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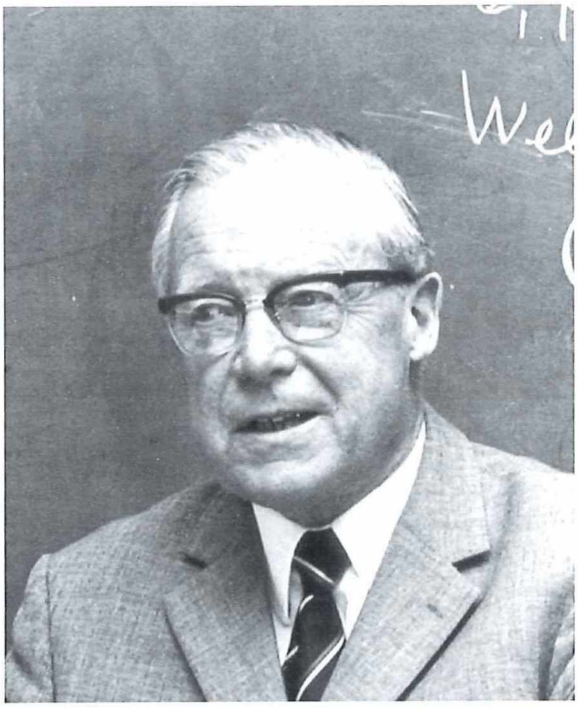

WALTER E. DIEMINGER
1907 - 2000

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Contents

Front cover: *Professor Walter E. Dieminger, Honorary President of URSI, passed away on 29 September 2000. The obituary is printed on pages 4-5 of this Bulletin.*

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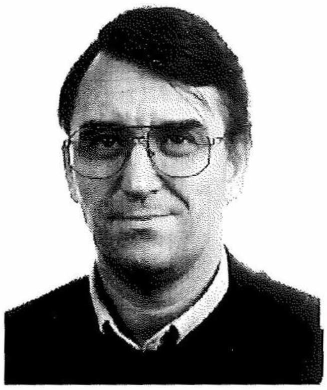
Editorial

Dear URSI Correspondent,

Welcome to the last issue of the Radio Science Bulletin for the year 2000.

This time you will find in our Bulletin two scientific contributions dealing with very different topics. In the first one the backscattering by ionospheric layers is analysed in the context of midlatitudes. The second contribution gives us a vision on standardisation problems in future mobile multimedia systems.



Beside the regular news section with conference reports, awards and future events we have an In Memoriam of Prof. Dr. W. A. Dieminger.

As we are at the end of the year, the traditional address list of the URSI Officials is given. For those who are interested, the International Geophysical Calendar 2001 is also provided.

I wish you a pleasant reading.

Piotr Sobieski, Editor

In Memoriam

Walter E. Dieminger
1907 - 2000

Prof. Dr. Walter Dieminger passed away on 29th September 2000 at the age of 93. Born in Würzburg, he received his scientific education at the *Technische Hochschule München*, graduating in 1931 with a diploma in physics. In 1935 he obtained the degree Dr. rer. techn. with a thesis on the dependence of radio wave propagation on the properties of the ionosphere, under the supervision of Jonathan Zenneck. His first professional position was with the *Deutsche Versuchsanstalt für Luftfahrt*, where he was involved in the development of radio navigation methods. In addition he acquired the title *Flugbaumeister* after a state examination and also got a pilot's licence. He established a scientific team for radio wave propagation studies which developed into the *Zentralstelle für Funkberatung*, to which he was appointed director in 1943. This agency with a staff of about 300, provided short wave radio propagation forecasts for the military and the police. It was first based in Rechlin (north of Berlin) and later in Leobersdorf/Austria and ran ionospheric observatories distributed over the whole Europe between 35-70° N and 15°W – 30°E.

Since Dieminger's team was very successful in their radio propagation forecasts and their scientific studies on the ionosphere, their work was regarded as important for the Allies, and they became a 'target' of the Field Intelligence Agency Technical (FIAT) after the end of the war. As a result the Royal Air Force moved a skeleton staff and their equipment into the British Zone of post-war Germany to Lindau near Göttingen. A very essential and beneficial role in this transfer was played by the well-known ionospheric scientist William Roy Piggott, a student of Sir Edward Appleton who served as a technical officer at that time. Dieminger and Piggott enjoyed a sincere friendship stretching back to these days.

Beginning in 1946 Dieminger established a ionospheric research institute in Lindau, first under the administration of the *Kaiser-Wilhelm-Gesellschaft*, which was succeeded by the *Max-Planck-Gesellschaft*. Dieminger was one of the signatories of the founding protocol of this scientific society on 26th of February 1948. The institute developed gradually into the *Max-Planck-Institut für Aeronomie*, in 1951 it was incorporated in the *Max-Planck-Gesellschaft* of which Dieminger became a scientific member. The scientific activities under his director- and leadership comprised upper atmospheric and ionospheric research and radio wave propagation studies. Among his special interests were sub-polar and trans-equatorial radio wave propagation. For these studies Dieminger established close collaborations with Finnish ionospheric observatories, in particular with the Geophysical Observatory in Sodankylä, and set up an ionospheric observatory in Tsumeb (today in Namibia). The latter was also a German contribution to the International Geophysical Year (IGY, 1957-59). In the following years he and his institute participated in various scientific campaigns like the International Quiet Sun Year (IQSY) and in scientific activities of COSPAR and ESRO. He also established close contacts and collaborations with several foreign geophysical institutes.

Diemingers academic career continued with the *Habilitation* (on ground backscatter of ionosperically reflected radio waves) at the *Universität Göttingen* in 1948. He was appointed an *außerplanmäßiger Professor* in 1954 at this university. In appreciation of his scientific achievements he became a member of the Finish Academy of Sciences in 1959, a corresponding member of the International Academy of Astronautics in 1965, a member of the renowned *Akademie der Naturforscher Leopoldina zu Halle* in 1968, and a member of the *Österreichische Akademie der Wissenschaften*. He also received the Karl-Friedrich-Gauss medal in 1971. His local and national contributions to science and scientific institutions were also honoured with the Honorary Citizenship of Katlenbug-Lindau in 1975 and the *Bundesverdienstkreuz am Bande* (Cross of Merits of Germany) in 1972.

Very early in his scientific career Dieminger became associated with the *Union Radio-Scientifique Internationale* (URSI) and participated in its activities. Already in 1938 he was a member of the German delegation to the URSI General Assembly in Italy. From 1954 to 1967 he lead the URSI Committee of the Federal Republic of Germany, and thereafter became honorary president of this national committee. He served as a Vice-President of URSI from 1963 to 1969 and as President of URSI from 1969 to 1972. In 1978 he was awarded with the title URSI Honorary President.

Dieminger's scientific work comprises about 120 articles on various geophysical and radio wave propagation topics, including landmark papers on ground scatter and the D-region winter anomaly. He also contributed to several books and encyclopaedias, like Brockhaus and Landolt-Börnstein, and he served as an editor of the *Zeitschrift für Geophysik* from 1961 to 1988.

After his retirement in 1975 he still kept close contacts to the *Max-Planck-Institut für Aeronomie* and worked on historical and bibliographical publications in his field. In his retirement he now enjoyed his hobbies, amateur radio (already since 1926 !) and model trains.

Dieminger married Dr. rer. techn. Ilse, née Günther in 1935. He is survived by his wife, two sons and a daughter.

Walter Dieminger will be remembered as a dedicated scientist, a pleasant colleague, and a responsible Director. He will be missed by all who knew him.

Kristian Schlegel

Radio backscatter studies in South Europe of the Midlatitude E Region Ionosphere

C. Haldoupis
A. Bourdillon
K. Schlegel
J. Delloue
G.C. Hussey

Using a VHF radio Doppler system in Crete, Greece, and a large HF radar in south-east France, several experiments were performed in the last few years in order to study coherent backscatter from ionospheric *E* region plasma irregularities that occur in close relation with midlatitude sporadic *E* layers. Following a general introduction to the topic, the main observational findings obtained so far with these two radar experiments in South Europe are reviewed in an effort to document their physical significance and assess their advances in the present state of knowledge.

Background

The strongest radio wave scatter in the Earth's ionosphere occurs in the *E* region, mostly at the magnetic equator and the auroral zones and less frequently and intensely at midlatitude. These phenomena, which take place in the altitude range from about 95 to 115 km, can be detected only if the incident radio wave vector is perpendicular to the Earth's magnetic field. Note that in the weak scattering theory, e.g., see *Farley* [1971], coherent scatter occurs only if wavelike plasma density inhomogeneities propagate along the bisector of the scattering angle, that is, the angle Q between the incident and scattered radio wave vectors, and have a wavelength $l_{ir} = l_r / (2\sin Q/2)$, where l_r is the radar wavelength; for backscatter $Q = 180^\circ$, and thus $l_{ir} = l_r / 2$. This means the scattering is caused by short-scale electron density fluctuations which are spatially coherent only in directions perpendicular to the magnetic field. The latter, known as magnetic aspect sensitivity, is a consequence of the strong electron magnetization which restricts electron motion perpendicular to the geomagnetic filed **B**, therefore allowing for plasma density wave generation and growth to occur only in directions close to perpendicularity because in these directions plasma diffusion is minimal.

On the other hand, the basic underlying physical reason for the strong backscatter to occur near the *E* region peak is the unique plasma properties at these heights which dictate different mobilities for the electrons and ions. There, the massive ions are unmagnetized because their motion is controlled by collisions with the much more numerous neutral particles, whereas the light electrons are strongly magnetized since their gyrofrequency W_e is much greater than the electron-neutral collision frequency n_e. This inherent plasma property leads to an electron-ion drift motion V_i - V_e in the presence of an ambient electric field **E**, and therefore to an electric current. The *E* region currents, either alone or in combination with ambient gradients in electron density, provide the free energy that generates the aspect-sensitive electrostatic plasma waves, through plasma instability mechanisms and nonlinear interactions, that scatter HF and VHF radio waves.

After many years of intensive research, it is now established that the main instability mechanisms which operate in the *E* region plasma are the modified two stream, or Farley-Buneman, instability and the gradient drift instability (e.g., see classic review by *Fejer and Kelley* [1980]). As mentioned, the most intense *E* region scatter occurs at the magnetic equator and auroral zones. This is because of favorable magnetic field geometries and relatively large electric fields which combine to generate the strongest currents in the ionosphere, that is, the equatorial and auroral electrojets. Many studies show (e.g., see reviews by *Fejer and Kelley,* 1980 and *Haldoupis,* 1989) that in these regions the key role in plasma destabilization is played by the relatively large electric fields present, which means that the Farley-Buneman instability operates there routinely in generating meter-scale irregularities.

On the other hand, at midlatitude a key feature for instability generation is the close connection with E_s layers which are characterized by large abundance in heavy metallic ions and sharp vertical gradients in plasma density. Given that ambient electric fields at midlatitude are small, the destabilization of plasma irregularities is attributed to the gradient drift instability rather than the two stream instability.

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Figure 1 sketches the observing geometry for backscatter measurements at midlatitude in the presence of a sporadic *E* layer. As pointed out first by *Ecklund et al.* [1981], in this picture one would expect the generation of gradient drift irregularities near the top of E_s when the ambient electric field has a southward and downward component, and near the bottom of E_s if the electric field has a component pointing northward and upward. Although these irregularities propagate preferentially in the zonal direction, their wave energy may cascade through nonlinear wave-wave interactions to shorter scale secondary waves (e.g., *Sudan* [1983]). The latter, which presumably propagate in all directions perpendicular to the magnetic field, are believed to be responsible for the observed coherent radio wave backscatter at midlatitude.

Prior to 1990 nearly all *E* region backscatter research was conducted in equatorial and auroral latitudes, with very few radar studies made at midlatitudes. In the last few years, however, the situation has reversed and the interest in the midlatitude *E* region has grown remarkably. This trend actually started about 10 years ago with the deployment and operation of the large Middle and Upper atmosphere (MU) radar near Kyoto, Japan and the detection of some interesting range-time-intensity (RTI) radar signatures which came to be known in the literature as midlatitude Quasi-Periodic (QP) echoes (e.g., see *Yamamoto et al.* [1991]). Since then, several radar systems and experiments were put in operation at midlatitudes for the study of *E* region plasma instabilities and for investigating the physics of interaction between the motions of the neutral atmosphere and the *E* region plasma (e.g., see a recent paper by *Hysell and Burchmam* [2000] and references therein). The purpose of this report is to highlight the midlatitude *E* region backscatter findings contributed from the European sector with the SESCAT experiment in Crete, Greece and the SPOREX experiment in South France.

SESCAT: Experiment description and results

SESCAT, an acronym for Sporadic E SCATter experiment, is a continuous wave (CW) Doppler radar which started operation in 1992. As shown in Figure 2, the experiment is located along the northern coastline of Crete, Greece at about 35° N geographic latitude and 24° E geographic longitude, ~28° N geomagnetic latitude, and 50° magnetic dip angle. The system operates at 50.52 MHz with the transmitter and receiver arrays beaming northward to a region perpendicular to the Earth's magnetic field at *E* region peak electron density altitudes. As seen in Figure 3, which shows a view of the receiver site in western Crete, the antenna arrays consist of four 11-element Yagis antennas which give an array beamwidth of 8°. The intersection of the transmitting and receiving antenna array patterns defines an *E* region observing area of about 15x30 km^2 located in the central Aegean sea near 30.8° invariant geomagnetic latitude (*L* shell value = 1.35, magnetic dip I = 52.5°, magnetic declination D = 2.5°). As seen from Figure 2, the observing direction, which is along the bisector of the transmitter and receiver line-of-sights (wave vectors), points about 5.5° east of geomagnetic north and thus SESCAT observes nearly along the geomagnetic meridian. Although it cannot give range resolution, SESCAT has the advantage of providing excellent time and Doppler spectrum resolution. The data acquisition was based on a DSP (digital signal processor) unit and was fully automated to perform FFT (Fast Fourier Transform) analysis in real time and average the Doppler spectra, which had a 3.8 m/s Doppler velocity resolution, over ~ 5 s. More details about SESCAT are given by *Haldoupis and Schlegel* [1993].

Soon after its initial operation, SESCAT observations indicated that 50 MHz backscatter events with relative power of 10 to 25 dB and lifetimes of a few minutes to more than an hour do occur at midlatitudes, in accordance with

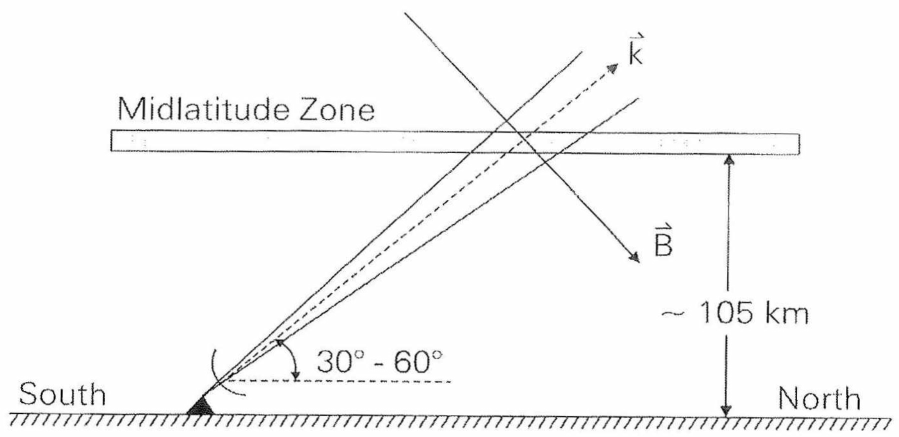

Figure1. Observing geometry for the detection of coherent radar backscatter from field-aligned irregularities in the midlatitude E *region ionosphere*

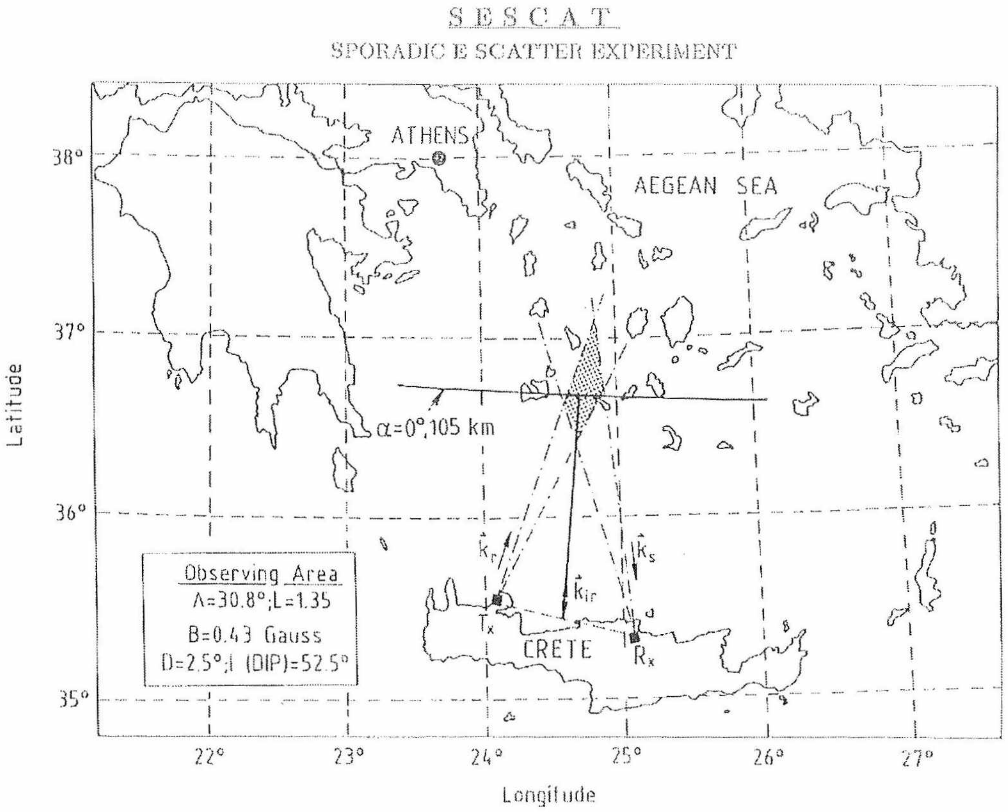

Figure 2. *Location and observing geometry of the Sporadic* E *Scatter experiment (SESCAT) in Crete, Greece.*

past experiments that related these echoes to sporadic *E* layers. The observed events, except for very few early afternoon cases, occurred during dark hours in the period between a few hours before and after local midnight. The backscatter was at times continuous but in many cases a quasi-periodic behavior was found with periods between 1 and 15 min. Backscatter is most often associated with symmetric Doppler spectra with mean velocities usually propagating northward and having magnitudes usually less than 100 m/s and mean spectral widths from 50 to 150 m/s. In terms of spectral width, the midlatitude *E* region echoes do not compare well with low velocity type 2 echoes from the equatorial and auroral electrojets where Doppler spectra are much broader and identify with secondary irregularities (e.g., see review papers by *Fejer and Kelley* [1980] and *Haldoupis* [1989]). On the basis of statistical evidence, it was concluded that 50-MHz midlatitude echoes are largely due to secondary irregularities generated during conditions of weak plasma turbulence.

