We use cookies to ensure that we deliver the best user experience of our website. If you would like to, you can change your cookie settings at any time. Continue

Professor Paul S Cannon OBE, FREng, CEng, FIET, MAGU, PhD

Professor of Radio Science and Systems
Vice-President and Treasurer, International Union of Radio Science (URSI)
Editor, Radio Science

Engineering and Physical Sciences

Contact details

Telephone +44 (0) 7990 564772 (tel:+44 7990 564772)

Telephone (2) +44 (0) 121 414 4323 (tel:+44 121 414 4323)

Email p.cannon@bham.ac.uk (mailto:p.cannon@bham.ac.uk)

Gisbert Kapp Building
University of Birmingham
Edgbaston
Birmingham
B15 2TT
UK

About

Until recently Prof Paul Cannon, FREng was the part-time Director of the **Poynting Institute (http://www.birmingham.ac.uk/poynting)** at the University of Birmingham and a Senior Fellow at QinetiQ (Malvern). Paul Cannon is a leading figure in Radio Science and Systems, being interested in a wide range of radio propagation and radio environment problems and how they impact communications, radar and navigation systems. As a scientist (originally) and as a research engineer (latterly) Paul seeks novel, but real world, solutions to challenging problems.

Recent News

- **July 2013** – Paul supports the Committee on Science and Technology in a meeting in Washington DC
- **June 2013 –** Paul to speak at the **Cheltenham Science Festival (http://www.cheltenhamfestivals.com/science)** on Solar Superstorms.
- **February 2013 –** Paul speaks in UK Houses of Parliament to the Parliamentary and Scientific Committee on the subject of Solar Superstorms.
- **February 2013 – Royal Academy of Engineering (http://www.raeng.org.uk/)** report on Solar Superstorms launched. A **detailed technical report (pdf) (http://www.raeng.org.uk/news/publications/list/reports/Space_Weather_Full_Report_Final.PDF)** and a **summary report (pdf) (http://www.raeng.org.uk/news/publications/list/reports/Space_Weather_Summary_Report.PDF)** are available. See also various press and TV reports for example: **BBC (http://www.bbc.co.uk/news/science-environment-21357909)**, **Guardian (http://www.guardian.co.uk/science/2013/feb/07/solar-superstorms-uk-engineers)**, the **Financial Times (http://www.ft.com/cms/s/0/f30d9e54-7067-11e2-ab31-00144feab49a.html#axzz2NQyPKQmC)** and **Channel 4 News (http://www.channel4.com/news/plan-for-solar-superstorm-or-expect-chaos-report-warns)**.
- **September 2011** – Paul joins the Engineering Policy Committee of the **Royal Academy of Engineering (http://www.raeng.org.uk/)**.
- **August 2011 –** Paul elected as Vice President and Treasurer of the **International Union of Radio Science (http://www.ursi.org/en/home.asp)**, (URSI).
- **March 2011 –** Paul to talk at the **Cheltenham Science Festival (http://www.cheltenhamfestivals.com/science)** on the vulnerability of satellite navigation to space weather.
- **January 2011 –** Paul appointed Director of the **Poynting Institute (http://www.birmingham.ac.uk/poynting)**, University of Birmingham.

Qualifications

Professor of Radio Science and Systems

- FREng, Fellow of the **Royal Academy of Engineering (http://www.raeng.org.uk/)**, 2003
- Ph.D., Physics, University of Southampton, 1981
- M.Sc., Electronics, University of Southampton, 1976
- B.Sc. (Hons), Physics, University of Southampton, 1975

Biography

Paul is Professor of Radio Science and Systems at the University of Birmingham. Until recently Prof Paul Cannon was concurrently the part-time Director of the Poynting Institute at the University of Birmingham and a Senior Fellow at QinetiQ. Prior to this Paul served as Chief Scientist and Technical Director of the Communications Division of QinetiQ and as the University Partnerships Director of QinetiQ. Paul is currently the Editor-in-Chief of the US journal “Radio Science” and a Vice-President of the International Union of Radio Science. He is a fellow of the Royal Academy of Engineering.

