTEC), DC and AC E-fields by 2 boom-mounted double probe sensors; Theile (IGM), DC magnetometer, 3-component fluxgate; Dehmel (IGM), AC magnetometer, 1-component search coil; Spenner (IPW), Plasma by retarding potential analyser; Wilhelm (MPAe) and Riedler (TUG), Particle spectrometer I, Hemispherical electrostatic analyser and open e- multipliers; Studemann (MPAe), Particle spectrometer II, Magnetic particle analyser and solid state detectors; and Fischer (IRAK), Particle spectrometer III, Solid state detector telescope.

FIRST GARP GLOBAL EXPERIMENT (FGGE)

IMSCIE Office has received a copy of the GARP Newsletter describing developments in planning the FGGE. Perhaps some IMS participants will be interested in this global meteorological experiment. Dec 1977 through Nov 1978 will be the "Build-up Year" and Dec 1978 through Dec 1979 the "Operational Year". During the latter, there will be two special observing periods for intensive observations. They are scheduled for Jan 5 - Mar 5 and May 1 - July 1, 1978. Anyone wishing further information should contact Prof. B.R. Doos, Dir. Joint Planning Staff for GARP, c/o WMO Secretariat, Case postale No 5, 1211 Geneva 20, Switzerland.

USSR IMS STATIONS AND INSTRUMENTATION

I.A. Zhulin (IZMIRAN) sends the following information for USSR stations participating in the IMS: (instrument code --- M = magnetometer, I = ionosonde, A = all sky camera, P = photometer, C = complex observations)

(1) 145° Geomagnetic Meridian Chain: Cape Zhelaniya, M; Tambey, M; Kharasavey, M; Seyakha, M; Amderma, M; Cape Kamenniy, M; Nyda, M; Numto, M; Ugut, M; and Tevriz, M.

(2) 115° Geomagnetic Meridian Chain: Rybachiy, M; Loparskaya, M; Lovozero, M; Apatity, C; Umba, M; and Kem, M.

(3) A trapeziform region of Siberian stations including, Permanent stations: Cape Chelyuskin, M,A; Norilsk, M,I,A; Podkamennaya Tunguska, I,M; Tixi, C; Cape Schmidt, C; Yakutsk, C; Irkutsk, C; and Provisional stations with periodic operations: Colomyanniy Island, M,P; Cape Sterligov, M,P; Tareya, P,M; Kresty, M,P; Snezhnogorsk, M,P; Khatanga, M; Zhokhov Island, M; Kotelniy Island, M,P; Batagay, M; and Batagay Alyta, M.

NEW OBSERVATORY ABBREVIATIONS

The International Service of Geomagnetic Indices has in preparation a new table of abbreviations for geomagnetic observatories (many of the sites are devoted to monitoring several types of geophysical data). They will consist of 3-letter combinations and may retain some similarity to the 2-letter codes used for many years. These Newsletters have generally followed the easy path of using any abbreviation supplied by the experimenter or other person reporting on a program. Already we have noted duplications between codes used by different groups with widely separated networks. This may continue to be somewhat of a problem with so many new sites being occupied either temporarily or for the duration of the IMS. Dr. D. van Sabben, Dir. ISGI, Koninklijk Nederlands Meteorologisch Instituut, De Bilt, Netherlands, is coordinating this project and results may be presented at the IAGA meeting in Seattle.

IMS SATELLITE INFORMATION

GEOS Launch

In about two weeks, on April 20, the European Space Agency is scheduled to launch the GEOS satellite. This is one of the reference spacecraft for the IMS. Experiment switch on will probably take place in May/June and by July 1977, routine data collection and distribution should be established. GEOS is expected to have a 2-year nominal lifetime.

GEOS Daily Summaries

K. Knott, Project Scientist, sends word about the daily summaries to be produced from the data transmitted back from GEOS. A description of the experiments is contained in "Payload of the GEOS Scientific Geostationary Satellite", ESA Scientific and Technical Review, 1, 173-196, 1975. Details on the S-302 Wave Measurements experiment were published in IMS NL 77-3, pgs 6&7. Daily data summaries will be plotted on 2 sheets/day and accumulated for distribution to the following groups:

(1) IMS national contacts in the ESA member states.

(2) IMS national contacts in countries having announced projects to be carried out in conjunction with GEOS.