Being an inexpensive experiment to run, SESCAT operated continuously for long periods of time and collected vast amounts of data which allowed detailed morphological and statistical studies [*Haldoupis and Schlegel*, 1996]. Based on one and a half years of continuous operation, a striking morphological pattern was established having a strong seasonal and diurnal character. The echoes, which showed no significant dependence on Kp index, appeared only during nighttime mostly in the pre-midnight local time sector. The absence of daytime echoes meant possibly that the gradient drift instability was inoperable during the day, probably because of electron density gradient smoothing due to strong solar photoionization production and electric field shortening effects due to conductivity enhancements. With respect to season, there was an abrupt rise in the number of echoes during the second half of May, followed by a broad maximum in the June-July period and a sharp decline in early September. Strong echoes were virtually nonexistent in the period from November to April. The seasonal echo occurrence follows exactly the seasonal morphology of strong E_s layers, a fact which reinforces the close relation believed to exist between the two phenomena. Finally, mean Doppler velocities were found to be larger in amplitude, but to vary approximately in phase with, both the ambient northward and upward **E** x **B** drifts and the neutral winds, as inferred from past incoherent scatter radar measurements and model predictions of the mean meridional wind, respectively.

We believe the most important contribution of SESCAT was the discovery of pure Farley-Buneman plasma waves in the midlatitude *E* region ionosphere. These are

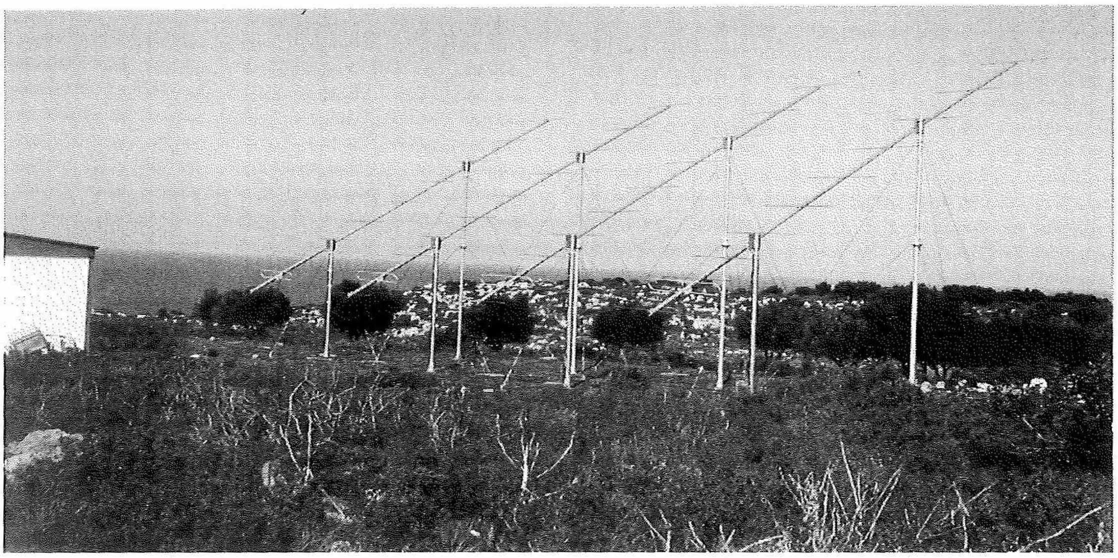

Figure 3. *A View of the SESCAT receiver array near the city of Chanea, west Crete*

identified with type 1 echoes that have relatively narrow Doppler spectra peaking at velocities near the plasma ion acoustic speed. Contrary to that anticipated, SESCAT showed that the Farley-Buneman instability can indeed operate for brief times in the midlatitude *E* region as well. The first clear evidence in favor of midlatitude type 1 irregularities was a single event presented and analyzed in detail by *Schlegel and Haldoupis* [1994]. *Haldoupis et al.* [1997] presented more evidence and statistics showing that type 1 echoes constituted a small but distinct subset of 50 MHz midlatitude coherent backscatter. These echoes were relatively rare and occurred sporadically in the summer nighttime. They lasted from several seconds to many minutes and had narrow Doppler spectral peaks corresponding to wave phase velocities from 250 to 350 m/s. On the average these values are about 20 % lower than nominal *E* region ion acoustic speed values, which represent the required threshold for instability. The measured lower type 1 velocities were probably because the instability occurred inside E_s layers where heavy metallic ions constitute the main ion population. This can lead to an increased mean ionic mass and thus to a reduced ion acoustic speed threshold. Figure 4, which is published here for first time, shows the longest lasting (for about half an hour) midlatitude type 1 echoes ever detected by SESCAT.

The midlatitude type 1 observations implied the existence of unexpectedly large electric fields; an order of magnitude higher than the prevailing ambient dynamo field on the average. To explain the origin of midlatitude type 1 echoes, *Haldoupis et al.* [1996a] proposed that the large fields required are simply polarization electric fields which can arise locally when nighttime sporadic *E* layer patches had the right geometry in relation to the magnetic field. They suggested that such fields could be generated by the same polarization process as at the magnetic equator, but with the geometry *turned on its side*. That is, they assumed that there were sharp horizontal conductivity gradients associated with patchy nighttime metallic ion layers that play the same role that vertical gradients play at the equator. In this mechanism, sharp gradients, particularly in the zonal direction, could lead to polarization fields more than an order of magnitude greater than the ambient dynamo fields. These polarization fields are sufficient to excite the Farley-Buneman instability in meridional directions, as implied by the SESCAT data.

The first simplified quantitative model of the proposed local polarization process was developed by *Shalimov et al.* [1998]. By including the effects of field aligned currents in the current continuity equation, they produced approximate analytical expressions which estimated the necessary conditions of the zonal versus meridional *E* layer extent and the ratio of the integrated Pedersen conductivity above and inside the layer for the generation of large zonal and meridional polarization fields. Their numerical results showed that the polarization process can account for elevated electric fields of several mV/m which were often implied from the SESCAT Doppler measurements. Moreover, it was shown that the polarization process could become more effective for dense and strongly elongated E_s layers under the action of an enhanced ambient electric field so that the resulting fields can become sufficiently large to excite the Farley-Buneman instability. According to the model by *Shalimov et al.* [1998], the stringent requirements for strongly elongated sporadic *E* layers with sharp boundaries, the low ionospheric Pedersen conductivities above the layer in relation to those inside, and the need for relatively enhanced ambient electric fields, would explain why type 1 echoes are so rare in midlatitude *E* region backscatter.

One of the least known observational parameters in the *E* region plasma instabilities is the irregularity *k*-spectrum dependence. To gain some knowledge on the wavelength dependence of coherent VHF echoes, a dual radar experiment was performed using a similar CW radar as SESCAT, but operating at 144 MHz. The 144 MHz radar was brought to Crete from the University of

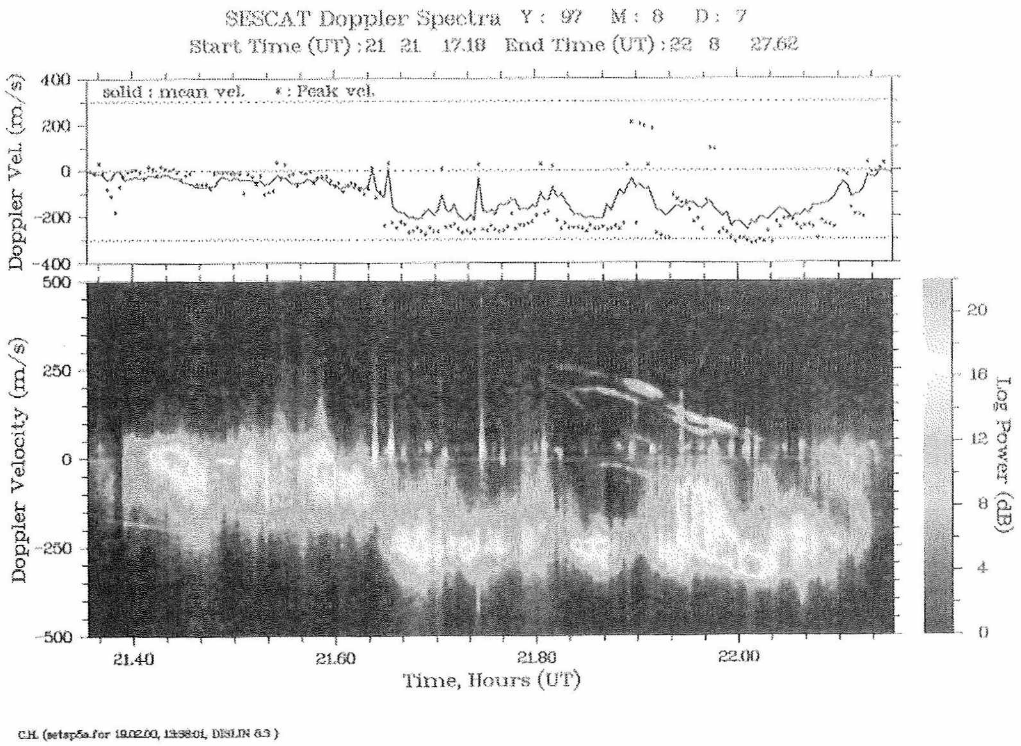

Figure 4. A SESCAT Doppler spectrogram showing the longest ever recorded interval of occurrence of type 1 irregularities (Farley-Buneman waves) at midlatitude. This implies that, in this event, electric fields exceeding 12 to 15 mV/m did prevail in the E *region for about 25 min.*

Saskatchewan, Canada. The Canadian system used scaled antenna arrays at the SESCAT sites in order to observe the same *E* region volume as SESCAT. For the first time at midlatitudes, this made it possible to investigate simultaneous echoes from 3-m and 1-m irregularities in the same scattering volume. The observations demonstrated clearly the different character of type 1 and type 2 irregularities. The 144 MHz type 2 echoes were completely absent during times of weak to moderately strong 50 MHz backscatter activity and appeared only when the signal at 50 MHz was very strong with relative intensities exceeding 20 dB above noise. On the other hand and in sharp contrast to type 2 echoes, there was one to one correspondence in the occurrence of 50 MHz and 144 MHz type 1 echoes, even when the signal at 50 MHz was only a few dB above noise levels. By calibrating the measurements and assuming a power law *k*-dependence for the irregularity spatial spectrum, $I_k \mu k^{-b}$, the spectral slope *b* was found on the average to be about 1.0 and 2.8 for type 1 and type 2 irregularities, respectively. This suggested that the *k*-spectrum is nearly 3 times steeper for type 2 than type 1 waves in the meter wavelength range. The results of this dual frequency experiment are described in two papers by *Koehler et al.* [1997 and 1999].

SESCAT was operated for one summer with a Canadian Advanced Digital Ionosonde (CADI) which had been located in the island of Milos, almost beneath the SESCAT scattering volume. The purpose was to investigate in detail the relationship between VHF backscatter and midlatitude sporadic *E*. It was found that 50 MHz echoes occurred always in association with E_s. The statistical analysis indicated significant correlation between scatter power and E_s characteristics such as the layer's top frequency $f_t E_s$ (a measure of maximum E_s electron density) and the apparent E_s spread which results from range spreading due to oblique reflections from a non-uniform and horizontally inhomogeneous layer. The experiment confirmed that the presence of an E_s layer, which could provide destabilizing plasma density gradients perpendicular to the magnetic field, is necessary but not sufficient for the occurrence of 50 MHz backscatter. It was suggested that in addition there was need for a locally enhanced electric field to be present. This was in line with the observed correlation of backscatter with a dense but strongly inhomogeneous E_s layer and the proposed mechanism of strong polarization fields at midlatitude. For details about the SESCAT/CADI data comparison see *Hussey et al.* [1998].

In another study by *Voiculescu et al.* [1999], published as a highlight in *Geophysical Research Letters*, the large SESCAT data base was used to investigate the long term variability in echo occurrence. The backscatter was found to be dominated by quasi-periodic variations with periods in the range from about 2 days to 10 days, which persist for time intervals from about 10 to more than 20 days and have no relation to geomagnetic activity. The most commonly observed periods appeared in two preferential bands; that

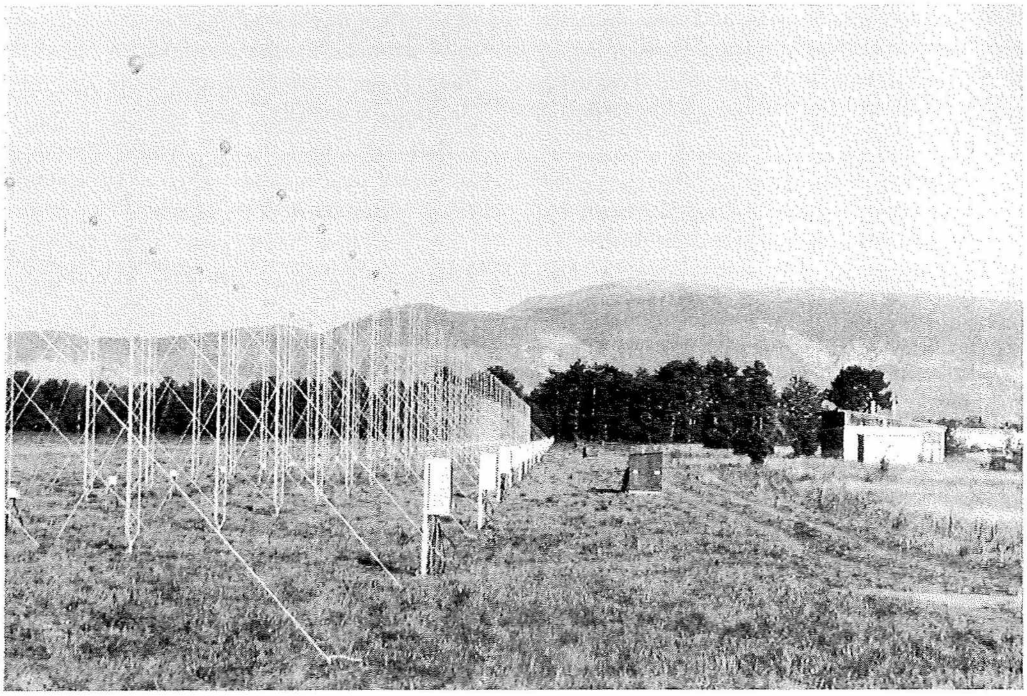

Figure 5. A view of the northward receiving array of the Valensole HF radar. The array consists of two rows of 48 vertical monopoles along a line of 560 m.

is, the 2 to 3 day and the 4 to 7 day band. Using concurrent ionosonde data, the variations in echo occurrence were found to be exactly in-phase with similar periodicities in the occurrence of relatively strong sporadic *E* layers. These findings constituted evidence in support of the possibility that planetary waves are responsible for the observed long-term periodicities in both E_s and echo occurrence, and suggested a close connection between the planetary wave morphology and the well known, but not well understood seasonal E_s dependence. This suggestion was taken up in a subsequent paper by *Shalimov et al.* [1999] who proposed a new mechanism for large-scale accumulation of metallic ions in the midlatitude *E* region driven by planetary waves in the lower thermosphere. In this process, the plasma is forced to converge horizontally and accumulate inside areas of positive vorticity set up by cyclonic neutral wind shears within a travelling planetary wave. Because of the long times required for ambipolar diffusion, the new mechanism can lead to significant plasma accumulation over large areas, thus acting as complementary to the vertical wind shear process so that dense E_s can form more efficiently and frequently. This new model provides the first physical base for understanding the long-period variations in occurrence and also the seasonal dependence of strong sporadic E layers at midlatitude. Finally, in a very recent paper by *Voiculescu et al.* [2000], the long-term periodicities in echo and E_s layer occurrence were compared directly with those in the neutral wind in the lower ionosphere (near 95 km) measured simultaneously from Collm, Germany. This comparison shows some reasonable agreement, which is the first direct indication in favor of a planetary wave role on the unstable midlatitude *E* region ionosphere.

