

International Foundation for Telemetry

**International Consortium
for
Telemetry Spectrum**

2002 ICTS Annual Report

Submitted by the ICTS Officers;

Mr. Viv Crouch (Australia) Chair
Mr. Tim Chalfant (United States of America), Vice Chair
Mr. Gerhard Mayer (Germany), Secretary/Treasurer

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ICTS Overview

Background. Spectrum encroachment is becoming an international issue as a result of increased commercial interest. It is important that we, the telemetry user and provider community, better protect and defend our spectrum to ensure its future availability for future telemetering. In response to this need, the **International Consortium for Telemetry Spectrum (ICTS)** was chartered under the sponsorship of the International Foundation for Telemetering (IFT). The IFT exercises oversight responsibility and authority of this consortium and provides administrative, policy, and programmatic approval.

The ICTS was formed in response to the need for an international coalition of telemetry practitioners who share a common goal of ensuring the availability of electromagnetic spectrum for telemetering. Under no circumstances shall the ICTS publish, present, or in any other way represent a position on spectrum issues. However, the information shared within the ICTS will enable telemetry practitioners to effectively respond to spectrum issues within their respective organizations. Examples of shared information maybe a database that contains a list of frequency allocations assigned to individual nations and regions for telemetering, data on telemetry technology development, technical reports and studies, and sharing of national positions on related issues. The ICTS will also publicize to members any planned or proposed changes to international spectrum allocations affecting telemetering.

The ICTS is structured as an international organization comprised of telemetry practitioners from government, industry, and academia. Regional Coordinators representing the three regions defined by the International Telecommunications Union (ITU) — Region 1: Europe/Africa, Region 2: Americas, Region 3: Asia/Australia. The consortium shall be open to individuals or organizations who support the goals of the ICTS and have a business or professional stake in the use of the telemetry spectrum. The ICTS needs to produce and exchange information that would be useful in developing a united front.

Charter and By-Laws. The IFT approved the charter and by laws (available at www.telemetry.org/icts.htm). An overview of the history of the consortium and an expression of the importance and benefit for information exchange, meeting announcements, minutes, as well as other information will be posted on the website.

Meetings. The ICTS host meeting bi-annually; Fall in the United States, Spring in Europe. The ICTS recently held meetings in June 2001 (Marseille), October 2001 (Las Vegas) and May 2002 (Garmish). The June meeting was held in conjunction with the European Test and Telemetry Conference (ETTC) on June 14, 2001 in Marseille, France at the Le Palais du Pharo. The October meeting was held in conjunction with the International Telemetry Conference on October 25 in Las Vegas, Nevada USA at Riviera Hotel. The

May meeting was conducted in cooperation with the European Telemetry Conference May 27-28 in Garmish, Germany.

Regional Reports

REGION I

Submitted by:
Mr. Jean-Marie Bergès
ICTS Region I Coordinator

Region 1 Newsletter

The Region I activities comprise the creation of the group's Newsletters; circulation of 6 newsletters; participation in a seminar of ANFR (French National Frequency Agency) on frequency regulation: January 21-23 2002 (before NL 1)

1. Newsletter 1: 12 March 2002
2. Newsletter 2: 23 March 2002
3. Newsletter 3: 9 April 2002
4. Newsletter 4: 30 April 2002
5. Newsletter 5: 14 May 2002
6. Newsletter 6: 4 June 2002

The circulation of the Newsletter is intended to reach for two kinds of receivers:

1. **ICTS members** (already accepted or candidates) following the ICTS charter and by-laws approved Oct. 25 2001 by the International Foundation for Telemetering
2. **Guests** from national frequency institutional managers, especially in Spain and France. This does not induce modifications to the ICTS charter and by-laws.