(3) GEOS experimenters and their associates.

(4) The 4 World Data Centers and IMSCIE.

These scheduled recipients are listed below. Countries/experimenters not listed there are expected to obtain the Summaries from the nearest WDC or IMSCIE Office. The mailing list was kept to an intentional minimum; however, a limited number of spare copies could be sent to involved scientists during special GEOS-supporting campaigns. Requests will be handled on a case-by-case basis.

Mailing List: (1)&(2) 18 national contacts: Austria, Ortner; Belgium, Nicolet; Denmark, Peters; Finland, Sucksdorff; France, Simon; Germany E, Wagner; Germany W, Lange-Hesse; Holland, de Jager; Iceland, Saemundsson; Italy, Giorgi; Japan, Hirasawa; Norway, Gundersen; Spain, Miguel; Sweden, Falthammar; Switzerland, Rieker; USSR, Migulin; US/Canada, IMSCIE Office; UK, Argent.

(3) 11 GEOS experimenters: S-300, CNET, Paris; DSRI, Lynby; SSD, Noordwijk; Univ. Sussex; Univ. Sheffield; S-302, UCL - MSSL; S-303, Berne; S-310, KGO, Kiruna; S-321, MPI-Lindau; S-329, MPI-Garching; S-331, CNR, Frascati.

(4) 4 World Data Centers: WDC-A R&S (Goddard); WDC-B2 (Moscow); WDC-C1 (Slough); and WDC-C2 (Tokyo).

Mailing to categories (1)-(3) will be weekly and to the WDC's on a monthly basis.

IMS Satellite Situation Center Notes

SSC Services --- EOS, Transactions, American Geophysical Union, Vol 58, 70-74, Feb 1977, continues the series of papers dealing with different aspects of the International Magnetospheric Study. Sugiura and Vette have given a concise presentation of the early history of the SSC, the reasons it was established and examples of the services provided to the IMS community. Sample plots of satellite orbits are shown, similar to those published in IMS NL 76-10, pg 6. Information about satellites of interest for IMS and data for Special IMS Satellite Intervals will be available from the SSC (co-located and staffed with WDC-A for R&S/NSSDC). Requests for services or further information should be addressed to IMS Satellite Situation Center, Code 601, Goddard Space Flight Center, Greenbelt, Maryland 20771, USA.

SSC Report No. 9 --- An important service of the IMS SSC is the publication of reports covering various aspects of the satellite part of IMS. The latest in this series is the just-released "IMS Directory of Spacecraft and Experiment Scientific Contacts", SSC Report No. 9, January 1977. In nearly 200 loose-leaf pages are given individual satellite descriptions including: Spacecraft name, international designation, launch date, orbit type, orbit characteristics, name, address and telephone/telex number of project scientist or equivalent contact, and list of experiments with each principal experimenter. In the "Experimenter/Scientific Contacts" section a separate page is devoted to each spacecraft experimenter or person now responsible for the data. In addition to full information to permit contacting each participant, there is given an update of the status of all spacecraft experiments for which each person is responsible. Only satellites/experiments are included for which there was known data collection during 1976 (44 vehicles) and only one contact is listed per experiment. Supplementary pages will be issued from time-to-time.
Distribution of Report No. 9 was to all regular recipients of SSC Reports and copies were sent to most groups or institutions known to have interests in satellite data. The format is designed to provide easy access to satellite information/data for GBR experimenters who may not be familiar with the satellite field.

Scientific Satellites of Interest for IMS

Two satellites not previously reported upon in these NL's are now described from information contained in SSC Report No. 9. They are S3-2 and S3-3 (also known as STP 73-6 and STP 74-2, respectively). For both satellites, the principal contact is Dr. John R. Stevens, Aerospace Corporation, Bldg. 125, Mail Station 1255, P.O. Box 92957, Los Angeles, California 90009, USA.
S3-2 --- Launched in 1975, data is available from Oct 75 to the present. Nominal orbital elements are: Inclination 97 , perigee 230 km, apogee 900 km, period 96 min. Scientists/experiments: Fennell, p+ time-of-flight and p+-alpha counters; Marcos, triaxial piezoelectric accelerometer; McIsaac, cold and hot cathode magnetron gages; Philbrick, RF quadrupole mass spectrometer; Rice, cold cathode magnetron gage, electrostatic analyzer (2-300 eV), and retarding potential analyzer; Shuman, Magnetometer; Smiddy, E-field observations; Vampola, e- magnetic spectrometer; Vancour, electrostatic analyzer (1-20keV); Wildman, electrostatic analyzers (1-30 eV); and Yates, low-energy p+ spectrometer and p+-alpha telescope.
S3-3 --- Launched in 1976, data available from June 1976 to present. Nominal orbital elements: Inclination 97.5 , perigee 230 km, apogee 8000 km, period 178 min. Scientists/experiments: Fennell, ion-e- spectrometer; Koons, ELF/VLF receiver; Mozer, DC E-fields; Sharp, ion and e- spectrometer; Vampola, energetic particle spectrometer; Wildman, electrostatic analyzer (0.1-30 eV); and Yates, low-energy p+ spectrometers and p+-alpha telescope.