SPOREX: Experiment description and results

SPOREX is an acronym for SPORadic E eXperiment, in which a large HF radar located near the town of Valensole in the south of France (43.8°N, 6.1°E geographic and 37.1° N, 82.2° geomagnetic) was used for midlatitude backscatter observations. This facility includes a monostatic oblique radar sounder and several large antenna arrays that cover the entire HF frequency band with 1 kHz resolution. It is a fully computerized multi-receiver system which can perform large azimuthal scans by using phased-array beam forming, to obtain in real time, full Doppler spectrum measurements over large regions of space. A unique characteristic of the system is its ability to operate in a multi-frequency mode by means of using a pulse-to-pulse frequency interlacing scheme within a given integration cycle. For transmission, the radar is equipped with two linear arrays of 16 broadband elements one beaming northward and the other westward. For reception, there are two large arrays made of vertical antenna elements. One is 1100 m long with a beamwidth of about 1° and covers east-west reception; the other is a 560 m long array with a beamwidth of 2° at 15 MHz and is used for northward or southward reception. Shown in Figure 5 is a view of the north-south receiving antenna array which was used for SPOREX experiments. The radar can be programmed to run under a variety of configurations. For more details on the radar system see [1995] and *Six et al.* [1996].

In SPOREX, the transmitter array was fixed and had a broad beamwidth, while the receiving array had a steering scheme which covered a large azimuthal sector extending from 26° east of north to about 58° west and the beamwidth was very narrow with a 2° angular resolution at 15 MHz. For SPOREX the transmitted waveform was adapted to the receiver bandwidth and consisted of Gaussian-shape pulses with pulse widths of 145 ms. The received signal was sampled every 18 km in 15 range gates extending between 100 and 370 km. The geographic location of the radar and the SPOREX field of view, which is centered near 37° invariant magnetic latitude ($L \sim 1.7$ and magnetic dip ~60°) are shown in Figure 6. Also shown across the field of view are the lines of zero magnetic aspect sensitivity at altitudes of 90, 100, 110 and 120~km. Finally, note that geographic and geomagnetic north are very close at Valensole because magnetic declination is only ~1°. SPOREX was run on a campaign basis for several weeks during consecutive summers from 1993 to 1998 using different multi-frequency and time averaging schemes, but keeping the same azimuthal coverage of about 84° over a 15-range times 42-azimuth grid. An example of azimuthal occurrence of Valensole backscatter is shown in Figure 7.

The first SPOREX paper by *Bourdillon et al.* [1995] was based on the 1993 summer campaign in which the experiment provided observations simultaneously at two frequencies of 9.0 and 14.8 MHz, which correspond to plasma backscatter wavelengths of from 16.7 and 10.1 m, respectively. The first results showed aspect-sensitive decameter-wavelength irregularities in the pre-midnight dark hours to have mean phase velocities less than 100 m/s and act as tracers of wavelike dynamic structures that drift westward with speeds in the 40 to 80 m/s range. These dynamic structures had characteristic lifetimes between 10 and 30 minutes and typical scale lengths between 40 and 90 km. In their interpretation these structures were considered to be sporadic E_s ionization patches, possibly affected by the passage of atmospheric gravity waves and/or Kelvin-Helmoltz instability shear waves, accompanied by both vertical and horizontal electron density gradients and enhanced electric fields which act to destabilize the plasma via the gradient drift instability.

In a subsequent paper by *Haldoupis et al.* [1996b], the dual frequency SPOREX-93 analysis showed that simultaneous Doppler velocities from largely shifted narrow spectra (presumably due to primary gradient drift decameter wavelength waves) were approximately equal for both 9.0 MHz (l_{ir} = 16.7 m) and 12.4 MHz (l_{ir} = 12.1 m) echoes. In a statistical treatment of the data, the velocity ratio $V_{12.1\,m}/V_{16.7\,m}$ was found to be somewhat less than 1.1; a ratio value well below the value of about 1.6 expected for the irregularity phase velocity ratio, if the widely-used assumption of wave velocity saturation at instability threshold is valid. On the other hand, the results of this study supported linear gradient drift theory predictions, that is, that the wave phase velocity of decameter waves should match closely the electron drift component along the direction of propagation (*Fejer and Kelley* [1980]). To gain more information on the geophysical conditions prevailing during HF backscatter events, a new experiment was performed in July 1994 which also included a vertical ionosonde beneath the scattering region. The results, presented by *Bourdillon et al.* [1997], showed evidence of modulation in the *F* region virtual height and Doppler velocity of the reflected signal during times of strong backscatter occurrence which displayed concurrent periodic-like range variations. These signatures were also accompanied by systematic changes

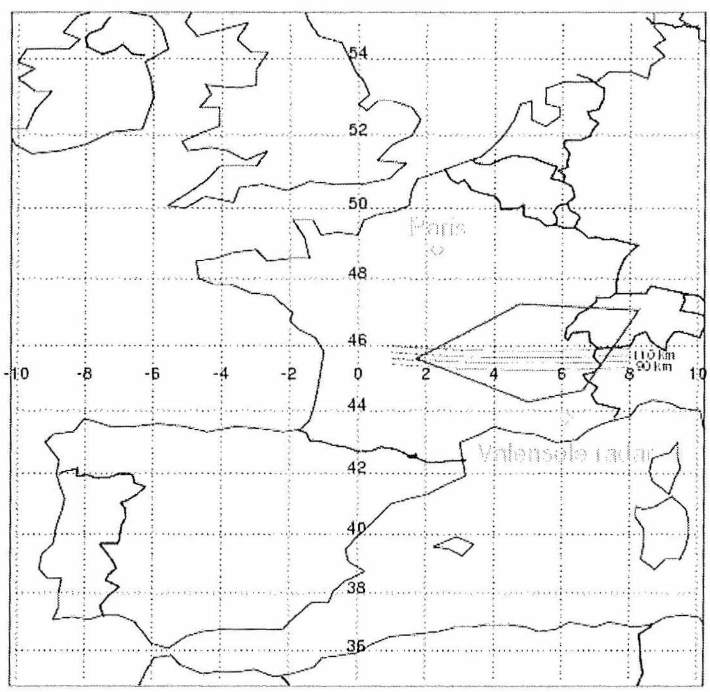

***Figure 6.** Location and viewing geometry of the SPOREX experiment for magnetic aspect sensitive backscatter observations.*

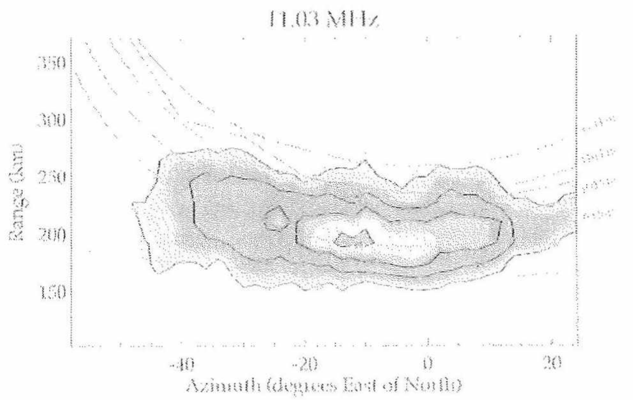

Figure 7. *Typical azimuthal occurrence of* E *region HF backscatter as observed by the Valensole HF radar. The expected line of sight field-aligned magnetic aspect curves are plotted for altitudes from 90 to 120 km. The southward displacement of the echoing regions, relative to the magnetic aspect angle curves of exact perpendicularity, is attributed to ionospheric refraction.*

in altitude of the sporadic *E* layer present, manifested by the vertical ionosonde time records. These wavelike variations in HF backscatter and ionosonde data were attributed to the passage and the modulatory effects of an atmospheric gravity wave.

To exploit the unique capability of the Valensole radar to perform multi-frequency probing of the plasma, a new experiment was performed in the summer of 1995 which allowed the measurement of *E* region backscatter Doppler spectra simultaneously at four different HF frequencies. As described by *Hussey et al.* [1997], the radar operated at the four frequencies of 9.23, 11.03, 12.71 and 16.09 MHz, which correspond to scatter from field aligned irregularities with wavelengths of 16.2, 13.6, 11.8, and 9.3 m, respectively. The data showed that lower-frequency echoes were stronger, more frequent, and more spatially extended than higher frequency ones, which is in general agreement with linear theory and rocket experiments. Using data from the same experiment, *Haldoupis et al.* [1998] studied the wavelength dependence of spectral broadening of decameter irregularities in the wavelength range measured by the radar. In their analysis they dealt with secondary irregularities, that is, type 2 echoes characterized by small mean Doppler velocities and mean spectral width to velocity ratios well above unity. The spectral width was found to increase monotonically with wavenumber k in the range from 0.38 to 0.67 m^{-1} covered by he experiment. By postulating that the width is determined mainly by the nonlinear growth rate of the secondary short-scale plasma turbulence, they compared their results to the theory by *Sudan* [1983]. Although there was some general agreement, on the average, the measured mean spectral width followed approximately a $k^{4/3}$ power law dependence which is considerably stronger than the theoretical $k^{2/3}$ dependence.

Finally, the multi-frequency Valensole measurements were used to study statistically the spatial occurrence of decameter midlatitude *E* region backscatter. The results were published recently by *Hussey et al.* [1999]. Based on the premise that scattering is fully aspect sensitive, statistics of spatial occurrence showed the aspect sensitive region to move toward the radar (southward) with respect to line of sight propagation calculations, with the lower frequency echoes being closer toward the radar than the higher frequency ones, in agreement with refraction theory predictions. Ray tracing inside nighttime midlatitude electron density profiles augmented with dense sporadic E_s layers was performed to calculate the expected echoing region, and good agreement was found. Another finding was the angular distribution of backscatter inside the wide azimuthal sector covered by the radar scan. The spatial distribution of echo occurrence had its maximum at small azimuths at and about geomagnetic north, suggesting that the meridional direction is strongly preferred for backscatter. Under the postulation that these are secondary waves, it was concluded that the observed angular anisotropy in spatial occurrence is at odds with the concept of strong isotropic plasma turbulence of *Sudan* [1983], but in general agreement with the two-step gradient drift instability theory of secondary wave generation process proposed earlier by *Sudan et al.* [1973].

Concluding Comments

In this report, the observations of midlatitude *E* region irregularities made during the last few years from the European sector independently with a 50 MHz continuous wave Doppler radar (SESCAT) in Greece and a multi-frequency HF radar (SPOREX) in France are reviewed. The studies undertaken with these two experiments had focused on a variety of research topics which included: 1) the morphological properties of backscatter and their relation to E_s layers, 2) the Doppler spectrum characteristics in relation with the predictions of the existing linear and nonlinear plasma instability models, 3) the *k*-spectrum dependence in the 1-m to 3-m and decameter irregularity wavelength ranges and comparison to theory, 4) the Farley-Buneman instability at midlatitude and the generation of strong polarization electric fields, 5) the azimuthal characteristics (including refraction effects) and spatial periodicities of HF echoes, and 6) the relationship between backscatter and large-scale neutral atmosphere wave motions, particularly planetary waves and their role in the formation of strong midlatitude sporadic *E* layers. Some of these investigations, for example those relating to the simultaneous multi-frequency observations in the VHF and HF band and the long-term variations detected in both backscatter and E_s occurrence, are quite unique in the sense that these studies were performed for the first time at midlatitude and only in the European sector. In this respect, several of the results here should be considered as complimentary to other findings made by midlatitude radar experiments in the Asian (Japan and Taiwan) and American sectors.

In concluding, we note that a substantial amount of experimental information was gathered from both these European ionospheric experiments. SESCAT and SPOREX have contributed new knowledge and a better understanding of the physics of midlatitude coherent radio backscatter phenomena and opened new dimensions in the long-going research of sporadic *E* layers. The discovery of pure Farley-Buneman waves in the unstable midlatitude *E* region ionosphere, which implied the presence at times of unexpectedly large electric fields (of about 15 mV/m or more), is one example. The detection of long-term variations, with periods in the ranges from 2 to 3 and 4 to 7 days, in both coherent backscatter and strong E_s occurrences (ionosonde observations) and the likely relation with planetary waves, is another example. These and several of our other findings emphasize the complexity of the physical processes in the unstable midlatitude *E* region of the Earth's ionosphere and the need for more research.

Acknowledgements

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The Mobile Multimedia Vision of IMT-2000/UMTS - A Focus on Standardisation

Josef F. Huber

Abstract

Cellular mobile telecommunications and the World Wide Web are growing at an exciting pace. Thus, it may me expected, that users will demand the combination of mobility and multimedia services in a foreseeable timeframe. Multimedia content increases and differentiates with changing information society, and an even richer variety of audio, visual, and text-based information will be required in the future. IMT-2000 - International Mobile Telecommunications - the family of 3rd generation systems, will provide these services. UMTS is a member of the IMT-2000 family. Its standardisation has set a new paradigm of timely market driven standardisation, in global partnership of standardisation bodies.

1. Introduction

In order to understand the role of next generation wireless services in the broader technology landscape, it is important to understand the current state of the Internet industry and other enabling technologies that shape its development. The Internet is transitioning from an inexpensive medium for advertising, marketing, and customer support to a common platform for transactions and business applications. At the same time, technological and commercial developments are melding together information, communications, commerce and entertainment into one large, consolidated industry. Part of the reason for this evolution is because more consumers are accessing the Internet using multiple devices and over multiple communications networks. They are also changing their behaviour and consumption patterns. In addition, tools and facilities are available that improve the consumer Internet access experience. These factors have created a number of opportunities and challenges for business as they develop their Web presence to better serve their customers.

Wireless access to the Internet is going to drive the overall development of the Internet for several reasons:

- Wireless allows service providers and Internet businesses to increase their mobile culture and total service consumption;
- The mobility and immediacy offered by wireless allows Internet content delivery and commerce to be non-location-specific;
- The person-specific nature of wireless allows companies to develop customer profiles that enable them to narrowcast and distribute better value-added information to customers; and lastly
- Location-based facilities and services provide another tier of customer knowledge that allows Internet businesses to deliver "context" specific services that also improve customer value.

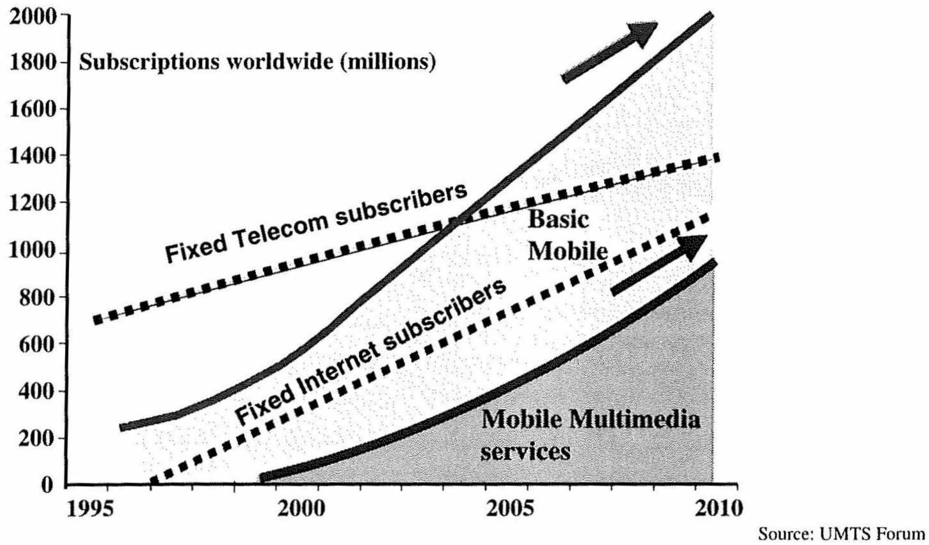


Figure 1.1: Mobile Terminals become Internet enabled

In short, wireless is an opportunity for Internet businesses to learn more about their customers, understand their customers' consumption patterns, strengthen their customer relationships and provide more personalised services. This is a critical component of Internet business strategies and what wireless Operators/service providers bring to the table in a full Internet solution.

At the start of the year 2000 the global mobile market counted 470 million cellular users, Internet approx. 260 million users. The diagram indicates that the Internet will reach a huge mass market size very soon and this will become the base for the launch of its services on the mobile side.

1.1 Mobile Multimedia Services are Set to Increase

The investigations in the UMTS Forum have shown, that medium/high bitrate services and applications will play a dominant role in future mobile communications.

Below you will find the frequency spectrum demand in the EU151 as a consequence of the expected 3G/2G traffic according to various service classes. In the year 2005 the mobile multimedia traffic will already play a significant role in relation to speech traffic. However, in the year 2010 mobile multimedia traffic will far exceed speech.

1.2 The Forum's decision to explore an Extended Vision

The fundamental reason for the foundation of the UMTS Forum was to prepare the 3G business marketplace for a new market for "Mobile Multimedia". Licensing and spectrum were topics for the initial UMTS work, and the results can now be seen in the license process for more than 100 UMTS/3G licences (Fig. 1.2) worldwide and in the spectrum designation of the so-called IMT-2000 Core Band.

Although IMT-2000 covers a comprehensive set of standards, an Extended Vision is hence needed to complete its vision. One example could be that Operators take advantage of new opportunities by deploying a Mobile Multimedia Portal platform - a higher element in the control chain where the user interacts - where information services are managed in relation to users' needs and profiles, and where new revenues can be developed. Service portability is another topic which comes into this focus, as it is part of the essential requirements. Service portability across networks - Internet, the Intranet and IMT-2000 and other legacy networks - creates questions about addressing and numbering, applications dependent QoS control and billing, roaming of information-oriented traffic relations, etc. The topic of Virtual Home Environment (VHE) gives an added value in this context. This is what is known as the "Extended Vision of IMT-2000/UMTS".