Paul has worked at the intersection of research and industry for the last 20 years and in his role as the first Director of the Poynting Institute at the University of Birmingham he leads a partnership between industry and academia dealing with Autonomy (air, land and space vehicles) and Space Engineering.

Paul is a leading figure in radio science and systems, being interested in a wide range of radio propagation and radio environment problems and how they impact communications, radar and navigation systems. He has made numerous personal and team leadership contributions to mitigating the impact of the environment on radio systems.

Paul initiated the UK Ministry of Defence (MOD) ionospheric space weather mitigation programme in 1986 and he led and nurtured it for over 25 years. This he did both as a civil servant within the MOD and, for the last ten years, on behalf of the Ministry whilst working both in QinetiQ and latterly also at the University of Birmingham. During this period he moved military space weather R&D from a Cinderella topic to a core technology with an articulated military requirement. Much of this was, and continues to be, achieved with the benefit of bilateral and multi-lateral arrangements which he has facilitated with the US DoD and other nations providing substantial benefit to the UK.

Paul has published many scientific papers including those addressing ionospheric modification, meteor scatter communications, HF communications and radars, space radars and ionosondes. In addition, he is the author of many classified reports and a number of book chapters. Paul initiated and led the Canadian-Norwegian-Swedish-UK team (DAMSON) which defined the requirements for the robust military HF modem, STANAG 4415, now used throughout NATO. In recent years his team has developed

and transitioned a new generation of real-time (assimilative) ionospheric models from laboratory to the user and, he and his team have conducted seminal measurements and built models to describe the impact of the ionosphere on space radars. Most recently the team have been involved in ionospheric modification rocket experiments being part of a UK-US collaboration which he initiated.

Paul currently serves on the UK Cabinet Office, Space Weather Project Board, has been an expert witness to the House of Commons Science and Technology Select Committee and has supported the Prime Minister's Committee on Science and Technology. He is currently a member of the Engineering Policy Committee of the Royal Academy of Engineering.

Postgraduate supervision

Applications are always welcome.

Research

After early periods in the universities and in the satellite communications industry Paul was appointed to the Ministry of Defence (MOD) Royal Aircraft Establishment (Laboratory) where he was rapidly promoted and offered a "fast track" career in London. He declined this opportunity preferring a technical career.
His early work on meteor burst communications (MBC) was significant in that he was the first to identify a signal loss mechanism due to signal polarisation rotation by the ionosphere, in the upper atmosphere. This, and subsequent work on the use of phased arrays, facilitated MBC systems operating with significantly enhanced data rates. These early successes convinced him that important radio engineering advances could be made via a detailed understanding of both the radio propagation and the atmospheric environment through which those signals propagate. Around this time (1989) he was invited to work on sabbatical at the University of Massachusetts.

Subsequent R&D resulted in the development of new and novel instrumentation to measure the ionosphere, new fast analytic ray tracing techniques and non-linear dynamical modelling to forecast the ionosphere. These many initiatives have provided innovative solutions to problems in high frequency (HF) systems. Of particular note was the pioneering work and his leadership (technical and managerial) of the international DAMSON programme (1993-2000) to measure and understand the HF communications propagation channel.
This work, carried out by a team of ~10 persons in Sweden, Norway, Canada and the UK was carried out in cooperation with the major communications modem manufacturers. NATO's robust HF modems are based on the results of this work.

Over the last ten years he has led the QinetiQ team delivering new techniques to support the design of innovative new sensors based around space radars, over-the-horizon-radar and other surveillance systems. This has included formal assimilation of measured data into models and ionospheric scintillation measurements and modelling using phase screen approaches.
During this time he was the first to measure the trans-ionospheric impulse response which he did using a major radar facility located in the Marshall Islands. This period has included investigations of the practical effects of climate change on the ionosphere.