CORRIGENDA

Prognoz 5 correct launch date is 25 Nov 1976. Prognoz 4 correct launch date is 12 Dec 1975. Also, the 3-axis fluxgate magnetometer is now listed with Ye. G. Yeroshenko as PI.

SSC Special Satellite Intervals

On pg 5 (facing) is reproduced the table from SSC Report No. 7 that gives the positions of the seven high-altitude satellites (including the Moon) whose conjunctions in magnetospheric regions or passages across boundaries defined the SSC Special Intervals for the first half of 1977. The region symbols are: HT = High-latitude magnetotail; MT = Midlatitude magnetotail; Sh = Neutral sheet; DM = Dayside magnetosphere; NM = Nightside magnetosphere; DS = Dayside Magnetosheath; NS = Nightside magnetosheath; I = Interplanetary medium; C = Dayside access region (cusp); S = Bow shock wave; and P = Magnetopause.

Table 7. SSC Special Periods for Days 1-181 1977†

Special Period Number	Approx Time (Day/h)	Satellite Regions							Comments
		Moon	Solrad 11B	Solrad 11A	Hawkeye 1	IMP-H	IMP-J	Vela 5B	
1	3/17	P	I	MT	P	P	I	P	4 boundary crossings within 5 h.
	4/3	MT	I	MT	DS	NS	I	MT	3 satellites in MT for 4 h.
	4/7	Sh	I	HT	DS	NS	I	MT	3 satellites in tail regions for 4 h.
	4/20	Sh	S	P	P → C*	S	I	Sh	4 boundary crossings within 5 h. 2 satellites in Sh for 3 h. 6 h cusp pass.
2	11/20	I	Sh	I	C	I	Sh	I	2 satellites in Sh; 1 in cusp for 6 h.
	12/8	I	NM	S	DS	S	NS	S	3 boundary crossings within 5 h.
	12/12	I	NS	DS	DS	NS	NS	DS	6 satellites in sheath for 10 h.
	13/22	I	I	MT	C	HT	I	Sh	3 satellites in tail regions for 4 h.
	14/4	I	I	HT	P	HT	I	HT	3 satellites in HT for 4 h.
3	33/13	P	S	P	P	I	NS	P	5 boundary crossings within 5 h.
	33/23	MT	I	HT	DS	I	NS	NS	2 satellites in tail regions for 3 h.
	34/18	MT	I	Sh	P	I	HT	I	
	34/23	Sh	I	Sh	C	I	Sh	I	3 satellites in Sh for 5 h. 3 h cusp pass.
	35/10	MT	I	MT	DM	I	MT	I	3 satellites in MT for 3 h.
	36/22	NS	HT	I	C	I	MT → HT	Sh	3 satellites in tail regions for 4 h. 2 h cusp pass not simultaneous.
4	38/14	NS	NS	NS	DS	NS	NS	NS	7 satellites in sheath for 9 h.
	38/19	NS	S	P	DS	NS	S	S	4 boundary crossings within 2½ h.
5	63/12	Sh	Sh	I	P	NS	DS	I	2 satellites in Sh for 4 h.
	64/2	MT	P	S	NS	NS	S	S	4 boundary crossings within 4 h.
	64/16	MT	S	P	P	HT	I	P	4 boundary crossings within 3 h.
	65/4	Sh	I	HT	C	HT	I	HT	4 satellites in tail regions for 6 h. 2 h cusp pass not simultaneous.
	66/2	HT → MT	I	Sh	DS	MT → HT	I	HT	4 satellites in tail regions for 2½ h.
	66/10	P	I	Sh	DS	P	I	P	3 boundary crossings within 3 h.
	67/4	NS	NS	S	C	S	I	S	3 boundary crossings within 5 h. 2½ h cusp pass.
6	92/13	P	S	P	P	I	I	DS	4 boundary crossings within 3 h.
	93/18	Sh	MT	I	NS	I	I	HT	3 satellites in tail regions for 13 h.
7	146/4	I	MT	I	C	I	I	MT	2 satellites in MT; 1 in cusp for 2½ h.
	146/23	I	P	NS	P	I	I	P	3 boundary crossings within 2 h.
	147/5	I	NS	NS	NS	I	I	NS	4 satellites in sheath for 7 h.
	147/12	I	S	NM	NS	I	S	S	3 boundary crossings within 5 h.
8	150/7	NS	Sh → MT	I	P	I	HT	HT	3 satellites in tail regions for 13 h.
	150/18	NS	MT	I	NM	I	HT	Sh	3 satellites in tail regions for 4 h.
	151/0	NS	MT	I	NM	I	MT	MT	3 satellites in MT for 5 h.
	151/8	P	MT	I	P	S	P	MT	4 boundary crossings within 3 h.
	152/6	Sh	NS	DS	NS	NS	NS	DS	6 satellites in sheath for 6 h.
	153/6	Sh	I	Sh	NM	Sh	I	I	3 satellites in Sh for ½ h.
	154/4	Sh	I	MT → HT	NS	HT	I	DS	3 satellites in tail regions for 1½ h.
	154/12	P	S	P	P	HT	I	P	5 boundary crossings within 5 h.
9	177/4	I	MT	I	P	P → Sh	HT → P	S	4 boundary crossings within 5 h. 3 satellites in tail regions for 4½ h.
	177/23	S	P	DS	P	MT	NS	P	3 magnetopause crossings within 4 h.