2. A New World of Mobile Communications

From a user's perspective, future mobile communications enabled by IMT-2000/UMTS will combine personal communications with universal services. The former means wireless mobile person-to-person or person-to-machine communication instead of wired fixed station-to-station communication. Beyond the comfort to stay in contact anytime, anywhere, with anyone with a single number and bill, it includes a personalised user interface and a consistent set of personal services. On the other hand, one aspect of universality is to have seamless services in all radio environments (indoor, outdoor, suburban, urban, rural, pedestrian, vehicular, satellite) and application areas (customer premises, office, public, ...). It also includes "independence" from the terminal used, the access system, and the serving network, but is mainly characterised by the

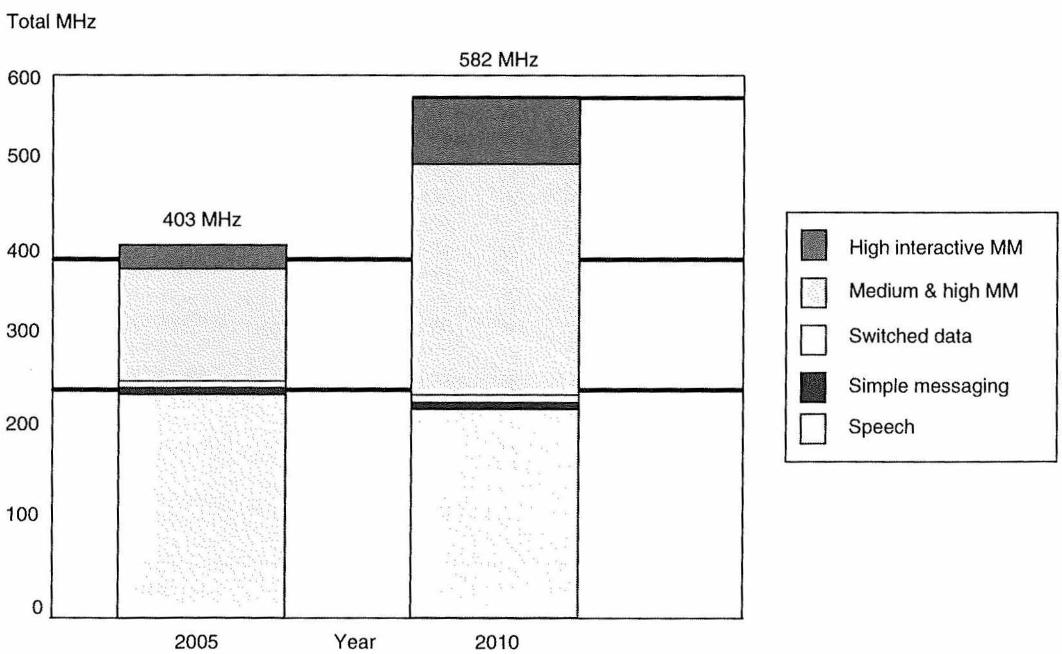


Figure 1.2: Frequency Spectrum Requirements for the Years 2005/2010, Example EU15

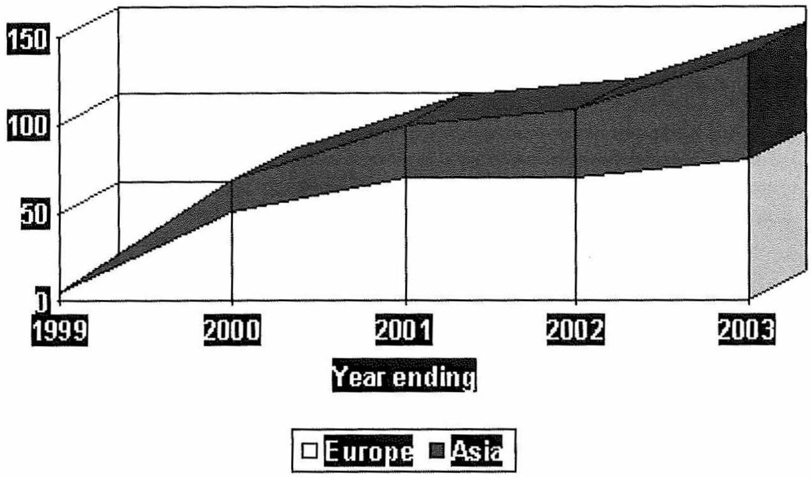


Fig. 1.3: Forecast IMT-2000 Licensing Activity - Europe and Asia

freedom of what to communicate (speech, text, data, graphic, video, ...) and how to communicate (real-time two way, messaging, paging, info retrieval ...).

This new service concept widens the market for services to be determined by users, service and content providers, not only by operators and standardisation. Among the main 3rd generation characteristics is Service Portability understood as the Virtual Home Environment (VHE) which defines a concept for portability of a personalised service environment across network boundaries and between terminals. Closely related is, beyond mere flexibility, the new freedom of service provisioning based on an Open Service Architecture (OSA). Instead of standardising services, appropriate building blocks to build services will be available in 3rd generation systems.

Using flexible bearers especially at the radio interface is essential to establish a multi service network. It requires omnipresent radio consisting of hierarchical cells. Spectral efficiency has to be improved significant-ly to overcome bandwidth and capacity limitations of 2nd generation radio. A major objective is to offer simultaneous data rates from narrowband up to wideband, optionally in combination with symmetrical or asymmetrical transmission.

True global service availability, i.e., also in maritime and aeronautic areas, is not possible without a satellite constellation. Therefore a satellite component is planned as integral part of IMT-2000/UMTS to complement the terrestrial segment. It completes and extends the terrestrial coverage, global intra system roaming becomes possible. Several additional roles have been considered, like disaster proof service availability, rapid global deployment of services/applications, and off-loading of terrestrial traffic to decrease blocking probability.

3. The Making of UMTS Standards on the Example of IMT-2000/UMTS

3.1 Glimpse on History

Three approaches have been distinguished in standards developing work for UMTS.

Table 1 summarises them.

1996: At the time when GSM phase 2, approved in 1995, was intended to be the complete and final version of the GSM specifications, UMTS was conceived as a completely new, single, monolithic standard, aimed at superseding not only GSM, but all 2nd generation systems.

Time Period	**1996**	**1996 – 1998**	**1998**
Body	ETSI SMG5	ETSI SMGs	3GPP
Approach	Monopoly	Plurality	Alignment
Deployment	Substitution	Coexistence	Integration
Architecture	Single network	Many networks	Layered networks

Table 1: 3 Phases of UMTS Standardisation

1996 - 1998: Since 1996 work on 3rd generation mobile systems has extraordinarily gained momentum in all regions of the world. Within the ITU the view of FPLMTS was revised and replaced by the vision of the IMT-2000 Family of Systems (IFS). The architecture design was built on existing system plurality, on the one hand to allow market differentiation, on the other hand to secure investment in existing infrastructure. Furthermore, the creation of the UMTS Forum helped to get into lively debate between all interested parties on all the critical issues beyond standardisation, like frequency allocation, regulatory frameworks, intellectual property rights, and market needs. They were laid down in the first UMTS Forum Report No. 1 [UMTSF1].

1998 onwards: After the principle agreement from standards developing organisations (SDO) in Europe, US and Asia in mid 1998 to use UTRA and the evolved GSM NSS in the UMTS core network, a reorganisation of SMG towards a world wide mobile specification group was initiated, in order to avoid duplication of work, to unite work forces of different regions. A similar group was founded shortly afterwards called 3GPP2 dealing with CDMA-2000 based standards. In 1999 the ITU-R agreed upon the framework standards on radio-interfaces, an important milestone in the IMT-2000 development. They formed the basis for the production of the detailed standards specifications - traditionally done by the regional Standardisation Organisations.

3.2 Globalised Specification Work

Officially recognised Standardisation Organisations of Europe, US, Japan, Korea, and China (who joined the 3GPP in May 1999), ETSI (European Telecommunication Standards Institute), ARIB (Association of Radio Industries and Businesses), TTC (Telecommunications Technology Committee), TTA (Telecommunications Technology Association, T1 (Committee T1 Telecommunications) and CWTS (China Wireless Telecommunication Standard Group) have declared to work collaboratively for the production of 3rd generation mobile system specifications by delegating the specification work for the 3rd generation to 3GPP. They co-operate for the mission of 3GPP, i.e., as part of the IMT-2000 family of systems, for the provision of one set of common, globally applicable, technical specifications for UMTS based on evolved GSM core networks and the radio access technologies studied in ETSI as UTRA, and in ARIB as W-CDMA (both FDD and TDD modes).

The new approach to standardisation in 3GPP is characterised by the separation of the so-called 'individual members' sphere and the 'partners' sphere (see Figure 3.1). The principle is to break collaborative global technical standards work apart from co-ordinated setting of regional or national standards. Both spheres appear as different categories of participation and as different internal organisations in 3GPP.

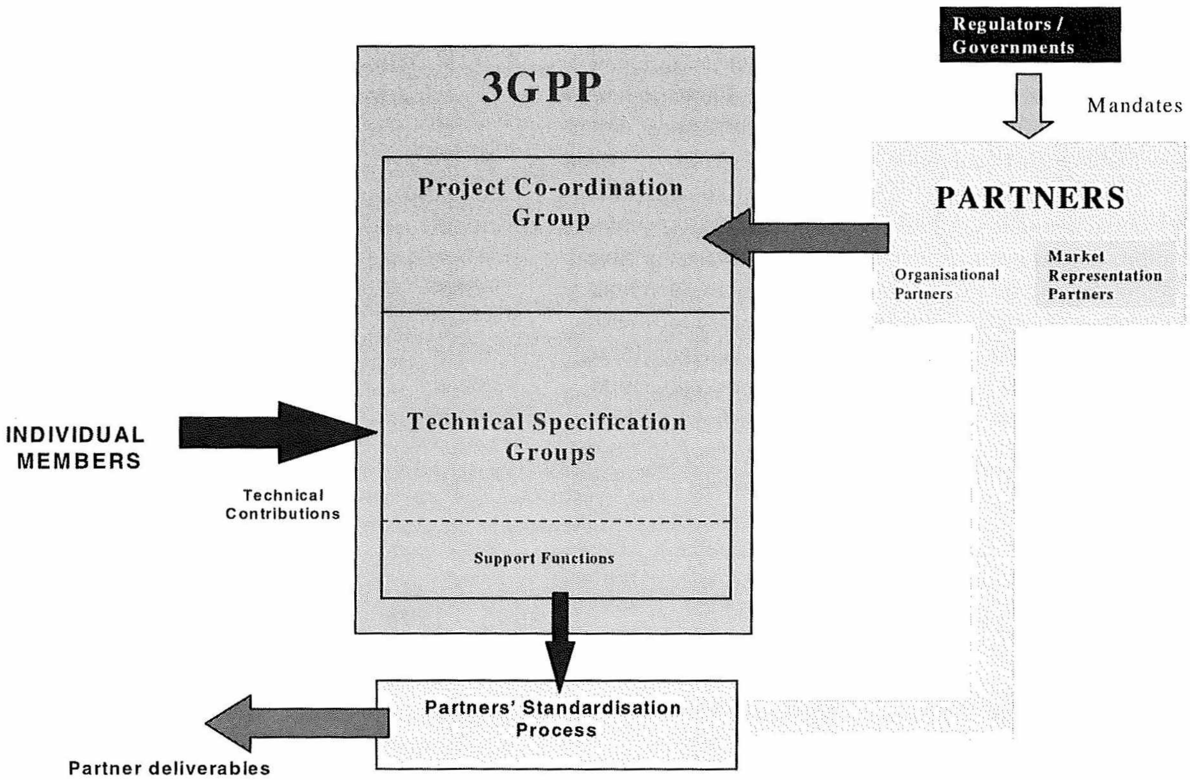


Figure 3.1: 3GPP based Development of Global Standards

As is shown in Figure 3.1, the internal work split of 3GPP is based on the distinction of the Project Co-ordination Group (PCG) and the Technical Specification Groups (TSGs), besides support functions. The PCG is responsible for determining the overall frame and for managing the progress of work. The TSGs prepare, approve and maintain the 3GPP Technical Specifications and Technical Reports. Four TSGs exist, one at a time for the radio access network, the core network, terminals, and system aspects. Decisions are made by consensus in PCG, whereas in TSGs in unavoidable cases it may also be decided by vote besides consensus.

The 'partners' sphere comprises two categories, Organisational Partners (SDO) and Market Representation Partners (MRP). Both participate in the PCG of 3GPP. The former may be any SDO with the status to set standards nationally or regionally. The latter bring market requirements into 3GPP. The first MRP in December 1998 was the UMTS Forum, followed by the Global Mobile Suppliers Association (GSA), the GSM Association and the US Wireless Communication Group (UWC). So-called Individual Members constitute the 'individual members' sphere. Only entities registered as a member of an SDO can become Individual Members of 3GPP. All Individual Members have equal rights and act in their own right. Observers and guests may also be registered, especially if they have the qualifications to become a future partner. What distinguishes 3GPP is that the elaboration of technical specifications by Individual Members in the TSGs is completely separated from transposition, approval, and publication as standards, or parts of standards, by the SDOs, following the usual standardisation process of the respective Organisational Partners. 3GPP has been founded for an innovative way of developing Technical Specifications in world wide collaboration, and not to establish new legal processes of setting standards.

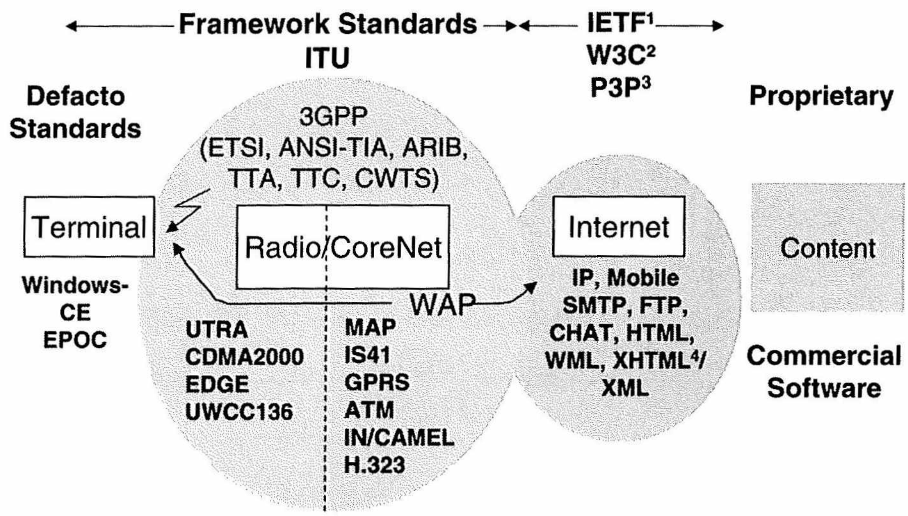
Working procedures in 3GPP ensure that decision making takes place at the lowest appropriate level. Maximum use of modern (electronic) working methods is made. The specification work in 3GPP is progressing as planned. The first release of the UMTS Specifications (the so called Release 99) was ready at the end of 1999. In parallel 3GPP prepares for UMTS Release 00 by collecting requirements and initiating feasibility studies.

4. The Impact of Internet onStandardisation

The wireless access to Internet has already introduced a new set of standards and protocols that add a layer of complication to application solutions which are existing in the Internet world. This experience was shown with the introduction of Voice/Video over IP, of WAP, i-mode and similar IP services to mobile networks. In the future, almost transparent solutions should be provided, e. g. HTML/XML transparency.

Figure 4.1 shows the scenario for Multimedia services in the scope of the Extended Vision: IMT-2000/UMTS is linked with the Internet, the Portal and the Content Provisioning and is therefore faced with a number of new interworking issues. They belong to quality, security, mobility management, billing etc. A main issue is the interworking on the protocol layers where "Out-of-band" and "In-band" control functions have to be aligned. The standardisation also has to specify impacts regarding addressing (ITU, IP), which is quite different in IPv4 and IPv6. The transition phase from IPv4 to IPv6 is not only impacting UMTS itself, but also the worldwide Internet and the Intranets. Thus, this topic will play a significant role in the future standardisation within 3GPP as well as IETF.

The harmonisation of the UMTS standards in the IMT-2000 framework with the standards on the Internet side is necessary to make the Mobile Multimedia Portal platform to a workable solution in an international networking



[1]IETF =Internet Engineering Task Force, [2]W3C= World Wide Web Consortium, [3]P3P=Platform of Privacy Preferences
[4]XHTML=an XML version of HTML (new mark-up language recommended by W3C in early 2000)

Figure 4.1: UMTS Standardisation Scenario UMTS/IMT-2000 with Internet

environment, especially for the roaming user. For Push E-Mail standards have to be specified based upon the existing IETF SMTP protocol standard. Regarding the Portals, HTTP standard issues need to be discussed in the relevant bodies to guarantee for the end-user XHTML/XML transparency and WAP compatibility.

The role of the UMTS Forum is to widen the scope in the standardisation and to convert its views into requirements/ work items. Also important is the compatibility with 2G systems, especially with GSM and the interworking with WAP. Items need to be addressed to 3GPP, IETF, IPv6 Forum etc.

4.1 Mobile Multimedia Portal Platform

It is located at the transition between the access and transport network and the content provision. It deals with the mobile user on the applications level, on top of the relevant protocols like HTTP etc. Thus, the question arises in which way and to what extent it needs to be standardised. E. g. there are the areas of applications-dependent QoS, security and billing. Then, there is the field of XHTML/HTML, XML, WML. And there is at least a common set of rules necessary related to the Portal functionality following the Portal Roadmap. This common set of rules is important for the roaming user.

4.2 Releases

The 3GPP Release 99 is composed of the UTRAN attached to two separate UMTS core network domains, namely a circuit switched domain based on GSM Mobile Switching Centers (MSCs), and a packet domain built upon GPRS Support Nodes (GSNs). 3GPP Release 00 will open the defined features for further evolution following GSM/Internet convergence.

In the following two main topics, which will impact the standardisation in the context of the Extended Vision are described in more detail.

4.3 Mobility

Mobility, in all its many forms, is becoming the watchword of our society. Everthing moves faster and faster. IP seems to be the end to end protocol of the future delivery of most services since it will exist in the wireline and wireless world, in Office Extension environments and Home networks.

The increasing interest in Mobile IP as a potential mobility solution for cellular networks leads to new solutions and extensions to the existing protocol world in telecommunication networks. There is also a need to put together the demands on Mobile IP, from a cellular perspective, in order to harmonize the evolution of Mobile IP and the existing mobility solutions in cellular networks. As a network-layer protocol, Mobile IP is completely independent of the media over which it runs i.e. independent of technology. This is in keeping with the design philosophy behind the Internet Protocol itself, which was designed to be independent of the underlaying characteristics of the links over which it runs.