The list of addresses is sent with each newsletter. Copies of the Newsletters are available on the ICTS Website at www.telemetry.org. Topics covered in each newsletter include:

- ETSC & ICTS plenary meeting preparation for ETC '02 **NL no. 2**
- ETTC'03 general topics **NL no. 2**
- ITEA Instrumentation workshop advertisement (Palmdale CA) **NL no. 2**
- ICTS region 1: presentation of organisation **NL no. 3**
- ICTS annual meeting, 23 October 2002 in San Diego (for election nomination committee) **NL no. 4**
- ICTS charter and by-laws **NL no. 4**
- ETC'02 Garmish final programme **NL no. 5**

- Brief summary of ICTS meeting at Garmish (30 May 2002) **NL no. 6**

3-30GHz Augmentation

At the October Meeting, a working group was established and MITRE (under contract to the US DoD) took an action to prepare an outline draft of a report on issues associated with augmentation of telemetry spectrum in the 3-30 GHz range. The initial draft of an outline of that paper was circulated to the Working Group and Region 1 for review and comment. We are still collecting and additional material for incorporation in this paper. If members have any additional material that could be provided, discussed, or circulated among the Working Group, contact your ICTS representative as soon as it can be done.

Comments received to date have been forwarded to the Working Group and included in the Region 1 Newsletter as referenced:

- Comment to section 6.b of the Working Group Paper (NL no. 1)
The space agencies of Europe have retained the advanced modulation techniques GMSK and SOQPSK for the high rate telemetry of their spacecraft. The ECSS standard E50-05 has been finalised and is in the process of final review. The CCSDS worldwide space agencies are going in the same direction; several of them are currently working at the development of the necessary hardware to implement GMSK and SOQPSK. There is to my knowledge no agency currently planning to implement FQPSK.
- Comment to section 6a of the Working Group. Paper Outline (NL no. 2)
“On the working group paper outline section 6 a, are we missing to include Multi-h CPM in our investigation of use of advanced modulation and multiplexing techniques, which the Advance Range Telemetry (ARTM) Lab at Edwards AFB is looking at ?”

Launch Vehicle Telemetry Safety Request

In pursuing the intersecting telemetry spectrum interests between defense and the civil space community, the Australian Federal Office that is responsible for launch safety has posed a question about the spectrum necessary to support launch vehicle safety. This, by necessity, should embrace command/destroy/flight termination, as well as launch vehicle telemetry behavioral monitoring and/or telecommand/control. There is doubt as to who works the link error margins to satisfy the safety requirements but some points of contact would be useful to get the ball rolling on this topic. Note that the inquiry relates to launch vehicle support and NOT to any operational TT&C or telemetry data-links that are associated with satellites or platforms once launched in space. This is of special interest to the European Space Agencies. For example, the UHF bands for launch vehicle range safety command launch destruct receivers are in the 449.75-450.25 MHz band (extract from RR §5.286) as well as around 421.0, 425.0, 427.0, 440.0 and

445.0 MHz in the USA and, in the French Overseas Departments in Region 2, the 433.75-434.25 MHz band (extract from RR §5.281).

UK Radio Spectrum Management Report

Steve Lyons from QinetiQ Aberporth (ex-DERA) provided a report on UK spectrum prepared by consultants for the UK DTI / Treasury. This report, along with other UK spectrum management documentation, is available from the DTI's Radio Communications Agency, which sponsors a useful web site at www.radio.gov.uk. They also hold road shows to communicate plans and seek comments etc. The RA is planned to become part of OFCOM, a newly created government body. For further information, you can consult www.communicationsbill.gov.uk

Frequency Band Sharing : Utopia or Reality ?

Jean Isnard (SEE, France) provided a revised version of a paper he presented at [the 2001 CIE International Conference on Radar held in Beijing PRC](#), 15-18 October 2001. This article appears with the IEEE's permission and is due to be published in the May issue of the IEEE's "AES Magazine" (ISSN 0885-8985, Volume Seventeen, Number 5).