*This type of notation indicates that the satellite passed from one to the other of two regions of interest (in this case, from the magnetopause P to the cusp C) at the approximate time shown in column 2.

†See Table 8 for definitions of symbols.

The following contribution originated with the URSI/IAGA Working Group on Passive EM Probing of the Magnetosphere and was forwarded by its co-chairman, Dr. D.L. Carpenter, to IMSCIE Office.

Passive VLF Probing of the Magnetosphere during IMS

1. Major scientific questions to be investigated.

What is the worldwide response of the plasmasphere during magnetospheric substorms? During magnetic storms? How do substorm electric fields penetrating the plasmasphere differ from and in general relate to the intense high latitude fields that have been measured at ionospheric heights? How are outlying plasma structures formed during periods of enhanced magnetospheric convection? Can taillike extensions of the plasmasphere be detected and tracked by VLF means or by combining VLF methods with other techniques? How and where do irregularities in plasmapause radius ($\Delta L \sim 0.1$-1 Re and $\Delta\phi \sim 20°$) develop and what role do they play in wave propagation and in particle loss processes due to local penetration of the boundary by azimuthally drifting energetic particles? What is the quiet state of the electric field in the plasmasphere? Is the residual field of dynamo origin? Does it produce a secondary plasmasphere bulge near the noon meridian? Are there significant variations in thermal plasma density with longitude? How do large scale variations in plasmasphere electron density ($\Delta ne \sim 2$-3, $\Delta L \sim 0.5, \Delta\phi \sim 10°$) develop? Can the injection of energetic particles into the nightside magnetosphere be identified through VLF noise events observed on the ground, and can the eastward drift of particle 'clouds' be traced through the occurrence of noise events at spaced stations? What is the worldwide distribution of VLF noise associated with power-line radiation detected at ground stations in the recovery phase of a magnetic storm?

Many of the foregoing topics have been investigated by means of data from individual stations. The emphasis now is upon questions that can only be answered through measurements at spaced longitudes and latitudes and with combinations of ground and satellite measurements.