Specific current personal research is currently addressing:

- The effects of the ionosphere on space based radars and mitigation strategies (University of Birmingham).
- Mitigating the effects of the ionosphere on Over the Horizon Radar (QinetiQ).

Other activities

Leadership

- In order to facilitate his research Paul initiated the RF Operating Environments (RFOE) Group at QinetiQ. During his leadership RFOE rose to be one of the largest research groups of its kind in the UK. The Centre had a wide remit covering (primarily) communications systems operating from 10 kHz to 60 GHz.
- In 1998 Paul was appointed to a part-time chair (one day per week) at the University of Bath where he integrated QinetiQ and University aspirations to mutual benefit in a Partnership through the building of a small team consisting of research assistants and students.
- From 2000-2008, Paul served as Technical Director and then as Chief Scientist of Communications Dept at QinetiQ. In this role he reported to the Director of Communications Division with ~400 staff. He was responsible for innovation and for horizon scanning. In analysing the resources allocated to these various research programmes, he assessed both the short term value (business or in society) and the value of discovery which will provide innovation options in the future. In this role, he successfully initiated a multi-million pound Galileo satellite business.
- From 2004-2005 Paul served as co-Director of the pan-QinetiQ University Partnership Scheme reporting to the Technical Director of QinetiQ. He developed new ways for QinetiQ to Partner with a small number of Universities to mutual benefit.
- In late 2009 Paul conceived and commenced negotiations to set up the Birmingham Poynting Institute. The Institute was inaugurated in January 2011, with Paul as its first Director on secondment from QinetiQ.

Summary of Roles on National and International Committees
Paul has participated in, and led the R&D community, in various ways. He has, served as Chair of UK Research Council committees, has been a member of the Institute of Engineering Technology (IET) Council, has been vice-chair of the NATO Advisory Group on Aerospace Research and Development (AGARD) Sensors and Propagation Panel and was until 2008 Chair of Commission G (the Ionosphere and Ionospheric Radio Propagation) of the International Union of Radio Science (URSI). He is currently Vice President and Treasurer of the **International Union of Radio Science (http://www.ursi.org/en/home.asp)** , (URSI).

Publications

Journal Papers

Turunen, T., P. S. Cannon, and M. J. Rycroft (1980), Generation of ELF radio signals in the auroral ionosphere by non-linear demodulation of LF and/or MF transmissions, Nature, 286, 375-377.

Rycroft, M. J., P. S. Cannon, and T. Turunen (1981), ELF radio signals produced in the auroral ionosphere by non-linear demodulation of signals from high-power amplitude modulated transmitters, Advances in Space Research, 1, 449-454.

Cannon, P. S. (1982), Ionospheric ELF radio signal generation due to LF and/or MF radio transmissions: Part I Experimental results, J. Atmos Terr Phys, 44, 819-829.

Cannon, P. S., and M. J. Rycroft (1982), Schumann resonance frequency variations during sudden ionospheric disturbances, Journal of Atmospheric and Terrestrial Physics, 44, 201-206.

Cannon, P. S., T. Turunen, and M. J. Rycroft (1982), Ionospheric ELF radio signal generation due to LF and/or MF radio transmissions: Part II Interpretation, Journal of Atmospheric and Terrestrial Physics, 44, 831-841.

Cannon, P. S. (1986), Polarization rotation in meteor burst communication systems, Radio Science, 21, 501-509.

Cannon, P. S., and A. P. C. Reed (1987), The evolution of meteor burst communications systems, Journal of Institute of Electrical and Radio Engineering, 57, 101-112.

Cannon, P. S. (1989), Morphology of the High Latitude Ionosphere and its Implications for HF Communications Systems, IEE Proc, Pt I, 136, 1-10.

Cannon, P. S. and A. H. Dickson (1991), Signalling efficiency modelling and measurement of simplex, block encoded MBC system, IEE Proc.-I, 138.