REGION II
North America, South America

Submitted by;
Mr. Mike Ryan
ICTS Region II Coordinator

3-30GHz Augmentation

Region II members are deeply involved in the issue of spectrum augmentation. Mr. Charles Glass of the National Telecommunications & Information Administration has been selected to be the USA point man for addressing the ITU-R 231-1/8 Wideband Aeronautical Telemetry (ATM) Augmentation Questionnaire. To further this effort:

- Several ICTS Region II Members participated in Mr. Glass's periodic meetings with his ad-hoc Telemetry Experts Group
- The ICTS distributed copies of Mr. Gehrig's (Deputy Director Resources and Ranges USA DoD) Data Call Questionnaire ("Aeronautical Telemetry Requirements for Frequencies <3 GHz") to both ICTS Region II Members and Range Commanders Council Frequency Management Group Members
- We helped and coordinated Air Force, Navy, and Industry responses to the Gehrig Questionnaire

World-Wide TM Utilization Matrix

To aid in our search for this new ATM band, we previously compiled a survey detailing the USA-usage of the two current candidate bands: 4.4-4.99 & 14.7145-15.1365 GHz. (see Figure II-1 and II-2).

Assignments in the 4.4-4.99 GHz Band at 11 Sites (200 MIRAD)

	4.4-4.5	4.5-4.6	4.6-4.7	4.7-4.8	4.8-4.9	4.9-4.99	“Open” Bands (Size in MHz)
NAWCAD PAX River	29	16	14	17	13	21	4.59-4.637(47), 4.68-4.725(40), 4.784-4.832(48)
Patrick AFB	14	4	4	13	5	5	4.5-4.56(60), 4.5-4.7(200), 4.784-4.99(206),
Eglin AFB	0	0	0	0	0	3	4.4-4.9(500)
Boeing St. Louis	2	2	3	9	10	2	4.4-4.67(270), 4.884-4.99(106)
Wichita	0	0	0	0	0	0	4.4-4.99(590)
White Sands Missile Range	19	17	13	25	20	14	4.485-4.52(35), 4.66-4.7(40)

Assignments in the 14.7145-15.1365 GHz Band at 11 Sites (200 MIRAD)

	14.7145-14.8	14.8-14.9	14.9-15.0	15.0-15.1365	“Open” Bands (Size in MHz)		
NAWCAD PAX River	6	1	0	7	14.73-15.0(270), 15.05-15.13(80)		
Patrick AFB	3	2	2	6	14.7145-14.83(116), 14.92-15.0(80), 5.05-15.13(80)		
Eglin AFB	0	2	3	4	14.7145-14.845(131), 14.87-15.02(150), 15.07-15.1365(266)		
Boeing St. Louis	1	0	0	0	14.7145-15.1365(422)		
Wichita	1	0	0	0	14.7145-15.1365(422)		
White Sands Missile Range	12	6	6	16	14.73-14.78(50), 14.82-14.93(110),		
Luke AFB	8	14	4	6	14.765-14.815(50), 14.881-14.98(99)		
Edwards AFB	4	8	4	6	14.75-14.86(110), 14.9-14.99(90), 15.05-15.1365(86)		
Boeing Seattle	44	31	5	4	14.872-14.993(121), 14.995-15.093(98)		
Barking Sands	0	1	0	0	14.7145-15.1365(422)		
Kwajalein	0	0	0	0	14.7145-15.1365(422)		
Luke AFB	20	9	9	14	12	8	4.445-4.48(35), 4.535-4.59(55), 4.727-4.775(48), 4.85-4.92(70)
Edwards AFB	61	31	29	47	35	28	
Boeing Seattle	11	8	21	27	31	6	4.478-4.56(82), 4.685-4.755(60), 4.884-4.97(86)
Barking Sands	5	2	4	6	7	1	4.445-4.637(192), 4.895-4.99(95)
Kwajalein	0	0	0	0	0	0	4.4-4.99(590)
Totals	161	89	97	158	133	88	