2. Plans for realizing IMS objectives.

A. Methods. Broadband VLF receivers will be operated. In a number of cases, directional information on whistler-mode signals will be extracted using goniometer or other df techniques. Triangulation on signal-path endpoints at ionospheric heights will be attempted from spaced stations. In the case of whistlers, standard dispersion techniques will be used to extract information on magnetospheric electron density versus equatorial radial distance as well as total electron content in tubes of ionization. From properties of observed whistlers and the inferred density profiles, the position of the plasmapause will be estimated when feasible. Cross-L motions of whistler paths will be inferred from gradual changes in the dispersion properties of received whistlers. If possible, bulk motions of the plasma will be tracked through time variations in signal path endpoints as determined from direction finding methods. Information on VLF noise activity will be obtained from broadband records as well as continuously operating chart recorders.

B. Stations. There is a concentration of whistler activity at stations spaced in longitude near L=4 in the southern hemisphere. These stations include Siple, Belgrano, Sanae, Kerguelen Island and Campbell Island. In the northern hemisphere supporting measurements will be made at Roberval, Canada and at a network near L=4 in Alaska. Additional observations are being conducted at higher latitudes, for example, in the Antarctic at Syowa Base, Mirny, and Vostok and on the USSR Traverse in February and March of 1977. A number of low-latitude stations are operated by Japanese and Indian experimenters, among others.

C. Coordination. Coordination of multigroup activities is conducted in part through ad hoc bilateral and multilateral arrangements among the investigators involved and in part by the URSI/IAGA working group on passive EM probing of the magnetosphere. The working group has been arranging for cooperative measurements emphasizing the Antarctic L=4 stations during each of the IMS years. (This program is called IPPDYP, or International Plasmapause-Plasmasphere Dynamics Program.) Several stations are operating or will operate on an ad hoc basis in cooperation with satellite experimenters and in general support of certain satellites.

D. Operations plans. The cooperative plans prepared thus far call for periods of intensified synoptic observation in the austral winter, periods of continuous recording during the austral winter, and arrangements for ad hoc recordings at times determined by field operators to be favorable.

E. Analysis plans. It is proposed to prepare for a one-month period in each of the IMS years a worldwide summary of plasmapause position. This summary would serve as a general reference for the scientific community as well as a basis for studies of plasmasphere response to disturbance. The spatial and temporal resolution and coverage of this survey remains to be determined; they are dependent upon the resources of the groups and upon the extent of the natural activity. It is proposed to conduct multistation case studies based on the research interests of individual scientists. It is hoped that through the coordination of measurements at spaced stations, the data sets acquired will be sufficient to provide information on many of the topics outlined above.

The following brief note illustrates the way that recent results in whistler studies contribute to answering some of the points raised in the preceeding item while raising still more questions.

A Search for Dynamo E-Fields in the Magnetosphere

An outstanding problem confronting whistler researchers during the IMS concerns the presence of ionospheric dynamo electric fields at L=3-5 in the magnetosphere. Such fields have apparently been detected at low altitudes by incoherent scatter radar and at high altitudes by whistler techniques. When more fully measured, these fields may serve as a quiet day reference in terms of which the effects of electric fields of magnetospheric origin can be more fully evaluated. Recent studies of whistlers recorded at Siple, Antarctica confirm earlier evidence that a regular cross-L drift pattern is present near L=4 on magnetically quiet days. More significantly, these studies provide the first evidence that the east-west electric fields associated with the cross-L drifts fall off with increasing equatorial distance, in direct contrast to the behavior of fields of magnetospheric origin.

Figure 1 shows whistler path equatorial radii (Req) measured over a period of several hours on the quiet day July 4, 1973. The vertical scale is linear in (Req)**-2 so as to provide direct proportionality, independent of the radial variation of the geomagnetic field Beq, between the rate of change of path equatorial radius and the east-west component of E field. The graph suggests that the electric field falls off with increasing radial distance. This is confirmed in Figure 2, which shows a plot of Ew versus equatorial radius for seven about 1-hour quiet periods on July 4-7, 1973. During those periods, cross-L motions could be measured simultaneously on paths distributed over a range of about 1 Re in radius.

A full analysis of uncertainty in the method remains to be done. However, the consistency of the measurements made on nearby paths (case 5 in Figure 2) and the consistency of the data in showing a decrease with increasing L suggest that the falloff is a real effect.

(continued on page 7)

(continued from page 6)

Questions now facing whistler experimenters include the following:

(1) Are the 24-hour cross-L drift patterns reported thus far in fact worldwide?

(2) What are the important variations in the patterns from day to day and from case to case?