Cannon, P. S., B. W. Reinisch, J. Buchau, and T. W. Bullett (1991), Response of the polar cap F-region convection direction to changes in the interplanetary magnetic field: Digisonde measurements in Northern Greenland, Journal of Geophysical Research, 96, 1239-1250.

Cannon, P. S., G. Crowley, J. Buchau, and B. W. Reinisch (1992), Digisonde Measurements of Polar Cap Convection for Northward Interplanetary Magnetic Field, Journal of Geophysical Research, 97, 16877-16885.

Crowley, G., P. S. Cannon, C. G. Dozois, B. W. Reinisch, and J. Buchau (1992), Polar cap convection for Bz northward, Geophysical Research Letters, 19, 657-660.

Shukla, A. K., P. S. Cannon, and M. Lester (1992), Spaced antenna diversity in temperate latitude meteor burst propagation systems at 37 MHz: Variation of signal cross correlation coefficients with time, Radio Science, 27, 841-849.

Cannon, P. S., A. K. Shukla, and M. Lester (1993), Spaced antenna diversity in temperate latitude meteor burst systems operating near 40 MHz - Variation of signal cross correlation coefficients with antenna separation, Radio Science, 28, 203-212.

Arthur, P. C., and P. S. Cannon (1994), ROSE, A high performance oblique ionosonde providing new opportunities for ionospheric research, Annali di Geofisica, 37, 135-144.

Akram, A., and P. S. Cannon (1996), Passive beam forming and spatial diversity in meteor scatter communication systems, Radio Science, 31, 367-380.

Cannon, P. S., J. A. Weitzen, J. Ostergaard, and J. E. Rasmussen (1996), Relative impact of meteor scatter and other long distance high latitude propagation modes on VHF communications systems, Radio Science, 3, 1129-1140.

Akram, A., and P. S. Cannon (1997), A new meteor scatter prediction model and its application to adaptive beam steering, Radio Science, 32, 1023-1035.

Norman, R. J., and P. S. Cannon (1997), A two-dimensional analytic ray tracing technique accommodating horizontal gradients, Radio Science, 32, 387-396.

Angling, M. J., P. S. Cannon, N. C. Davies, T. J. Willink, V. Jodalen, and B. Lundborg (1998), Measurements of Doppler and Multipath Spread on Oblique High-Latitude HF Paths and their use in Characterising Data Modem Performance, Radio Science, 33, 97-107.

Brown, A. G., N. M. Francis, D. S. Broomhead, P. S. Cannon, and A. Akram (1999), Is there Evidence for the Existence of Non-linear Behaviour within the Interplanetary Solar Sector Structure?, Journal of Geophysical Research -Space Physics, 104, 12537-12547.

Norman, R. J., and P. S. Cannon (1999), An evaluation of a new 2-D analytic ionospheric ray tracing technique - SMART, Radio Science, 34, 489-499.

Francis, N. M., A. G. Brown, P. S. Cannon, and D. S. Broomhead (2000), Non-linear prediction of the hourly foF2 time series in conjunction with the interpolation of missing data points, Physics and Chemistry of the Earth, Part C-Solar-Terrestrial and Planetary Science, 25, 261-265.

Francis, N. M., A. G. Brown, P. S. Cannon, and D. S. Broomhead (2000), Prediction of the ionospheric parameter, foF2, on hourly, daily and monthly time-scales, Journal Geophysical Research, 105, 12839-12949.

Francis, N. M., P. S. Cannon, A. G. Brown, and D. S. Broomhead (2000), Nonlinear prediction of the ionospheric parameter foF2 on hourly, daily and monthly timescales., Journal of Geophysical Research - Space Physics, 105, 12839-12849.

Clivered, M. A., C. J. Rodger, N. R. Thomson, J. Lichtenberger, P. Steinbach, P. S. Cannon, and M. J. Angling (2001), Total solar eclipse effects on VLF signals: Observations and modeling, Radio Science, 36, 773.