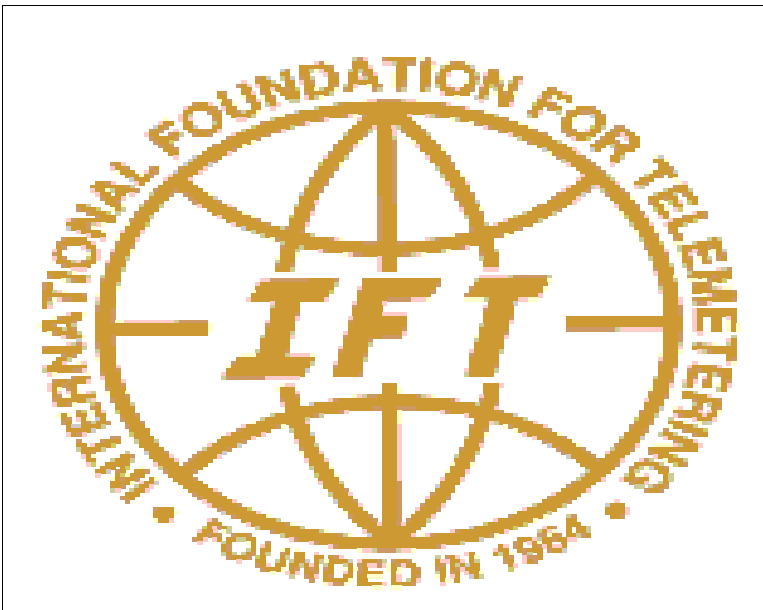
Recently we further refined the survey by:

- Choosing the likely sites (with 200 mile radius) where this new wide-band flight testing would be utilized (Figure II-3)
- Plotting and breaking-down the number of assignments (in the two proposed bands) around the 11 candidate sites into 100 MHz sub-bands
- Finding the gaps in the candidate bands where this new ATM band augmentation can be accommodated

Figure II-3 Wide Band Sites in the US

Although more study needs to be made, the 4.5-4.7 (200 MHz wide), 4.884-4.99 (106 MHz wide) & 14.87-15.1 GHz (130 MHz wide) sub-bands look promising.

Figure II-2 14.7145-15.1365 GHz Band Utilization in the US



Region II Members

The membership list has been updated, corrected and approved by the current ICTS Members for full ICTS Membership. Members are included from the United States of America and Brazil. Canadian telemetry experts have expressed interest in joining soon, and have provided us with data (Figure II-4) for the ICTS Worldwide Telemetry Use Matrix.

1435-1535	FIXED, MOBILE		NIB to CA DARS 1452-1492 MHz
2300-2483.5	FIXED, MOBILE RADIOLOCATION, Amateur	UAVs, Drones	NIB to CA DARS 2320-2345 MHz Note 2360-2400 MHz reserved for Government of Canada exclusively
4460-4540 4900-4990	FIXED, MOBILE	TRR, UAVs planned.	Bands reserved for Government of Canada Exclusively. Assignment plan may be adjusted due to harmonization issues.

Figure II-4 Canadian TM Bands

REGION III

Asia, Australia, New Zealand

Submitted by:

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Combined Communications and Electronics Board [CCEB]

Australia has successfully raised telemetry spectrum harmonization as an agenda item for the Combined Communications and Electronics Board. The Australian, Canadian, New Zealand, United States and United Kingdom points of contact can be downloaded at the public domain CCEB web site.