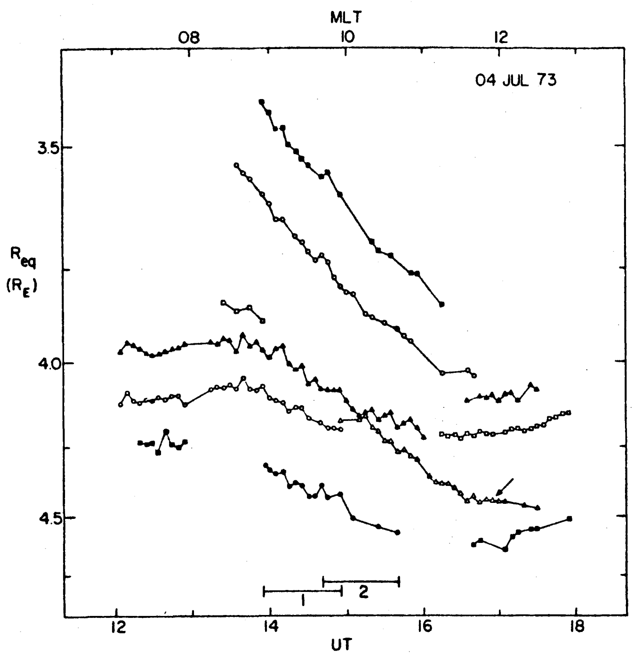

Figure 1.

Whistler Path equatorial radii versus UT (lower scale) and MLT (upper scale) on July 4, 1973. During the intervals marked 1 and 2, estimates were made of the variation in east-west electric field with equatorial distance (see Figure 2). The data marked with an arrow represent a group of whistler paths that are believed to have been displaced in longitude with respect to the main group.

(3) What are the azimuthal east-west drifts accompanying the quiet-day cross-L motions? (Here is a case to which recently developed direction finding methods can hopefully be applied.)

(4) How and under what conditions can falloffs of the type indicated in Figure 2 be observed?

Increasing attention is now being given to the means by which the earth and lower ionosphere influence the overlying medium. Whether or not an ionospheric dynamo process is confirmed to be a key factor in the drifts, their study will lead to better understandigng of the dynamics of the plasmasphere in the aftermath of disturbances. Plasmaspheric features such as the secondary bulge at noon (also reported from spacecraft) will be more clearly delineated. This bulge may be of importance in energetic particle dynamics during storm recovery phases.

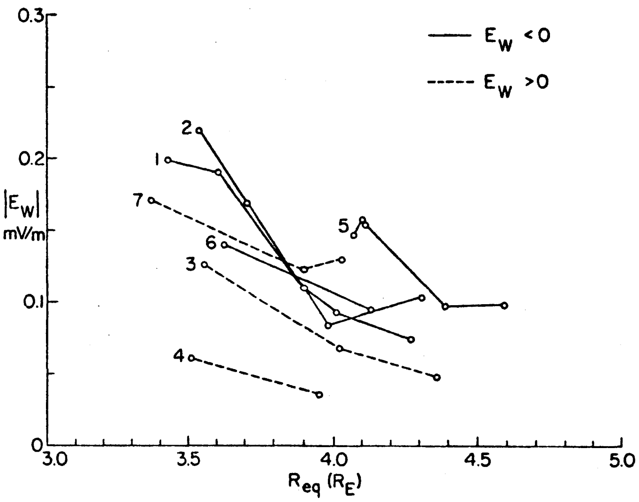

Figure 2.

Plot versus equatorial radius of the magnitude of the east-west component of the magnetospheric electric field. Seven about 1-hour quiet periods during July 4-7, 1973 are represented.

Publications

IMSCIE Office has received a small yellow booklet called "The AFGL Magnetometer Network", by D.J. Knecht and P.M. Pazich, Geomagnetism Branch, Space Physics Div, Air Force Geophysics Laboratory, Hanscom AFB, Massachusetts, May 1976. It summarizes a more detailed AFGL technical report and describes the essential features of their new magnetometer network. Lanzerotti, Regan, Sugiura and Williams gave some details on this network in their EOS article (June 1976 EOS, pp. 442-449). It has been further publicized in the Magnetometer Network Newsletter circulated by Sugiura and Manka (Dec 76) and is included in the tables and maps of N. American magnetometer/riometer networks given in IMS NL 77-1, pp. 5-7. Still, this small report is a more complete description of the instruments and the data collection network for anyone interested in details.