Mobile IPv6 as standardised by IETF benefits today from an integal part of an ongoing development of the Internet and cellular standards. It allows the user to keep his/ her home address while roaming- always "ON".

IPv6 mobility determined by and optimised for mobile terminals will be one of the major features in cellular networks. IPv6 provides max. and transparent interoperability with core networks and it is simple and scalable to support billions of users new devices.

It's key benefits are mobility, security, QoS, scalability and auto-configuration. But also offers "Built-in" IPSec that provides all management applications security.
It supports cellular and non cellular access. The flexibility allows sharing of resources for support of a diversity of technologies both wireline and wireless.
It has no impact on location registers since, the information required to route packets is managed independently from the information used to locate and authenticate a UMTS user.

The IETF is currently working with 3GPP to incorporate the UMTS requirements on terminal Mobility into to Mobile IPv6 to provide a seamless wireless and wireline mobility management. This will offer a major advantage in comparison to second generation Cellular Network Roaming concepts (optimized routing).

Each mobile terminal is always identified by its home address, regardless of its current point of attachment to the

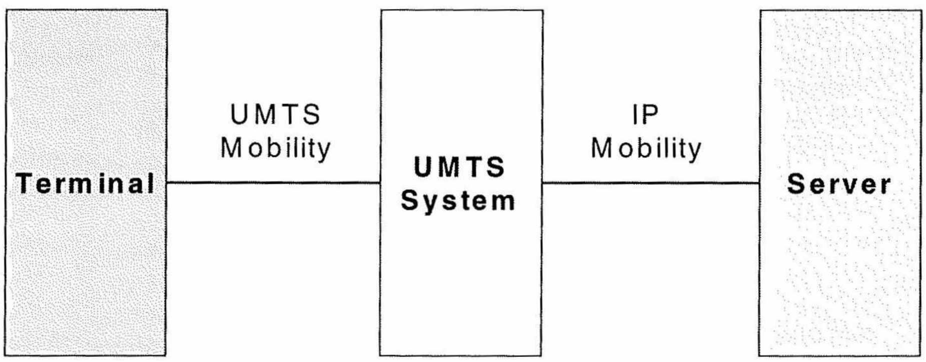


Figure 4.2: Mobility Interworking

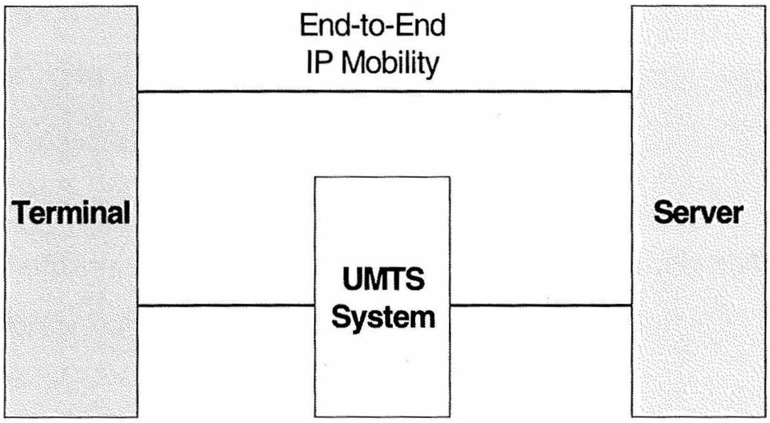


Figure 4.3: Transparent IP Mobility

Internet. While situated away from its home, a mobile terminal is also associated with a care-of address, which provides information about the mobile node's current location. IPv6 packets addressed to a mobile terminal's home address are transparently routed to its care-of address. The protocol enables IPv6 terminals to cache the binding of a mobile terminal's home address with its care-of address, and to then send any packets destined for the mobile terminal directly to it at this care-of address. The way it is done is as follows

- Advertisement from local router
- Seamless Roaming: mobile terminal keeps home address
- Address auto-configuration for care-of address
- Binding updates sent to correspondent nodes
- Mobile terminal „always on" by way of home agent.

The figure below illustrates on possibility for the start-up phase of UMTS to solve the provision of Mobility control functionality across heterogeneous networks.

Figure 4.2 presents a first option in providing mobility functionality over heterogeneous networks, that is an interworking solution: within the UMTS system, classical MAP-based mobility functions are exploited, while on the IP side, Mobile IP can be used. In this option a complete interworking function has to be developed in order to allow the user an overall mobility across both the mobile and the IP environment.

Figure 4.3, is a transparent IP mobility solution: both within the UMTS system and on the IP environment, and will be implemented after the IETF/3GPP solution is available as unique mobility support functionality. In this case a transparent end-to-end mobility protocol is provided through the exploitation of IP integrated functions, i. e. Mobile IP for the discrete macro-mobility, within and between Core Networks, and Cellular IP for the continuous micro-mobility, within the Access Network.

4.4 Security

Rapid advances in communication technology have accentuated the need for security in the Internet. The IP Security Protocol Working Group (IPSec) has developed mechanisms to protect client protocols of IP. A security protocol in the network layer is developed to provide cryptographic security services that will flexibly support combinations of authentication, integrity, access control, and confidentiality.

The protocol consists of three core components. The IP Authentication Header (AH) that verifies the identity of a packet's sender and the authenticity of the packet's contents. The IP Encapsulating Security Payload (ESP) that encrypts a packet before transmitting it; and may also encapsulate the original IP packet. It is independent of the cryptographic algorithm. The Internet key exchange (IKE) governs the transfer of security keys between senders and receivers.The preliminary goals will specifically pursue host-to-host security followed by subnet-to-subnet and host-to-subnet topologies.

AH and ESP can be used with various authentication and encryption schemes, some of which are mandatory.

Protocol and cryptographic techniques have also been developed to support the key management requirements of the network layer security. The Internet Key Management Protocol (IKMP) will be specified as an application layer protocol that is independent of the lower layer security protocol.

IPSec gateways work only in tunnel mode, which means no part of the original packet is vulnerable to interception.

Some of the key IPSec features are:

- Signalling: integrity, authentication, anti-replay protection
- User traffic: integrity, authentication, confidentiality
- Visited network resources and traffic: access control, confidentiality
- No Foreign Agents
- IPSec protocols are integrated into IPv6 devices as standard
- Home Address Option eliminates network-ingress filter problems
- Route-optimisation functionality is integral

Similarly, to the Mobility problem of providing complete and reliable end-to-end functionality across heterogeneous networks, security will follow the same approach.

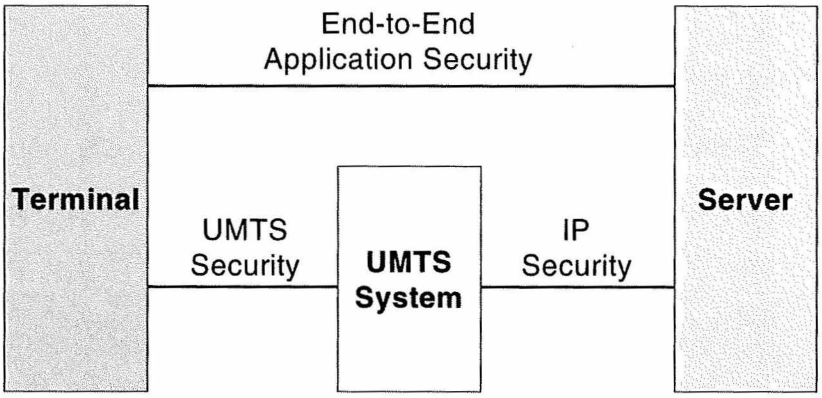


Figure 4.4: Security Relationships

3GPP is currently performing a conformance check of IPv6 and the different add-on components i.e. MIP, IPSec, Diffser etc. It is expected that the necessary amendments meet the requirements of a huge cellular market.

Security relationships in a heterogeneous network environment can be very complicated, actually requiring both an interworked and a transparent end-to-end solution. In fact, dedicated mutual authentication and encryption facilities are used to check and secure the transmission segments in each specific environment, i. e. both the UMTS system and the IP segment. While end-to-end transparent solutions are needed to secure the application layer, via e. g. digital signatures plus non-repudiation techniques. Non-repudiation can be achieved by generating a signature and combining it with some form of user authentication data (such as a PIN). When the user commits to transaction, the signature will ensure that he/she cannot deny later that it took place. Of course, this kind of functionality is fundamental in any kind of mobile-commerce transaction.

In order to guarantee the overall required level of security, global co-ordination is therefore necessary between the two different solutions adopted at the transport layer and solutions adopted at the different layers, i. e. transport and applications.

4.5 Smart Card Issues on the Terminal Side

Smart cards are of eminent importance to secure transaction-based communications. Thus, the USIM card which is based on the already standardised SIM card from GSM, is a highly relevant issue for standardisation. There are key items for the user in order to avoid fraud and to guarantee billing when roaming.

5. Conclusions

The original vision of a single technology for 3rd generation has transformed into the goal to standardise a family of 3rd generation mobile telecommunications systems allowing to deploy networks depending on market needs, operator business plans, with several technological choices. Following an innovative approach to globalise standardisation, IMT-2000/UMTS standards are developed by 3GPP.

IMT-2000/UMTS will benefit from the huge GSM footprint world wide. It combines the best of different worlds, circuit switching for voice only services and IP connectivity to bring IP based real-time multimedia communication services and non-real-time multimedia information services to the user on the move. Technical Specifications mature within 3GPP in a timely and efficient manner. They will form a sound base for commercial take off in the year 2002. For subsequent Releases, a stepwise approach will be taken towards an "All-IP" based radio and core network.

6. Acknowledgement

- UMTS Forum Reports No. 1, No. 6 and No. 10
- IEEE Article by Josef F. Huber, Dirk Weiler and Hermann Brand

New URSI Award

The URSI Board of Officers has approved the establishment of a fifth URSI award in honor of Professor Henry G. Booker who served as Vice President, 1969 - 1975, and Honorary President from 1978 until his death in 1988. It will be recalled that Professor Booker was a strong advocate for the role of telecommunications in URSI.

Henry George Booker was born in Barking, Essex, England on December 14, 1910, and became a naturalized US citizen in 1952. He was educated at Cambridge University, where he received the BA degree in pure and applied physics in 1933 and his PhD, specializing in ionopheric physics, in 1936. He received the Smith's prize and was appointed a Fellow of Christ's College, Cambridge, in 1935. During World War II he conducted theoretical research on antennas and radio wave propagation, and on the conclusion of hostilities, returned to Christ's College as a lecturer. He became Professor of Electrical Engineering and Engineering Physics at Cornell University in 1948, and served as the Director of the School of Electrical Engineering and Associate Director of the Center for Radiophysics and Space Research. He helped build up the research program in radio science at Cornell, and attracted many talented graduate students, post-docs and faculty. He was also instrumental in the creation of the Arecibo facility. In 1965 he moved to the University of California in San Diego, where he founded and was the first Chair of the Department of Applied Electrophysics. He was appointed Emeritus Professor of Applied Physics in 1978.

Dr. Booker was active in the IEEE Antennas and Propagation Society, and served a term as President. Among his many honors, he was elected a Fellow of the IRE (now IEEE) in 1953 "for his theoretical work in electromagnetism and radio wave propagation". He received the IEEE Centennial Medal in 1984. He was elected a Member of the US National Academy of Sciences (NAS) in 1960, and served as Chair of the NAS Sanguine and Climatic Impact Committees. He also served URSI in many capacities, including Chair of Commission H, 1963-69.

The Booker Award consists of a 2 in. diam. 10 kt gold medal in an inscribed case, plus a certificate, and is supported by a fund administered by the Booker Committee whose chair (or, if convenient, a member of the Booker family) will hand out the award at the URSI Awards Ceremony. The recipient will be selected by the URSI Board on the recommendation of the URSI Awards Panel, and the first award will be made at the 2002 General Assembly. The award is for outstanding work in telecommunications or a related discipline of direct interest to URSI, with weight given to contributions in the past six years and to prior contributions. As in the case of the other URSI awards, no current member of the Board of Officers is eligible to receive it.

The two sides of the Booker Gold medal are pictured below.

Financial Support

As a result of conversations initiated at the 1978 General Assembly, some friends of Professor Booker established a fund to honor him on his retirement from the University of California - San Diego, and decided to use the income from the fund (held by the US National Academy of Sciences) to support the attendance of a young US scientist at each General Assembly. The Booker Fellowship was first awarded in 1981, and has been awarded every three years since then. The selection of the recipient is made by the USNC/URSI on the recommendation of the Booker

Front and Backside of the Booker Gold Medal

Committee. The award covers all expenses associated with attendance at a General Assembly, and a listing of the Fellows is as follows:

1981	John Armstrong
1984	Yahya Rahmat Samii
1987	Shrinivas Kulkarni and Timothy Cornwall
1990	Eric Yang
1993	Jacqueline N. Hewitt
1994	John Sahr
1995	Eric Michielssen

Over the years the fund has almost doubled in value, and with the help of some additional donations recently received, it is now able to support the new medal and also continue the Fellowship (but with a fixed stipend of 2000 USD). The members of the Booker Committee for the present triennium are E.K. Smith (Chair), W. E. Gordon and Z. Popovich.

Rules for the Award of the Booker Gold Medal

1. The Booker Gold Medal honours the memory of Professor Henry G. Booker who served as URSI Vice President, 1969-1975, and Honorary President until his death in 1988. The award is made normally at intervals of three years, on the occasion of the General Assembly of URSI. If the interval between two General Assemblies is either considerably greater or considerably less than three years, the Board of Officers is authorized to modify the date on which the next Medal will be awarded, the period referred to in Article 2, and the dates referred to in Articles 3 and 5.
2. The Medal is awarded for outstanding contributions to telecommunications or a related discipline of direct interest to URSI. The award is for career achievements of the candidate with evidence of significant contributions within the most recent six-year period. No member of the URSI Board of Officers shall be eligible.
3. Candidates may be nominated by any Member Committee or URSI, URSI Commission Chair or Vice-Chair or former laureate of any URSI award, but not more than one candidate may be nominated by any one Committee or individual. The names of the candidates must be received by the Secretary General of URSI not later than 15 August of the year preceding that of the General Assembly at which the award is to be made.
4. The name of each candidate must be accompanied by a nomination form (supplied by the URSI Secretary General) providing information on, inter alia:
(a) a general summary of the candidate's career and scientific activities;
(b) a review of the candidate's recent achievements, including references to the most important papers of which the candidate is the sole or a joint author published during the six-year referred to in Article 2;
(c) an outline of the reasons for the nomination of the candidate.
5. As soon as possible after 15 August, copies of the nomination forms referred to in Article 4 shall be sent to the Awards Advisory Panel by the Secretary General. The members of the Awards Advisory Panel shall be determined by the President of URSI in consultation with the Board of Officers. The Panel is authorized, when necessary, to consult non-members regarding the merits of the candidates, before submitting its own considered view to the Board of Officers not later than 1 March of the year of the General Assembly.
6. The Board of Officers has full authority to select the candidate to whom the Award will be made. In doing so it will take into account the information provided by the proposers of the candidate, and also the views expressed by the Awards Advisory Panel.
7. The Board of Officers has full authority to withhold the award if, in the opinion of the members, there is not a qualified candidate.

Thomas B.A. Senior

CONFERENCE REPORTS

IAU Colloquium 182

Guiyang, China, 17-21 April 2000

IAU Colloquium 182, "Sources and Scintillations: Refraction and Scatteringin Radio Astronomy,'' which was co-sponsored by URSI, took place in Guiyang,China, 17-21 April 2000. The conference was well attended, with 85 registered participants from 11 countries. The topics covered included, Theory of Scattering and Scintillation, Distribution of Scattering Material, Intra-day Interplanetary Scintillation, and Future Highly-Sensitive Radio Telescopes.On the afternoon of 19 April, there was an excursion to an area of karst depressions which could be the site of a future large spherical radiotelescope. The trip concluded with a visit to Huangguo Shu, one of the most picturesque waterfalls in China.

Some of the scientific highlights of the conference included excellent introductory reviews on the physics of refraction and scintillation (Rickett and Cordes), MHD turbulence (Goldreich), and pulsar scintillation (Gupta). These emphasized the essential properties of diffractive andrefractive scattering, how they differ in temporal and frequency structure,and what they tell us about irregularities in the ISM. The irregularity structure follows a Komolgorov (power-law) spectrum to a large degree, as is the case in many other fluids (such as the terrestrial atmosphere and the ocean). The significance of the departures observed was a topic of some discussion.

Pulsar scattering and dispersion measure (DM) observation shave enabled us to model the distribution of free electrons in the galactic disk, and we heard about ongoing research to refine the existing model.Pulsars, being near-perfect point sources, provide an ideal probe for propagation studies. Their radiation can, moreover, be examined in a number of different ways as a function of frequency: time variability (both shortand long term), DM changes, pulse broadening, angular extent and Faradayrotation. There were observational talks on ground-space (HALCA) VLBI observations of PSR 0329+54 by Yangalov et al., and of the scintillation frequency structure for a number of pulsars (Kondratiev). Manchester summarized the results of the Parkes multibeam survey, which has thusfar discovered over 500 new pulsars, and will have roughly doubled the number of known pulsars by the time it is finished. A number of the new objects have unusual properties, such as one of the eight binaries which has ahigh-mass companion, probably a K supergiant near the galactic center. Future surveys should take account of propagation effects in planning their observing strategy (signals can be considerably enhanced, for example, during periods of strong refraction).