<http://www.dtic.mil/jcs/j6/cceb> By extension, it is generally hoped that the CCEB linkage with NATO will facilitate and enable wider contribution so that a future CCEB voice on the topic will also be a NATO voice – via the Multi-National Interoperability Council [MIC]. Vide:
<http://www.c3i.osd.mil/org/c3is/ccbm/micright.html>

Air Standardization Coordinating Committee [ASCC]

The issue of Flight Termination Standardization is now being addressed via the Air Standardization Coordinating Committee - Working Party 20 Project 155. Similar to the CCEB, this committee provides for representation from Australia, New Zealand, Canada, the United States and the United Kingdom. Again it is hoped that the NATO countries that are willing to contribute will co-join on this effort. Details about the ASCC can be found -- along with the points of contact in each country at the ASCC web site:

<http://www.xo.hq.af.mil/xor/xorg-iso/ascc>

Australian Movements on Spectrum Planning

The need for a Defense Spectrum Planning Committee [DSPC] within Australia and the need for a Strategic Spectrum Plan have been recognized. A presentation on this was given at the Defense Spectrum Management Seminar, Canberra, 19-21 March 2002. The discussion paper on providing RF protection zones for the Australian ranges is posted at:

<http://www.aca.gov.au/frequency/fx3/fx03apd1.htm> the Spectrum Planning appointment made within Australia's Defense Science and Technology Organisation to assist in preparing a strategic view is now well active. Email address for Mr Bruce Vyden is at: bruce.vyden@dsto.defense.gov.au

Spectrum Augmentation

The responses to ITU Administrative Circular CA/109, covering the need for additional spectrum in the 3-30GHz Band have been collated and submitted to Working Party 8B. The document containing the responses is 8B/219-E. Inquiries to: Mr George Wardle. george.wardle@ties.itu.ch Notably, this action was precipitated through the previous CCEB action (attached to previous report – copies available on request).

Biomedical Telemetry

The discussion paper on the future of bio-medical telemetry is posted at <http://www.aca.gov.au/frequency/proposal.htm>

Research and Development

Regional telemetry research efforts appear to be limited to wild-life tracking [vide: the International Society for Bio-Telemetry web-site at <http://baby.indstate.edu/isb/>] and meteorology applications. A notable exception includes the collaboration between New Zealand and the University of Arizona on underwater telemetry propagation and the now terminated collaboration between the University of South Australia and USAF on 'data cycle map synthesis'. The very notable exception to the paucity of telemetry research investment in the Asian countries is China, but its something we should all be aware of via the extensive reporting of their research and development efforts in space and aerospace application at both the annual ITC and ETTC events.

Considerable records were made at the Woomera range during the Anglo/Australian Joint Projects, NASA and DLVR programmes up until 1987 on the effects of missile plumes on telemetry propagation. It would seem to me that this data should be assembled and appropriated for the benefit of all. I'm not sure at present, if Australia (as the service provider) or the UK or others (as the customers) either have the spare capacity or willingness to do this. Apart from this, perhaps the National Plume Measurement Capability in the United States could be augmented to incorporate those RF measurements needed to characterise missile plume attenuation across the RF spectrum. This would help remove any speculation about WHY specific frequency bands better support telemetry/telecommand and command-destruct/flight termination applications.

CCSDS Coordination

The national CCSDS representative in Australia has been kept informed on ICTS activities and all alerts on spectrum happenings. Email address is: richard.c.jacobsen@jpl.nasa.gov The recent response forwarded to the ICTS executive committee noted that spectrum preservation to support launch support was outside the CCSDS charter and that of its Space Frequency Coordinating Group. [SFCG] Unless someone (somewhere) maintains a global launch site directory this means that each individual launch site would need to be separately addressed to help populate the ICTS global-use matrix.