Francis, N. M., A. G. Brown, P. S. Cannon, and D. S. Broomhead (2001), Prediction of the hourly ionospheric parameter, fof2, incorporating a novel non-linear interpolation technique to cope with missing data points, Journal of Geophysical Research, 106, 30077-30083.

Hall, C. M., and P. S. Cannon (2001), Indication of the shrinking atmosphere above Tromso (69°N, 19° E), Atmospheric Science Letters, Royal Meteorological Society, doi10.1006/asle.2001.0036.

Heaton, J. A., P. S. Cannon, N. C. Rogers, C. N. Mitchell, and L. Kersley (2001), Validation of electron density profiles derived from oblique ionograms over the UK, Radio Science, 36, 1149-1156.

Jodalen, V., T. Bergsvik, P. S. Cannon, and P. C. Arthur (2001), The performance of HF modems on high latitude paths and the number of frequencies necessary to achieve maximum connectivity, Radio Science, 36, 1687-1698.

Rogers, N. C., C. N. Mitchell, J. A. T. Heaton, P. S. Cannon, and L. Kersley (2001), Application of radio tomographic imaging to HF oblique incidence ray tracing, Radio Science, 36, 1591-1598.

Chan, A. H. Y., and P. S. Cannon (2002), Nonlinear prediction of foF2:Variation of model predictive accuracy over time, Annales Geophysicae, 20, 1031-1038.

Hall, C. M., and P. S. Cannon (2002), Trends in foF2 above Tromso (69°N 19°E), Geophysical Reseach Letters, 29, Article No 2128.

Angling, M. J., and P. S. Cannon (2004), Assimilation of radio occultation measurements into background ionospheric models, Radio Science, 39, RS1S08

Lilensten, J., L. R. Cander, M. T. Rietveld, P. S. Cannon, and M. Barthélémy (2004), Comparison of EISCAT and ionosonde electron densities: application to a ground based ionospheric segment of a space weather programme, Annales Geophysicae 23, 183-189.

Cannon, P. S., N. C. Rogers, and C. M. Hall (2004), Trends in Critical Frequencies and Layer Heights over Tromsø and their Consequential Impact on Radio System Modelling, Advances in Space Research, 34, 2085-2091.

Cannon, P. S., K. M. Groves, D. J. Fraser, W. J. Donnelly, and K. Perrier (2006), Signal Distortion on V/UHF Trans-Ionospheric Paths: First Results from WIDE, Radio Science, 41.

Angling, M. J., J. Shaw, A. K. Shukla, and P. S. Cannon (2009), Development of an HF selection tool based on the Electron Density Assimilative Model near-real-time ionosphere, Radio Sci, 44, (RS0A13), doi:10.1029/2008RS004022.

Cannon, P. S. (2009), Mitigation and Exploitation of the Ionosphere: A military perspective, Radio Science, 44, (RS0A20) doi:10.1029/2008RS004021.

Rogers, N. C., P. S. Cannon, and K. M. Groves (2009), Measurements and simulation of ionospheric scattering on VHF and UHF radar signals: Channel scattering function, Radio Science, 44, (RS0A07), doi:10.1029/2008RS004033.

Rogers, N. C., P. S. Cannon, and K. M. Groves (2009), Measurements and simulation of ionospheric scattering on VHF and UHF radar signals: Coherence Times, Coherence Bandwidths and S4, Radio Science, 44, (RS0A33), doi:10.1029/2008RS004035.

van de Kamp, M., P. S. Cannon, and M. Terkildsen (2009), The effect of the Ionosphere on Defocusing of Space Based Radars, Radio Science, 44, (RS1003), doi:10.1029/2007RS003808.

van de Kamp, M., and P. S. Cannon (2009a), Equatorial TEC Power Spectra: Strength and Slope, Ann Geophys, 27, (.), 2205-2214.

van de Kamp, M. M. J. L., P. S. Cannon, and R. Watson (2010), V/UHF Space Radars - Spatial Decorrelation of Trans-Ionospheric Signals in the Equatorial Region, Radio Science, 45, (RS4012), doi:10.1029/2009RS004226.