Lyne and Graham-Smith have made the fascinating discovery of a pulse echo in the Crab Nebula pulsar (PSR 0531+21) during a period of several months in 1997. The echo is first seen delayed with respect to the main pulse,but the delay gradually decreases until the pulse and echo coincide, at which the pulse disappears for a short period. After the pulse reappear, the DM is found to be enhanced, and then the echo is again seen with agradually increasing delay which mirrors the first half of the event. The whole episode is interpreted as reflection off the surface of a discreteionized cloud in the outer envelope of the nebula, which moves across thel line of sight to the pulsar. A few similar events were subsequently found in archive data going back some 20 years. It is concluded that the nebula contains a large number of compact, shell-like clouds.

Intra-day variable sources (IDVs) formed another major topic of the conference. In an introductory review, Jauncey pointed out that source variability, and the implied intrinsic size, was one of the original motivations for developing the Very Long Baseline Interferometry (VLBI) technique. Although many of the variable sources clearly exhibit intrinsic changes, IDVs are generally believed to result from scintillation effects.They require source sizes on the micro-arcsec scale. Subsequent talks considered the relevant properties of a sample of flat-spectrum sources (Gorshkov et al,), and structural changes in the BL Lac 2007+777 (Jinet al.). The properties of the remarkable IDV J1819+3845 (Dennett-Thorpeand De Bruyn) were presented. It displays very substantial intensity variations on timescales which can be under an hour. Changes in the timescale during the course of a year are interpreted as being due to the earth's orbital motion with respect to a scattering screen at a distance of only 20 pc. The implied source size of tens of micro-arcsecs has implications for the source lifetime and emission mechanisms. Kedziora-Chudczer et al. discussed a southern survey for IDVs, and the implications for interstellar scintillations. There are problems in explaining the changes in polarized intensity, and the implied brightness temperatures which exceed the usual synchrotron limit by up to two orders of magnitude.

The interpretation of polarization variations was discussed by Rickett,who finds evidence for anisotropic scattering. Changes in the polarized component of one source are found to be more rapid than the change intotal intensity. A possible model has two regions of orthogonal polarization separated by only 5 micro-arcsecs. A related topic was the strongly variable circular polarization found in PKS 1519-273 (Macquart et al.), which is correlated with total intensity variations at high frequencies. It is argued that the variations are due to scintillation of a compact, polarized component, although no simple model can account for all the observed effects. Many of these topics figured in a lively discussion on the afternoon of the penultimate day, including the significance of deviations from a Kolmogorov spectrum, the interpretation of the Crabpulsar echos, and the kind of instrumentation required for further progressin this field. New highly sensitive radio telescopes are a clear necessity (although the Crab echos, discovered with a 13 m telescope which doessystematic monitoring, and other timing projects with relatively modest instruments, show the continued value of small elements). It was, for example, noted that because of scattering near the galactic center, a telescope of large collecting area operating at 20 GHz would be needed to discover pulsars on the other side of the Galaxy.Finally, there were a number of presentations on future high-sensitivity telescope projects, such as the Square Kilometer Array (SKA). Australian investigations of the Luneburg lens (a dielectric concentrator) were discussed by Brouw, while Parijskij looked still further to the future, beyond the SKA. He noted that there will soon be more collecting area in private hands, with the rapid growth of communication receivers of all kinds (including mobile phones), and envisaged the creation of a whole-earth radio telescope by linking all of this potential together (on a time-sharing basis). In the final session, Chinese radio astronomers and engineers sketched the progress of a project to build a 500 m spherical telescope (FAST). Different groups are researching the various components: surface panels, active supporting systems, feed stabilization and drive, site selection. The instrument would be built in a karst depression, like the Arecibo telescope, and the conference appears to have enhanced the chances that the project will go ahead.

The conference finished with a fine summary (Ekers), which noted that the discovery of interplanetary scintillation (IPS) arose accidentally from a low frequency survey at Cambridge, just as the later chance discovery of pulsars resulted from an IPS survey. It is interesting to see how pulsars, IDVs, and other compact sources, when observed with a variety of techniques over a wide frequency range, provide complementary information on the irregular component of the interstellar medium. Radio astronmers also have something to learn from the speckle techniques used in the optical and infrared bands. Many questions still need to be answered, including the distance to the scattering screen, the circularly-polarized component in some compact sources, and the sources with extremely high brightness temperatures.

ISEA 2000

Antalya, Turkey, 17-24 May 2000

The tenth International Symposium on Equatorial Aeronomy (ISEA) was held in Antalya, Turkey, May 17-24, 2000. Over 110 scientists from five continents attended.Thanks to financial assistance from a number of organizations, including URSI, young scientists and scientists from developing countries made up a significant fraction of the attendees.

Talks were presented in all fields of equatorial aeronomy.The meeting included summaries of significant results in equatorial aeronomy during the past five years, including:

- Modeling capabilities have significantly increased since the last ISEA: the models are better, cheaper, and faster.
- Collaboration of optical and radar measurements was particularly impressive, especially measurements of structureassociated with the equatorial anomaly
- New radar techniques enabled imaging of E-region electrojet irregularities
- Mid-latitude E-region plasma instabilities present some interesting theoretical problems which may be resolvable with non-local theories.
- New measurements show that strong shears exist in the neutral E-region winds

Some outstanding questions were highlighted in the meeting, including:

- Discrepancies between temperatures measured by FPI technique and those inferred from ISR measurements or model results.
- The unknown cause of 150 km echoes
- The occasional occurrence of E-region equatorial irregularities being "sucked up" into the F-region
- The nature of QP echoes: is this one phenomenon or several?
- The need for a 3D plasma simulation/theory to understand aspect sensitivity
- Is equatorial spread F predictable based on equatorial aeronomy, with a few hours warning, at all longitudes, or is the problem of day-to-day variation of spread F outside the domain of equatorial aeronomy?
- What is the nature of extremely short scale structures in ESF; can these be confirmed.
- Need to model storm effects at all longitudes
- Technical controversy concerning the effect of electron collisions on the ISR spectrum

Finally, The meeting highlighted new techniques and planned experiments, including:

- Ongoing widespread use of GPS to investigate equatorial aeronomy, including especially expansions of networks of GPS receivers.
- Clusters of nanosatellites (<10 kg) as a possible future tool.
- Successful efforts to observe airglow under daylit conditions promises to open a whole new field of observations.
- More and wider networks of more sensitive all-sky cameras coming on line for studying, for example, finger structures in the equatorial anomaly.
- Approaching real-time interaction between modelers and experimenters Plans for a triplet of small university satellites in low-inclination orbit

The meeting covered these topics and many more. Products of the meeting will include resolutions on equatorial aeronomy to be authored by the program committee, and a proceedings to be published in the Journal of Atmospheric and Solar-Terrestrial Physics (JASTP). The JASTP special issue should appear within one year.

The program committee met several times during the conference to discuss resolutions and to nominate sites for the next ISEA. Sites under consideration include India, Peru, Brazil, Taiwan, and Puerto Rico. A decision is expected within a few months.

ISEA X was concluded on Tuesday, May 23, with an energetic "town meeting" at which most attendees participated. ISEA provides a unique forum where scientists from developed and developing countries interact.

J. LaBelle with D.T. Farley

EMC Wroclaw 2000

Wroclaw, Turkey, 27-30 June 2000

General

The International Wroclaw Symposium and Exhibition on Electromagnetic Compatibility (EMC) was held in Wroclaw, Poland, on June 27-30, 2000. It was convened at the Wroclaw University of Technology, on the bank of the Odra River, at the same place where all the previous fourteen gatherings of that series were held. An open meeting of URSI Commission E preceded the symposium. As earlier events, it was co-organized by the National Institute of Telecommunications, the Wroclaw University of Technology, and the Association of PolishElectrical Engineers. URSI was one of major cosponsoring and cooperating organisation. The symposium was co-chaired by Prof. D.J. Bem and Mr. J. Rutkowski. As previously, Mr. Wladyslaw Moron' chaired the Organizing Committee, and Prof. W. Majewski (Poland) - the Symposium Council, with Prof. A. Pilatowicz (Poland), and Dr M. Rusin (Poland) as two v-chairmen.

Two Jubilees

This year, the Wroclaw EMC Symposium was celebrating its fifteenth jubilee, and at such occasions one usually refers to the celebrator's birth. Being one of co-founders of the symposium, I have still in memory our discussions on how to improve peaceful relations between people across political, racial, and religious borders. At that time, thirty years ago, traces of the World War II were still visible, and Europe was divided by the cold-war iron curtain against the wishes and interests of normal citizens. We were just entering the fascinating field of electromagnetic interactions and electromagnetic compatibility, but our possibilities of travelling abroad were limited. We thus decided to organize a symposium in Wroclaw and to invite all those interested. Although the concept of electromagnetic compatibility was already established in the United States and EMC conferences were regularly being held there, there was no such event organized on a regular basis in Europe. At the beginning, the participants came from a few neighbouring countries only, but that pattern has changed with time. Now, contributions to this oldest EMC biannual event in Europe come from dozens of countries, even from such distant regions as Mexico, Japan and Australia. The symposium has gained its reputation, manifested not only by the quality of participants and contributions, but also by the sponsorship offered by the Minister of Posts and Telecommunications of the Republic of Poland, the Polish Academy of Science Committee of Electronics and Telecommunications, and by URSI. The symposium enjoys cooperation of renowned experts and major organisations. In total, some ten international organizations and twenty-five professional associations, trans-national such as IEEE and EUREL, and national from various countries. The 10'000 pages of the Symposium Proceedings published document various EMC research studies during almost thirty years. Certainly, it contributed to the creation of an international fraternity interested in the development of art and science of EMC.

Just about the time of the symposium, there was another jubilee celebrated formally: the millenium of the Wroclaw city. That coincidence justifies few words about the town. Wroclaw, known also under its German name Breslau, is one of the largest cities of Poland, an important commercial, transportation, industrial, scientific, cultural, historical, and tourist centre. Located in a rich agricultural and mining region where the Poles, Czechs and Germans have been meeting together, it figured in recorded history as early as 1000. Its Old Inner Town witnesses its development, disrupted only by the Black Death, floods of the Odra River, and wars. During the 13th century, Germans settled in the area and Wroclaw joined the Hanseatic League federation in 1294. In 1526 it became a Habsburg possession, with Austrians, Croats, Czechs, Hungarians, Macedonians Serbs, Slovenes, and others. After the War of the Austrian Succession (1741), it was seized by Prussia.

During the World War II (1939-1945) it was completely ruined and captured by Soviet troops. After the unconditional surrender of Germany, the heads of government of the USA, the USSR and Great Britain, decided at the Potsdam Conference (1945) to assign the city and the whole region to Poland, to create space for millions of Poles forced to move from Eastern part of Poland given to Belarus, Lithuania, and Ukraine, then-republics of the Soviet Union. It was probably the greatest migration of population known in the history. The Germans living there were forced to move westward.After 1945, the Poles recreated the city from ruins, with special care to reconstruct the medieval appearance of the Old Inner City, following the original pictures made hundreds years ago. In 1997, "Flood of the Millenium" injured the city, but all damages were repaired well before the time of the symposium, and no traces of the disaster were visible. Now, the city is looking forward to joining the European Union.

Participation and Young Scientists Programme

More than three hundred participants from thirty-one countries attended in the symposium. About 6% of them received financial support facilitating participation. It was possible thanks to contributions kindly offered by the URSI, by the European Office of the United States Air Force Research Laboratory (London, UK), by the MTU-INFORM Co (Moscow, Russia), by the Satcom Commercial Office (Warsaw, Poland), by the Kogeneracja Co (Wroclaw, Poland), and by the ELTEST Co (Warsaw, Poland). Fifteen young scientists received financial aid, following the general URSI rules: from Belarus (2), Russia (7), Turkey (1) Ukraine (4), and the United Kingdom (1). Moreover, two key speakers were helped.

Programme

The symposium co-chairman, Prof. D.J. Bem, inaugurated the opening of the symposium. Then, the Rector of the University of Technology welcomed the attendees, and PTT Deputy-Minister, Dr. M. Rusin, addressed the symposium on behalf of the Symposium Patron.

The symposium programme covered a blend of theoretical and practical issues of the EMC discipline. Virtually all "hot" topics were covered, and the current status and trends were reviewed. As the symposium has been included in the activities of URSI Commission E (Electromagnetic Noise and Interference), its programme included several items from the Commission's terms of reference. The programme embraces also some issues relevant to Commissions A (Electromagnetic Metrology, Measurements and Standards), B (Fields and Waves), C (Signals and Systems), F (Wave Propagation and Remote Sensing), G (Ionospheric Radio and Propagation), H (Waves in Plasma), J (Radio Astronomy), and K (Electromagnetics in Biology and Medicine):

* Measurements and standards (Commission A)
* Propagation, radiation, and antennas (Commissions B, F, G)
* Spectrum utilisation and congestion (Commissions C, E)
* Terrestrial and planetary noise of natural origin (Commissions E, H)
* Man-made noise and the composite noise environment (Commission E)
* The effects of noise on system /equipment performance (Commission E)
* The scientific basis of noise and interference control (Commission E)
* Protection of radio-astronomical observations (Commission J)
* Biological effects of EM fields (Commission K).

Professors J. Bach-Andersen (Denmark), T. Boe (Norway), J.A. Catrysse (Belgium), P. Degauque (France), G. Goldberg (Switzerland), E. Habiger (Germany), M. Hayakawa (Japan), G. Hurt (USA), M. Janoz (Switzerland), A. Karwowski (Poland), W. Luther (USA), A. Marvin (UK), H. Mikolajczyk ISEA 2000 Antalya, Turkey, 17-24 May 2000 (Poland), E. Nano (Italy), A.P. Pavliouk (Russia), A. Schiavoni (Italy), J. Shapira (Israel), G. Varju (Hungary), M.C. Vrolijk (The Netherlands), T. Yoshino (Japan) kindly accepted to serve in the Scientific Program Committee, and to review the contributions proposed. Prof. F.L. Stumpers, the URSI Honorary President, was the Honorary Chairman of the program committee, and I served as its Chairman (independently of my function of the URSI representative).

Plenary sessions

Five invited plenary lectures created the backbone of the Symposium. Dr W.A. Radasky, (IEC-ACEC Chairman) discussed the electromagnetic compatibility strategy for the future. Dr. P. Laven, (European Broadcasting Union, Technical Director) addressed the future development of broadcasting technologies and services. Capt. R. Azzarone, (NATO General Directorate TELEDIFE) discussed the harmonisation of civilian and military EMC standardization activities. Mr. G. Goldberg (IEC-ACEC immediate past chairman) raised the key issues in EM phenomena and standardization activities: safety and human exposure. In my own lecture, I addressed some spectrum congestion issues, a topic exposed at the URSI Plenary Assembly, Toronto 1999.

Sectional sessions

Thirty-four regular and nine poster sessions covered different fields of EMC. From those, nineteen regular sessions were invited. URSI Commission E sponsored five sessions. Prof. M. Hayakawa (Japan, Immediate past chairman of URSI Com. E) organized and chaired two sessions on terrestrial electromagnetic noise environment, Prof. H. Kikuchi (Japan, past chairman of URSI Com. E) organized a session on gravito-electrodynamics, EHD, self-organization, and pre-earthquake effects in the atmosphere, ionosphere and magnetosphere (chaired by Prof.S.A. Pulinets of the Russian Federation). Prof. T. Yoshino (Japan) organized and chaired a session on energy transmission from the earthquake focus and EM emission wave generated on the ground surface and in the ionosphere. Dr R.L. Gardner (USA / URSI Commission E Chairman) chaired a regular session on EM Hazards and Terrorism - a topic exposed at the URSI Plenary Assembly, Toronto 1999. Dr T.A. Spoelstra (Netherlands) organized and chaired session on scientific use of radio and regulations. European Science Foundation - Committee on Radio Astronomy Frequencies sponsored his session. Mr. G. Goldberg (Switzerland, Immediate past chairman of IEC - ACEC) organized and chaired two sessions on the limitation of human exposure to EM fields.

Dr L. Halme, (Finland) organized and chaired session on EMC performance of symmetrical and coaxial cabling. Mr. R.J. Mayher (USA, Chairman of ITU-R SG 1) organized and chaired session radio spectrum issues in 2000. Capt. R. Azzarone (Italy/ NATO), Dr M. Kukulka (Poland/ NATO), and Cmdr R. Archer (Belgium/ NATO) organized four sessions on NATO approach to harmonization of civil and military EMC standards. The NATO Special WG 10 "EM Environment Effects" sponsored these sessions. They addressed comparisons of military and civil standards, standard procedures for simulation, prediction and modelling of EMC problems, applications of existing EMC testing and measurement standards, and various aspects of EMC standards implementation. The sessions were chaired by Mr. A. Lavell-Smith (UK Defence Evaluation & Research Agency), Mr. F.M. Stewart (USA Space & Naval Warfare System Command) and by the session organizers, respectively. Dr R. Vick (Germany) organized and chaired session on EMC problems in power line communication. Prof. M. Ianoz (Switzerland) organized and chaired session on lightning effects and coupling models. Dr R. Meidan (Israel) organized and chaired two sessions on EMC matters in satellite-based communication systems. Prof. A. Karwowski (Poland) organized and chaired session on computational EM techniques in mobile wireless communications. Prof. K. Gonschorek (Germany) organized session on EMC modelling and analysis, chaired by Dr H. Harms (Germany). Dr T. Cesky (Luxemburg) organized and chaired Session on computer support of international frequency management activities. Prof. H Trzaska (Poland) organized session on EMC in Amateur Radio Service, chaired by C.M. Verholt (Denmark). International Amateur Radio Union Region 1 sponsored that session.