Missile Terminations

The missile termination band [420-450MHz] is under severe stress in Australia and other regions. ICTS members must brief their national spectrum administrations on the safety and security aspects. Prospective civil aerospace and space launch industry responses in Australia have yet to be assembled and consolidated to contribute to a position paper. A good response was received from Dr Ian Tuohy at British Aerospace Australia. Other responses included quotable quotes such as *'our members are seized by more immediate matters'* which came from the Australian Association of Aviation Industries and the Systems Engineering Society of Australia (affiliated with INCOSE) responded with *'what has this got to do with us?'* Minor responses and membership inclusions [but no contributions] resulted from promotion to the Society of Experimental Test Pilots, Air Services Australia, the Australian Chapter of the Association of Old Crows, the Society of Flight Test Engineers, and the regional chairs of the IEEE and the AIAA. This means that in the Asia/Pacific region – the only professional body that is taking a pro-active interest is the International Test and Evaluation Association – through its two regional Chapters [the Southern Cross Chapter - Australia and the Mid-Pacific Chapter - Hawaii]. Notably - SLASO alerted the prospective Australian space launch industries (in-country and off-shore) - which generated a single response from a US-based subcontractor - *"Viv, you're asking a drowning man to get interested in water pollution"*. Delivered incorporated ICTS awareness into the presentations I gave to the Defence Radio Frequency Management Seminar, held Canberra Australia 19-21 March 2002 and to the Town Meeting of the ITEA Workshop held in Solomons, MA, April 8-11, 2002. The theme of the ITEA Workshop was 'The T&E Role in Experimentation'. A copy of both these presentations are available on request.

Global TM Utilization Database

All regional embassies have responded with their Table of Allocations – which, almost in their entirety, contribute NOTHING to the global use matrix – as telemetry receives no specific citation. This means that the principal stakeholders need to be identified and individually targeted in order to populate the ICTS global use matrix. Still unclear on exactly who is protecting KMR interests [Marshall Islands] in Region 3 but have done our best to keep KMR informed of spectrum happenings in Region 3. No regional spokesman could be found for the Space or Aerospace Industries in Australia or in the Asia/Pacific region.

Strongly suspect that the telemetry industry (via the US and European suppliers) can paint a better picture of national telemetry spectrum use within the Asia/Pacific countries than their various national administrations can! This STILL highlights the exquisite vulnerability of the space/aerospace and tracking and launch ranges in this part of the world – who are seemingly operating in the absence of both situation awareness and literate national and regional representation. There is a clear lack of regional situation awareness and leadership in evidence that must necessarily place high cost infrastructure at extreme risk.

Self-regulation at the world's ranges (.eg via adoption of the IRIG or CCSDS standards or their prospective future merging into an international standard) cannot survive the current and accelerating global spectrum deregulation. Who will actually staff and fund the regulatory effort to achieve global telemetry harmonisation – and hence counter the fragmentation caused by the current deregulatory efforts - is still quite unclear. This national and regional infrastructure vulnerability clearly lacks ownership.

Spectrum Congestion in Region III

With respect to high altitude UAVs such as Global Hawk, our understanding on spectrum availability and the intersecting radio horizons within Asia/Pacific sovereign states is that any permanent operational use of military or civil UAVs/RPVs within the Asia/Pacific region could be quite constrained. The extent of these constraints is still yet to be consolidated and reported – but current experience should also serve to highlight the compelling linkage between spectrum planning and airspace planning -- with respect to future experimentation and Advanced Concept Technology Demonstrations. With respect to the Australian ranges supporting military or civil space/aerospace or weapons systems development activities, understanding is STILL sought on how others have sought and achieved **RF protection zones** within their national administrations. A common understanding and practice might be usefully explored and promoted.

Summary

With respect to Region III, the Australian revisions to the global ICTS have been forwarded to the ICTS Vice-Chair for inclusion. Thanks go to Mr Peter Henrick for his sleuthing efforts. Email: peter.henrick@defense.gov.au We can only strongly recommend that a critical emphasis also needs to be placed on strategic planning to support a twenty year look-ahead on 'things to come' and agree on a shared vision - followed by strong consolidated recommendations – to help bring order out of the present chaos.

Working Group Reports

WG 1 Spectrum Augmentation

CTS WG 1 was established to prepare a report on the technical challenges of conducting telemetry operations in the 3-30 GHz region of the electromagnetic spectrum. The report is in response to the International Telecommunications Union's proposal to consider the allocation of a new telemetry band in the 3 to 30 GHz region of the spectrum. The report will be for the use of ICTS members in understanding the issues associated with the proposal, and in supporting their respective national spectrum management offices that will be developing their national positions on the proposal. The report will not contain any official ICTS position; its sole purpose is to present a consolidation of the technical issues.