The magnetometers provide vector magnetic field values once per second and vector time derivatives of the field for fluctuations in the period range between 1 and 1000 seconds. They are part of a data collection station that consists of the unmanned magnetometers, a 3-component fluxgate system and 3-component searchcoil magnetometer, a data conditioning/collection package and a voice-quality communications line for data transmission and telephone service. A dedicated mini-computer on-line with all the field sites provides the central data acquisition and initial processing capability. The three data processing steps are: (1) reception and recording of data for permanent file, (2) making real-time and daily presentations, and (3) handling data for retrospective studies. Development of the most useful rapid display formats is a principal objective of the program. On a schedule yet to be worked out, the rapid measurements will be averaged to produce 1-min values in the data center format. These will be deposited with NGSDC/WDC-A for STP on a routine basis if present plans work out.

IMS Steering Committee Report No. 3

A sequel to the original COSPAR-IUCSTP program planning reports published by the Special Study Group for IMS (the "Orange" and "Yellow" books) is now ready for press. It is essentially a progress report that details the many recommended ideas that have become reality and the few that turned out to be impracticable.

The chapter headings for Report # 3 are: 1. Overview (a summary); 2. Milestones in organization of IMS; 3. Basic and Applied Research (a brief description of outstanding scientific problems approached not only as pure science but also in relation to the impact of magnetospheric conditions on daily life); 4. National, bilateral and multi-national programs; 5. Dedicated IMS projects; 6. Coordination of IMS programs (functions of the IMS Steering Committee, SSC, IMSCIE, MONSEE, IUWDS, SELDADS and other mechanisms for obtaining spacecraft data); and 7. Prospects and recommendations. Appendices list sources of information about IMS, including publications and useful names and addresses. Report # 3 should be useful for administrators and also as an abbreviated guide to IMS services

IMS CALENDAR OF GBR CAMPAIGNS FEBRUARY - JULY 1977
(As of 25 March 1977)

WORLD-WIDE- -
Special SSC-selected satellite periods
GEOS (K. Knott, et al)
ASHAY (Radicella, et al)
IISN (Bauer, et al) (preliminary)

MULTIPLE SITES- -
#0139 (Berthellier; "Vortex") Pretoria region

HEISS ISLAND- -
#0327 (Beghin, et al; "IPOCAMP")

KIRUNA (ESRANGE)- -
B-1 (Witt, et al; "Aurora")
B-2 (Holmgren, et al; "Trigger")
#0356 (Sheldon, X-ray)
B-3 (Bjorn, et al.; "D-Layer")
#0183 (Haerendel, "Porcupine")

ANDOYA (ANDENES)- -
#0131 (Arnoldy, Cahill; 18.1004UE)
"Polar High Atmosphere" (#0308; Theile: Skylarks)
"Polar High Atmosphere" (EUV-1; EUV-2)
B-7 (Matthews; 18.211 UE/IE)
B-8 (Maehlum, Maynard, et al; "Composition")

SOUTH UIST- -
A-19 (Williams; P112H, P191H, P193H)
#0085 (Dickinson; P189H, P192H)
A-18 (Woolliscroft; P73H)
B-16 (Krankowsky; P194H, P195H)
A-19 (Williams and De Jonckheere, MOPI)
A-18 (Woolliscroft: P139, P140H)
A-19 (Williams; P170H, P197H)
#0085 (Dickinson: P196H)

WALLOPS ISLAND- -
A-32 (Smith; 14.533UE, 14.534UE)

FORT CHURCHILL -
B-14 (Whalen, et al.)
B-9 (Zipf; 31.001UA, 31.002UA, 14.500UA)
B-10 (Gentieu/Mentall; 18.1013GA, 18.1014GA)
B-12 (Hays/Sharp; 13.132UE)
#0087; (Forsyth, Black Brant VI)

POKER FLAT- -
#0400 (Fitz; Auroral Studies)
#0164 (Davis; 18.1011UE, 18.1012UE)

EGLIN AFB -
#0400 (Fitz; "STRESS")

KWAJALEIN -
#0400 (Fitz; "Equatorial Wideband")

CANADA- -
#0205 (A. Vallance Jones, et al)

CONJUGATE POINTS- -
#0011, 0429 (Perrault, Hirosawa)