The remaining sessions dealt with various topics of current interest. Mr. W.A. Luther (USA) chaired a session on radio frequency spectrum management and monitoring. Dr R. Vick (Germany) chaired a session on EMC in communication and power systems. There was a regular session chaired by A. Medeisis (Lithuania) on antennas and propagation, complemented by a poster session on the same topics. Two regular sessions, chaired by Dr E. Griese (Germany), and by Prof. T.R. Gazizov (Russian Federation), respectively, dealt with the EMC problems on the component and PCB level. Dr E.B. Joffe (Israel), and Prof. D.J. Bem (Poland) chaired each a regular session on EMC modelling; moreover there was a poster session on that topic. Dr A.S. Podgorski (Canada) chaired a session on EMC measurement techniques. Dr N.V. Ryazantseva (Belarus) chaired a session on EMC Regulations. Prof. B. Jecko (France) chaired a session on EMI reduction techniques; there was also a poster session on that topic. Dr D. Hansen (Switzerland) chaired a session on EM interference measurements. Prof. R.E. Zich (Italy) chaired a session on lightning and electrostatic discharge (ESD). Poster sessions were organized on EMC measurements, EMC in Communication, Power and Transport Systems, Technical aspects of biological effects of FM radiation, EMI sources and coupling path to victims, Immunity, and on Spectrum engineering.

Workshops and Company Presentations

Two workshops took place during the Symposium. One was organized by the European Telecommunications Standards Institute (ETSI) and convened by Mr. O.J. Wheaton (Radiocommunications Agency, UK). It was devoted to presentation of the ETSI activities in EMC and Radio Spectrum Matters. The second one was organized by the European Radiocommunication Office (ERO) and was devoted to the presentation of the Spectrum Engineering Advanced Monte Carlo Tool (Seamcat). It was convened by Mr. A Benamar (Motorola, France) and S. Bond (Radiocommunications Agency, UK).

Two Companies made special presentations that complement the symposium programme. The TCI Technology for Communications International (USA) presented its integrated spectrum management and monitoring system using wide-band measurement servers. The Schroff GmbH (Germany) presented its achievements in the EMC design of enclosures with emphasis on cable entry.

Exhibitions

There were two exhibitions held during the Symposium. One was the literature exhibition. Exhibited were the publications of a number of international organizations such as URSI, International Telecommunication Union - ITU, European Telecommunication Standards Institute - ETSI, European Broadcasting Union - EBU, International Electrotechnical Committee: Special Committee on Radio Interference - CISPR, and Technical Committee 77 "Electromagnetic Compatibility". Besides some books on EMC, spectrum management and electromagnetics, annual editions such as ITEM, and some specialized periodicals e.g. Microwave News, were shown. The exhibition was well received and well attended. Another one was the technical exhibition, with the participation of eight companies involved in electromagnetic compatibility area. It was well attended, too.

Practical Arrangements

The two-volume Proceedings were available to all the participants before the opening the Symposium. They include the full texts of the 208 papers selected for presentation and submitted by 339 authors and co-authors from 34 countries. The Proceedings contain also all written contributions submitted for the open meeting of the URSI Commission E, as well as workshops' material. The proceedings contain 924 pages and weight about 2 kg.

Spare copies of the Symposium Proceedings are available from: EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland, fax: +4871 3728878, e-mail: emc@il.wroc.pl

Some dozen desktop computers with an unlimited access to Internet were made available, free of charge, to all registered participants. It was well received by the participants. Amateur radio station was available, and ham's meeting was organized for those interested. Special buses were offered to transport the participants from hotels to the meeting place, cocktail and picnic, and back. Post office, payphones, coffee shops and canteen were at the disposal of the participants at the place.

Social activities

The four days of the symposium were filled tightly. On the evening of the first day, all participants were invited to a cocktail party held in historical rooms of the City Hall, now converted into museum. Its 13th-century gothic architecture with its medieval sculptures, the excellent performance of the local Opera Quintet, and fine food and drinks created a friendly atmosphere. That mood was reinforced during the picnic party organized on the third day of the symposium in the neighbouring horse-stables, with equally fine food and drinks and entertainment programme. The last evening, the session Chairmen, the members of the Symposium Council, Scientific Program Committee and Organizing Committee were invited to the reception offered by the Symposium Patron in a beautiful countryside palace. There, His Excellency Deputy Minister Dr. Marek Rusin welcomed the invitees. An accompanying persons programme and a selection of post-symposium tours were offered, including visits to Old City of Cracov, the Old Salt Mines Museum, and Museum of Auschwitz, all classified as first-class monuments in the UNESCO's registry of World Heritage Sites.

General Comments

A joint meeting of the Symposium Council, Scientific Program Committee, Organizing Committee, and the Session Chairmen took place in the last day of the symposium. It was co-chaired by Dr M. Rusin, v-chairman of the symposium council, and by myself as the chairman of the program committee. The participants found the symposium beneficial. With a large proportion of invited papers, and sharp screening spontaneous submissions, the quality of the contributions presented was found generally high.

Among comments of general nature, one (by Dr Spoelstra) addressed explicitly scientists. They should play more active role in spectrum management, in standard development, and in related technical studies. They should identify "gaps" in regulations (including their "definition" and "criteria" parts) that could lead to incompatibilities among systems. Administrations should enforce mitigation and protection measures vis-à-vis manufacturers and operators, and scientists should watch and intervene if needed. It implies a smooth cooperation of all partners, exchange of information, and monitoring.

The increasing number of commercially oriented symposia was noted. In that context, the value of, and the need for, not-for-profit, scientifically oriented gatherings far away from commercial pressures, such as the Wroclaw EMC symposium with its unique atmosphere, was stressed. Areas inadequately covered by other events were noted, such as man-made EM environment, EM phenomena associated with processes in the earth thrust, atmosphere and ionosphere, the radio frequency usage, engineering, monitoring, management, and regulation, and international aspects of convergence of civilian and military standards.

It was suggested to treat the URSI open meetings as regular sessions. Until now, they were held before the symposium, resulting in low attendance. The national URSI committee members, professors, and students of the university should explicitly be invited. The broad range of various topics included in the programme was praised, and continuation of efforts towards a balanced representation industry vs. academia was encouraged. Another question raised was the need for better coordination of various new symposia on EMC matters in Europe, and the URSI might be helpful here. Still another proposal concerned the electronic version of the proceedings that would be available via Internet or on a compact disk. A number of specific proposals were submitted for consideration by the organizers.

Final Remarks

The Wroclaw EMC symposium, conceived as a not-for-profit project, would not be possible without the support of numerous individuals and organizations. Three names deserve special mention here. The late Professor Wilhelm Rotkiewicz, who created the Wroclaw Branch of the National Institute of Telecommunications that become later the leading national research and development centre in the field of EMC, and spectrum management, engineering and monitoring, and the organisational base for the symposium. The late Professor Jan Holownia, who was the main initiator and the first chairman of the symposium. Professor Frans Louis Stumpers, then the URSI President, whose personal involvement played crucial role in the inclusion of the symposium in the mainstream of international cooperation in the EMC field. The symposium continues thanks to the involvement of program committee members, session organizers/ chairmen, and contributors.Some of them continue devoting their time and talents for a number of years. To honour those, special Letters of Appreciation were handed at the end of the opening ceremony. The recipients were (in alphabetical order): Prof. P. Degauque (France), Prof. M. Hayakawa (Japan), Prof. M. Ianoz (Switzerland), Prof. A. Karwowski (Poland), Prof. H. Kikuchi (Japan), Prof. H. Mikolajczyk (Poland), Prof. E. Nano (Italy), Dr A. Pavliouk (Russia), and Prof. R. Showers (USA). Dr T. Spoelstra (The Netherlands), Prof. T. Yoshino (Japan). Few years earlier, in 1994, Prof. F.L. Stumpers received his PhD Honoris Causa diploma of the Wroclaw University of Technology for similar reasons.

More information about the symposium can be found at: www.emc.wroc.pl.
Enquiries can be addressed to: emc@il.wroc.pl.

Prof. R. Struzak

February 2001

EMC Zurich
Zurich, Switzerland, 20-22 February 2001
Contact : Dr. G. Meyer, ETHZ-IKT, ETH-Zentrum, CH-8092 Zurich, Switzerland, Tel. : 41 1-2562 793, Fax : 41 1-2620 943, http://www.nari.ee.ethz.ch/emc/emc.html

April 2001

ICAP 2001 - Eleventh International Conference on Antennas and Propagation
Manchester, United Kingdom, 18-20 April 2001
Contact: ICAP2001 Secretariat, IEE Conference Sercives, Savoy Place, London WC2R 0BL, United Kingdom, Tel:+44 (0) 20 7344 8425, Fax: +44 (0) 207240 8830, e-mail: icap@iee.org.uk, http://www.iee.org.uk/Conf/ICAP/

May 2001

2001 URSI International Symposium on Electromagnetic Theory
Victoria, BC, Canada, 13-17 May 2001
Contact : Prof. S. Ström, Dept. of Electromagnetic Theory, Royal Institute of Technology, SE-100 44 Stockholm, Sweden, Tel.: +46-8-790 8195, Fax: +46-8-10 83 27, e-mail: staffan@tet.kth.se, http://www.nrc.ca/confserv/URSI-B2001

CLIMPARA'2001
Budapest, Hungary, 28-30 May 2001
Contact : Dr. J.P.V. Poiares Baptista, ESA/ESTEC, Keplerlaan 1, NL-2215 Noordwijk, The Netherlands, Tel. +31 71-565-4319, Fax +31 71-565-5675, E-mail : climpara@climpara.org

June 2001

MSMW'01 - Physics and Engineering of mm and submm Electromagnetic Waves
Kharkov, Ukraine, 4-9 June 2000
Contact: Dr. A.A. Kostenko, Institute of Radiophysics and Electronics, Ukranian Academy of Sciences, 12, ac. Proskura Street, 310085, Kharkov, Ukraine, e-mail: ukr-ursi@guukr.freenet.kiev.ua

ISSS-6 - Sixth International School for Space Simulations
Katlenburg-Lindau, Germany, June 2001
Contact: Dr. Jörg Büchner, MPI für Aeronomie, Max-Planck-Strasse 2, 37191 Katlenburg-Lindau, Germany, Fax: +49 5556-979 295, e-mail: buechner@linmpi.mpg.de

July 2001

ISSSE'01 - "Questing More Significant Harmony and Integration : Systems/Devices and Softwares/ Hardwares"
Tokyo, Japan, 24-27 July 2001
Contact : ISSSE'01 secretariat, Dept.of Elec. Eng., Science University of Tokyo, 1-3 kagurazaka, shinjuku Tokyo 162-8601 Japan, E-mail: issse01@ee.kagu.sut.ac.jp, http://issse01.ee.kagu.sut.ac.jp

August 2001

AP-RASC'01 - Asia-Pacific Radio Science Conference
Tokyo, Japan, 1-4 August 2001
Contact : AP-RASC'01 Secretariat, c/o REALIZE Inc., 4-1-4 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan, Tel.: +81-3815-8552, Fax: +81-3815-8529, E-mail: aprasc@oak.ocn.ne.jp, http://www.kurasc.kyoto-u.ac.jp/ap-rasc/

September 2001

ICEAA'01 - Int. Conference on Electromagnetic in Advanced Applications
Torino, Italy, 10-14 September 2001
Contact : COREP - ICEAA'01, Politecnico di Torino, Corso Duca degli Abruzzi 24, I-10129 Torino, Italy, http://www.polito.it/~iceaa/

URSI cannot be held responsible for any errors contained in this list of meetings.
The Guidelines and Rules for URSI Sponsorship of Meetings can be found at ***http://www.intec.rug.ac.be/ursi/Rules.html***

News from the URSI Community

STUDENT COMPETITION AT THE TORONTO GENERAL ASSEMBLY

The tradition of running a student competition during the URSI General Assemblies was inaugurated in Lille France during the XXV General Assembly (GA) back in 1996. Encouraged by the success of the competition in Lille, a mandate was given to the XXVI General Assembly Organizing Committee to continue the tradition by hosting a similar event in Toronto.

Early in the process it was decided to limit the competition to undergraduate students across Canada. This decision was taken based mainly on the fact that the Canadian undergraduate population, which is distributed across a geographically vast area, provides a sufficient number of students and enough diversity to ensure a successful competition. In addition the organization of the event could profit from the convenience of an already existing Canadian network of URSI members in Universities across the country. On the other hand, enlarging the geographical scope outside Canada was thought to be too ambitious for the available organizational resources.

In early 1998, an Advisory Board was assembled consisting of Prof. Jens Bornemann from the University of Victoria, Professors Fadhel Ghannouchi and Jean-Jacques Laurin from the Ecole Polytechnique in Montreal and Professor Peter Smith from McMaster University in Hamilton. The Advisory Board helped to prepare a preliminary announcement which was put on the official URSI GA '99 website. The announcement outlined the nature of the competition and indicated the subjects covered by URSI as well as a preliminary schedule of events for the forthcoming competition. In the announcement it was stipulated that the competition was open to individual undergraduate students or to groups not exceeding four members. Students could register on-line on the same website which was skillfully maintained by the Canadian National Research Council (Ms. Nicole Sarault was the person in charge). Although the competition was open to undergraduate students in all years, it was mainly targeting final year students (fourth year) to participate by submitting their Bachelor's thesis projects. It should be mentioned that the practice of completing a Bachelor's thesis during the final year of undergraduate studies is now common in Universities across Canada. This homogeneity of the undergraduate programs across the country was another motivator for restricting the event only to Canada. The implied convenience is apparent as these fourth year students did not have to work on entirely new projects to participate in the URSI Student Competition. In addition, final year students are mature enough to present substantial projects thus making the competition an interesting event to the general audience. Furthermore, final year students are at the cross-roads of choosing a career path and therefore the event had the potential of steering them toward the wonderful world of Radio Science. The only drawback of targeting final year students was the fact that by the time the General Assembly was held (August 1999), the students would have had graduated. Indeed it is believed that some students were reluctant to register to the competition for this reason. The preliminary announcement was also circulated through E-mail to the Canadian network of URSI members with a request to encourage their local undergraduate student population to participate. In the summer 1998 a bilingual (English and French) pamphlet was also prepared and was distributed throughout the country using the same network of URSI members. In the meanwhile, financial support for the competition was secured through URSI and the IEEE Canadian Foundation, an IEEE affiliated non-profit organization chaired by Mr. Miro Forest. The author would like to take this opportunity to gratefully acknowledge both organizations for their support.

In the final phase of the competition the student entries were received on video tapes, a practice that was previously followed with success in Lille. Subsequently, a panel of four judges was assembled consisting of Prof. Jens Bornemann, Prof. Langis Roy from the University of Ottawa and Dr. Peter Edmonson from Research In Motion of Waterloo, a local successful company in wireless technology. Four finalist projects were selected for a live presentation during the XXVI GA which was hosted at the Campus of the University of Toronto. The four finalist groups were invited to Toronto and their travel and lodging expenses were covered from the budget of the competition. The presentations took place in front of the judging panel in a state of the art Auditorium on Campus. The event was kept open to any registered GA attendee and took place during a noon-slot on August the 17th, 1999. Immediately

From left to right, Kenneth Ip of the University of Toronto (first prize), Allan J. Taylor of the Royal Military College, Kingston (second prize), Prof. George Eleftheriades, Prof. Tom Senior, Farhad Meshkati (3rd prize), Long T.P. Truong (second prize with Allan Taylor) and Trevor Williams of the University of Victoria (4th prize).

following the oral presentations, the judging panel convened and decided the winning order. The official announcement of the winning order took place during the GA official Banquet two days later where all of the finalist students (a total of six) were invited to attend. The four prizes awarded consisted of cash amounting to $1,000, $600, $400 and $200 respectively along with a commensurate certificate.

The student competition is an excellent vehicle for promoting the spirit of Radio Science to young engineers and scientists at an early stage in their careers. The participating students seemed to have enjoyed their experience very much indeed and to the best of the author's knowledge most of them are happily pursuing graduate studies or a career in a Radio Science related discipline. The overall experience was positive for everybody involved and clearly all the indications suggest that this is a worthwhile event that should be continued in subsequent General Assemblies.

I would like to thank everybody involved in the organization of the event and in particular the people whose names appear in this article as well as Prof. Keith Balmain, the Chair of the Local Organizing Committee for his support and advice during the preparation phase of the competition.

George V. Eleftheriades
Director of the Student Competition,
XXVI URSI GA, Toronto 1999

2001 RAJ MITTRA TRAVEL GRANTS

The Raj Mittra Travel Grant (RMTG) was established by former students and research associates of Raj Mittra to support travel by qualified graduate students and research scientists to the annual IEEE AP-S/URSI Symposium. The award's purpose is to encourage participation in the Symposium by junior and senior researchers. Interested applicants are encouraged to apply after carefully reading the following information to insure their eligibility and ability to comply with the application requirements and deadlines.

ELIGIBILITY: Candidates need not be members of either IEEE or URSI, but must have contributions accepted for presentation at the 2001 IEEE Antennas and Propagation Society International Symposium and USNC/URSI National Radio Science Meeting in Boston, Massachusetts, USA (http://ewh.ieee.org/soc/aps/2001/). Awardees must personally present their contributions at a regular AP-S or URSI Commission B session organized at the Symposium.

AWARDS: Two grants in the amount of $750 each are available to young scientists pursuing research in areas of traditional interest to AP-S and Commission B of URSI. A third grant for $1,000 may be awarded to a senior researcher associated with a research or educational institution and who has an active research program in areas of interest to AP-S or URSI Commission B. Award presentations cannot be made before the Symposium, and therefore awardees must make their own arrangements to cover expenses of travel to the meeting to receive the award.

APPLICATION & SCHEDULE: The schedule for evaluating candidates and notifying Awardees parallels the review process for Symposium submissions and is very short. For this reason, ALL APPLICATIONS MUST BE SUBMITTED VIA E-mail. To receive an E-mail application kit with instructions for filing, please submit a request for an RMTG Award Application Kit to the awards Chair at "wilton@uh.edu." The Application Kit will provide instructions for email submission of several items required of the candidate, including short biographical and research publication summaries, and a copy of all summaries or abstracts submitted to the meeting. Applicants must also solicit letters of reference, a statement of need for travel support, and letter of endorsement from the candidate's institution. The latter statement should also include an indication of the institution's commitment to supplement travel expenses on an as-needed basis if the candidate is selected to receive a grant. Though E-mail submission of these externally solicited items is preferred, they may also be sent by standard postal service or by fax.