The working group currently comprises members from the US, Germany, France, and the United Kingdom. Brazil is actively considering joining the working group. The working group has developed an outline of the report and will prepare an initial draft for presentation to the membership at the October meeting (held in conjunction with ITC). The report must be published no later than June 2004 in order to support national preparations for the World Radio Communications Conference in 2005.

Special Topics

Current Spectrum Encroachment. The main two threats to the spectrum were the launches of Digital Audio Broadcast (DAB) satellites within the L and S bands and the International Mobile Telecommunications (IMT) 2000 initiative. Several new L-band DAB satellite systems had been proposed and WorldSpace was teaming with Alcatel for a L-band DAB service for Europe. France is the filing administration. Malaysia intends to coordinate for a new satellite service and that two companies are ready to begin DAB services in the US in the S-band. Pertaining to the IMT 2000 threat, The US telemetry community was concerned with this initiative because of the high use of telemetry systems in the 1755-1850 MHz band. Four options are being considered within the US for accommodating IMT 2000 within the band. The four options under consideration are 1) share the band between IMT-2000 and government users; 2) have the government vacate the band and migrate to an unidentified band; 3) segment the band; or 4) a mix of the first three options. Within the US, the band must be auctioned off by September 2002. Allocations for IMT 2000 within Europe have already been settled.

Spectrum Augmentation. There is a WRC 06 Agenda Item to identify augmentation bands between 3 – 30 GHz for wideband aeronautical telemetry. There is a growing concern that such consideration would be used to support the ousting of telemetry from the L and S band. Several

candidate bands were identified. It was noted that at WRC 97, 25.5 – 27.0 GHz was allocated for wide-band telemetry and that Japan used 25.0 – 45.0 GHz for its wide-band telemetry. The US is conducting an investigation into the impact that the augmentation could have on hardware and antenna designs and networks by investigating channel characteristics and adverse channel mitigation techniques. France noted that they were in the process of propagating their antenna data and this information could possibly be of some use in their study. It was suggested that a session be held at the meeting in October to discuss the French the propagation. It was recommended that Mr. Christian Thomas conduct the session.

FCC Part 15 Devices. Mr. Mikel Ryan has presented information that discussed the threat of Part 15 devices to telemetry systems. Part 15 devices are very low powered devices, such as garage door openers and baby monitors, that don't require frequency approval or certification through the FCC for operation. He stated that even though they radiated very low powers, potential interference is possible if operating within close proximity to very sensitive equipment.

Summary

The work of the ICTS has just begun. In our first year we established the charter, by-laws, and structure needed to perform this vital mission. We have excellent membership numbers from regions I and II and are getting the message out to the international community through the IFT, the International Test and Evaluation Association, and the Society of Flight Test Engineers.

More publicity is needed. Members need to regularly offer papers at technical conferences that bring the ICTS and its mission forward. Articles need to be placed in trade journals and newsletters. Many national bodies are still unaware of the threat and the issues. Members need to make a concerted effort to inform their national regulatory bodies and ITU representatives of the Telemetry encroachment issue.

WRC is coming. The World Radio Council will discuss the 3-30GHz TM band Augmentation at WRC 2003 and as an agenda item in 2006. The ICTS will play a major role in distributing studies and technical reports to members in support of this agenda item. Members need to ensure this information is in the right hands within their governments to gather support for this new spectrum allocation.

Encroachment Continues. The ICTS closely monitors work in ITU Working Parties 8B and 8D with regards to telemetry spectrum encroachment. Commercial interests such as mobile Satellite Communications, Digital Audio Broadcasts, and Personal Communication Services will continue to seek additional airwaves for their services. We need to prevent further erosion and interference from these services to protect vital telemetry capability.

The next several years will be very busy for the ICTS.