No applications will be processed until all application materials are received by the awards Chair. The due date for applications is JANUARY 13, 2001, the same as that for submission of abstracts and summaries to the Symposium. The selection of Awardees and alternates will be completed prior to the meeting of the Symposium Technical Program Committee (TPC), which usually follows within a month of the above date.

SELECTION: Selection of an Awardee will be based upon a candidate's potential or demonstrated aptitude for research. Following the usual submission guidelines, candidates and alternates must also have their abstracts or summaries accepted by the TPC. Successful RMTG candidates will be notified of their selection immediately following the TPC meeting.

NEWS FROM THE MEMBER COMMITTEES

BELGIUM

8th URSI Forum - 2000

The Eighth URSI Forum, edition 2000, will be held at the Planetarium, Avenue de Bouchoutlaan 10, 1020, Brussels on Thursday, 14 December 2000

Objective

The 8th URSI Forum is offering a meeting opportunity to all Belgian researchers preparing a PhD in the different scientific fields covered by URSI.

Proceedings

The proceedings of the URSI Forum will consist of a collection of the submitted abstracts and summaries and will be distributed at the Forum to all participants.

Final Program

Since this year, the Forum is open to an international audience, therefore it will have the status of an international conference.

The final programme, including titles of sessions and poster presentations, time schedule and directions to the Planetarium is available on the web at the site of the Belgian URSI Committee, at url : http://www.ursi.be/

Organization

Dr. P. Cugnon, ORB
Dr. J.C. Jodogne, IRM
Prof. J. Lemaire, IASB
Prof. S. Prohoroff, ULB
Prof. E. Van Lil, K.U.Leuven
Prof. C. Vloeberghs, KMS

Scientific Programme

Dr. P. Cugnon, ORB
Dr. J.C. Jodogne, IRM
Prof. J. Lemaire, IASB

Contact

3, Ave Circulaire, B-1180 Bruxelles
Tel: 02-373.04.07, Fax: 02-374.84.23,
e-mail: jl@oma.be
http://www.ursi.be/

International Geophysical Calendar 2001

U.R.S.I.

	S	M	T	W	T	F	S
JANUARY		1	2	3	4	5	6
	7	8	9 F	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23*	24* N	25	26	27
	28	29	30	31	1	2	3
FEBRUARY	4	5	6	7	8 F	9	10
	11	12	13+	14+	15+	16	17
	18	19	20	21*	22*	23* N	24
	25	26	27	28	1	2	3
MARCH	4	5	6	7	8	9 F	10
	11	12	13	14	15	16	17
	18	19	20	21*	22*	23	24
	25 N	26	27	28	29	30	31
APRIL	1	2	3	4	5	6	7
	8 F	9	10	11	12	13	14
	15	16	17+	18*+	19*+	20	21
	22	23 N	24	25	26	27	28
	29	30	1	2	3	4	5
MAY	6	7 F	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23* N	24*	25	26
	27	28	29	30	31	1	2
JUNE	3	4	5	6 F	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20*	21 N*	22	23
	24	25	26	27	28	29	30
	S	M	T	W	T	F	S

S	M	T	W	T	F	S	
1	2	3	4	5 F	6	7	JULY
8	9	10	11+	12+	13+	14+	
15+	16	17	18*	19*	20* N	21	
22	23	24	25	26	27	28	
29	30	31	1	2	3	4 F	AUGUST
5	6	7	8	9	10	11	
12	13	14	15*	16*	17	18	
19 N	20	21	22	23	24	25	
26	27	28	29	30	31	1	
2 F	3	4	5	6	7	8	SEPTEMBER
9	10+	11+	12+	13+	14+	15	
16	17 N	18*	19*	20	21	22	
23	24	25	26	27	28	29	
30	1	2 F	3	4	5	6	OCTOBER
7	8	9+	10+	11+	12	13	
14	15	16* N+	17*+	18+	19	20	
21	22	23	24	25	26	27	
28	29	30	31	1 F	2	3	NOVEMBER
4	5	6	7	8	9	10	
11	12	13+	14*+	15* N+	16	17	
18	19	20	21	22	23	24	
25	26	27	28	29	30 F	1	
2	3	4	5	6	7	8	DECEMBER
9	10+	11+	12*+	13*+	14* N+	15	
16	17	18	19	20	21	22	
23	24	25	26	27	28	29	
30 F	31	1	2	3	4	5	2002
6	7	8	9	10	11	12	JANUARY
13 N	14	15*	16*	17	18	19	
20	21	22	23	24	25	26	
27	28 F	29	30	31			
S	M	T	W	T	F	S	

(23) Regular World Day (RWD)

24 Priority Regular World Day (PRWD)

21 Quarterly World Day (QWD) also a PRWD and RWD

3 Regular Geophysical Day (RGD)

12 13 World Geophysical Interval (WGI)

13 + Incoherent Scatter Coordinated Observation Day

N NEW MOON F FULL MOON

14 Day of Solar Eclipse: Jun 21 and Dec 14

18 19 Airglow and Aurora Period

23* Dark Moon Geophysical Day (DMGD)

This Calendar continues the series begun for the IGY years 1957-58, and is issued annually to recommend dates for solar and geophysical observations, which cannot be carried out continuously. Thus, the amount of observational data in existence tends to be larger on Calendar days. The recommendations on data reduction and especially the flow of data to World Data Centers (WDCs) in many instances emphasize Calendar days. The Calendar is prepared by the International Space Environment Service (ISES) with the advice of spokesmen for the various scientific disciplines.

The **Solar Eclipses** are:

- **21 June 2001** (total) eclipse with totality visible in the South Atlantic Ocean off East coast of Uruguay, crosses Atlantic, crosses Angola (totality duration 4.5 min), Zambia (totality 3 min 14 s in Lusaka, only major city in the path), Zimbabwe, Mozambique (duration 3 min), southern Madagascar (duration 2 min 30 s), and the Indian Ocean. Partial phases visible throughout Brazil, sub-Saharan and East Africa.
- **14 December 2001** (annular) eclipse with annularity visible in southern Nicaragua and northern Costa Rica (duration 3 min 15 s), magnitude 0.968%, following maximum duration over the Pacific of 3 min 56 s. Partial phases visible in the Pacific ocean, NW South America, Central America, continental U.S.A., western and southern parts of Canada.

Description by Dr. Jay Pasachoff, Williams College, Chair of the IAU WG on Solar Eclipses, jmp@williams.edu with input from Fred Espenak, NASA GSFC.)

Web Sites: http:// umbra.gsfc.nasa.gov/eclipse/predictions/eclipse-paths.html and www.williams.edu/Astronomy/IAU_eclipses.

Meteor Showers (selected by R. Hawkes, Mount Allison Univ, Canada, rhawkes@mta.ca) include important visual showers and also unusual showers observable mainly by radio and radar techniques. The dates are given in Note 1 under the Calendar.

Definitions

Time = Universal Time (UT);

Regular Geophysical Days (RGD) = each Wednesday;

Regular World Days (RWD) = Tuesday, Wednesday and Thursday near the middle of the month (see calendar);

Priority Regular World Days (PRWD) = the Wednesday RWD; Quarterly World Days (QWD) = PRWD in the WGI;World Geophysical Intervals (WGI) = 14 consecutive days each season (See calendar);

ALERTS = occurrence of unusual solar or geophysical conditions, broadcast once daily soon after 0400 UT;

STRATWARM = stratospheric warmings

Retrospective World Intervals (RWI) = MONSEE study intervals.

For more detailed explanations of the definitions, please see one of the following or contact H. Coffey (address below): ISES Synoptic Codes for Solar and Geophysical Data; Solar-Geophysical Data, October issue; URSI Information Bulletin; COSPAR Information Bulletin; IAGA News; IUGG Chronicle; WMO Bulletin; IAU Information Bulletin; and the Journal of Atmospheric and Terrestrial Physics (UK). WWW homepage http://www.sec.noaa.gov/ises/ises.html.

Priority recommended programs for measurements not made continuously (in addition to unusual ALERT periods):

Aurora and Airglow. Observation periods are New Moon periods, especially the 7 day intervals on the calendar;

Atmospheric Electricity. Observation periods are the RGD each Wednesday, beginning on 3 January 2001 at 0000 UT, 10 January at 0600 UT, 17 January at 1200 UT, 24 January at 1800 UT, etc. Minimum program is PRWDs.

Geomagnetic Phenomena. At minimum, need observation periods and data reduction on RWDs and during MAGSTORM Alerts.

Ionospheric Phenomena. Quarter-hourly ionograms; more frequently on RWDs, particularly at high latitude sites; ionogram scaled parameters to WDCs; continuous observations for solar eclipse in the eclipse zone. See Airglow and Aurora.

Incoherent Scatter. Observations on Incoherent Scatter Coordinated Days; also intensive series on WGIs or Airglow and Aurora periods.

Special programs: Dr. A. P. van Eyken, EISCAT Scientific Assoc., Ramfjordmoen, N-9027 Ramfjordbotn, Norway. Tel. +47 77692166; Fax +47 77692380 , e-mail tony@eiscat.no, URSI Working Group G.5. See www.eiscat.uit.no/URSI-ISWG.

Ionospheric Drifts. During weeks with RWDs.

Traveling Ionosphere Disturbances. Special periods, probably PRWD or RWDs.

Ionospheric Absorption. Half-hourly on RWDs; continuous on solar eclipse days for stations in eclipse zone and conjugate area. Daily measurements during Absorption Winter Anomaly at temperate latitude stations (Oct-Mar Northern Hemisphere; Apr-Sep Southern Hemisphere).

Backscatter and Forward Scatter. RWDs at least.

Mesospheric D region electron densities. RGD around noon.

ELF Noise Measurements of earth-ionosphere cavity resonances. WGIs.

All Programs. Appropriate intensive observations during unusual meteor activity.

Meteorology. Especially on RGDs. On WGIs and STRATWARM Alert Intervals, please monitor on Mondays and Fridays as well as Wednesdays.

GAW (Global Atmosphere Watch).WMO program to integrate monitoring of atmospheric composition. Early warning system of changes in atmospheric concentrations of greenhouse gases, ozone, and pollutants (acid rain and dust particles). WMO, 7 via avenue de la Paix, P.O. Box 2300, 1211 Geneva, Switzerland.

Solar Phenomena. Solar eclipse days, RWDs, and during PROTON/FLARE ALERTS.

ISCS (International Solar Cycle Studies). 1998-2002 SCOSTEP project: observations and analyses of underlying and resulting processes associated with the rising and maximum phase of the solar cycle. Contacts:

S.T. Wu, Univ of Alabama, Huntsville Dept. Mech. Eng. & Ctr. for Space Plasma & Aeron. Res., Huntsville, AL 35899 USA, Tel(205)895-6413, Fax(205)895-6328, wu@cspar.uah.edu and V. Obridko, IZMIRAN, Solar Physics Dept, 142092 Troitsk, Moscow, Russia. 095-334-0926; Fax 095-344-0124, obridko@lars.izmiran.troitsk.su.

S-RAMP (STEP [Solar Terrestrial Energy Program] Results, Applications, and Modeling Phase). Global coordinated ground-based and space-borne observations of space weather phenomena covering the entire space weather chain from the surface of the Sun to the effects on the near-Earth space and ground-based technological systems. Contacts: Dr. David Boteler (boteler@geolab.nrcan.gc.ca) and Dr. Phil Wilkinson (phil@ips.gov.au).See www.ngdc.noaa.gov/stp/SRAMP/sramp.html.

Space Research, Interplanetary Phenomena, Cosmic Rays, Aeronomy. QWDs, RWD, and Airglow and Aurora periods.

The **International Space Environment Service (ISES)** is a permanent scientific service of the International Union of Radio Science (URSI), with the participation of the International Astronomical Union and the International Union Geodesy and Geophysics. ISES adheres to the Federation of Astronomical and Geophysical Data Analysis Services (FAGS) of the International Council for Science (ICSU). The ISES coordinates the international aspects of the world days program and rapid data interchange.

This Calendar for 2001 has been drawn up by H.E. Coffey, of the ISES Steering Committee, in association with spokesmen for the various scientific disciplines in SCOSTEP, IAGA and URSI. Similar Calendars have been issued annually beginning with the IGY, 1957-58, and have been published in various widely available scientific publications.

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Additional copies are available upon request to ISES Chairman, Dr. Katsuhide Marubashi, Space Science Division, Communications Research Laboratory, 4-2-1 Nukui-kita, Koganei-shi, Tokyo 184-8795, Japan, FAX number +81-42-327-6677; e-mail kmaru@crl.go.jp, or ISES Secretary for World Days, Miss H.E. Coffey, WDC-A for Solar-Terrestrial Physics, NOAA, E/GC2, 325 Broadway, Boulder, Colorado 80303, USA, FAX (303)497-6513, e-mail Helen.E.Coffey@noaa.gov.

The calendar is available on-line at: http://www.sec.noaa.gov/ises/ises.html.

NOTES on other dates and programs of interest:

1. Days with **significant meteor shower activity** are: Northern Hemisphere 3 Jan; 21-23 Apr; 4-6 May; 6-11, 27-29 Jun; 11-14 Aug; 21-23 Oct; 17-19 Nov; 13-15, 21-23 Dec 2000; 3 Jan 2002. Southern Hemisphere 4-6 May; 6-11, 27-29 Jun; 27 Jul-2 Aug; 21-23 Oct; 17-19 Nov; 13-15 Dec 2001. These can be studied for their own geophysical effects or may be "geophysical noise" to other experiments. The Leonid shower is projected to be strong in 2001, with peak activity on November 18, 2001.
2. **Global Atmosphere Watch (GAW)** -- early warning system for changes in greenhouse gases, ozone layer, and long range transport of pollutants. (See Explanations.)
3. **ISCS (International Solar Cycle Studies)** Observing Program 1998-2002: SCOSTEP Study of processes associated with the maximum phase of the solar cycle. (See Explanations.)
4. **S-RAMP -- SCOSTEP Project.** Solar Terrestrial Energy Program (S) - Results, Applications, and Modeling Phase (RAMP). (See Explanations.)
5. **+ Incoherent Scatter Coordinated Observations Days** (see Explanations) starting at 1300 UT on the first day of the intervals indicated, and ending at 1600 UT on the last day of the intervals: 13-15 Feb CLUSTER; 17-19 Apr WLS; 02-31 Jul TIMED/LTCS, CLUSTER month long alert (11-15 Jul default); 01-30 Sep alert TIMED/LTCS/Joule Heating, CLUSTER (10-14 Sep default); 02-18 Oct WLS alert (9-11 Oct default); 16-18 Oct POLITE; 13-15 Nov HiTRAC/SPARC; 10-14 Dec Joule Heating/CLUSTER, where

CLUSTER = Cluster satellite observations (H. Opgenoorth – opg@irfu.se);
HiTRAC = High Time Resolution Auroral Radar Convection (J. Holt –jmh@haystack.mit.edu);Joule Heating = Two campaigns, at equinox and solstice (G. Crowley – crowley@picard.space.swri.edu);
LTCS = Lower-Thermosphere Coupling Study (C. Fesen - fesen@tides.utdallas.edu).
POLITE = Plasmaspheric Observations of Light Ions in the Topside Exosphere (P. Erickson -- pje@hyperion.haystack.edu);
SPARC = Researchers in upper atmospheric and space physics (T. Killeen tkilleen@umich.edu)
TIMED = Thermosphere Ionosphere Mesosphere Energetics Dynamics satellite (J. Salah -- jes@haystack.mit.edu);
WLS = Wide-Latitude Substorm Dynamics (J. Foster – jcf@hyperion.haystack.edu)See http://www.eiscat.uit.no/URSI_ISWG for complete definitions.

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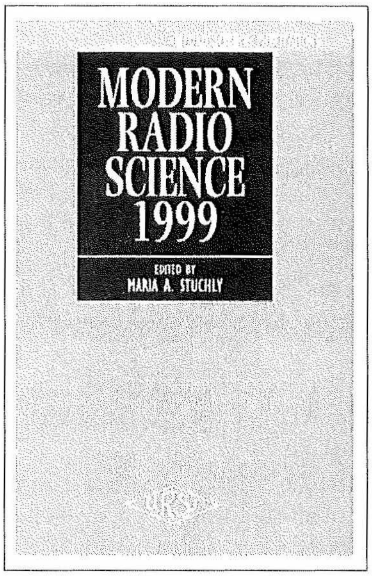

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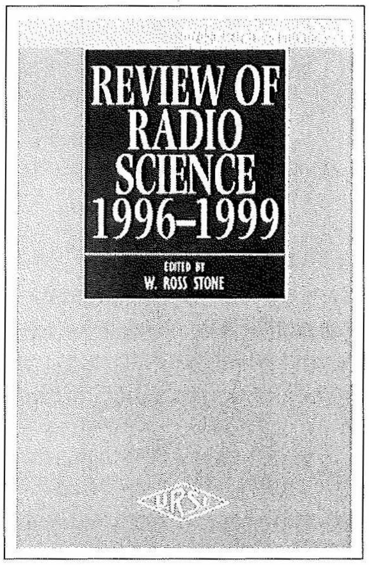

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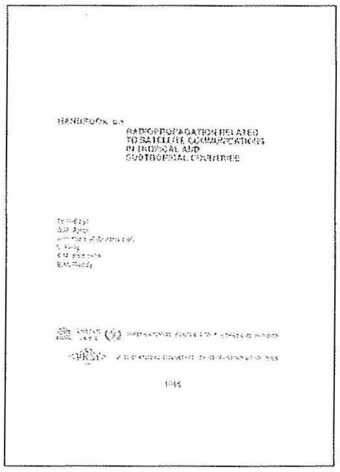

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