Published Conference Papers

Akram, A., and P. S. Cannon (1994), A meteor scatter communications system data throughput model, 392: 343-347, in HF Radio Systems and Techniques Conference, edited, IEE, University of York, UK.

Akram, A., and P. S. Cannon (1995), Beam Forming techniques in meteor scatter communication systems, Paper 44-1, in Symposium on Digital Communications Systems: Propagation Effects, Technical Solutions, System Design, CP 574, NATO-AGARD, Athens, Greece.

Angling, M. J., P. S. Cannon, N. C. Davies, B. Lundborg, V. Jodalen, and K. W. Moreland (1995), Measurements of Doppler Spread on High Latitude HF Paths, paper 17-1 , Technical Solutions, System Design, in Symposium on Digital Communications Systems: Propagation Effects, CP 574, edited, NATO-AGARD, Athens, Greece.

Angling, M. J., P. S. Cannon, N. C. Davies, and P. C. Arthur (1997), Estimation of the Availability of Data Modems on Oblique High Latitude Paths, pp. 159, in Seventh International Conference on HF Radio Systems and Techniques, edited, IEE, East Midlands Conference Centre, Nottingham, UK.

Angling, M. J., and P. S. Cannon (2001), On the application of meteorological data assimilation techniques to radio occultation measurements of the ionosphere, paper presented at Beacon Satellite Symposium, Boston, USA.

Angling, M. J., and P. S. Cannon (2002), Assimilation of radio occultation measurements into background ionospheric models, paper presented at Ionospheric Effects Symposium, Alexandria, USA, 7-9 May.

Angling, M. J., and P. S. Cannon (2006), On the development, testing and exploitation off an ionospheric data assimilation system, paper presented at Ionospheric Radio Systems and Technology Conference, IET, London, 188-192.

Angling, M. J., J. Shaw, A. K. Shukla, and P. S. Cannon (2008), Development of an HF frequency selection tool based on the EDAM real time ionosphere, in Ionospheric Effects Symposium, edited, JMG Associates Ltd, Alexandria.

Arthur, P. C., A. H. Dickson, and P. S. Cannon (1991), ROSE - A high resolution, amplitude coded, high frequency oblique ionosonde, Paper 10, in 49th Symposium on Remote Sensing of the Propagation Environment, NATO-AGARD-EPP, Cesme, Turkey.

Arthur, P. C., M. Lissimore, P. S. Cannon, and N. C. Davies (1997), Application of a high quality ionosonde to ionospheric research, paper presented at HF Radio Systems and techniques, IEE, Nottingham, UK.

Cannon, P. S. (1994a), Propagation in the ionosphere (A), paper presented at Propagation Modelling and Decision Aids For Communications, Radar and Navigation Systems, NATO-AGARD, September 1994.

Cannon, P. S. (1994b), Propagation in the ionosphere (B), paper presented at Propagation Modelling and Decision Aids For Communications, Radar and Navigation Systems, NATO-AGARD, September 1994.

Cannon, P. S. (1998), Ionospheric Propagation and modelling for modern HF communication systems, Invited Keynote Address, in Proc. Nordic HF Conference, HF98,, edited, Fårö, Sweden.

Cannon, P. S. (2008), Awareness, Mitigation and Exploitation of the Ionosphere – A perspective on Ionospheric Effects, in Ionospheric Effects Symposium, edited, JMG Associates, Alexandria, Virginia, USA.

Cannon, P. S., W. Gibbons, B. K. Madahar, and L. J. C. Wooliscroft (1980), ELF/VLF wave field measurements at the time of launch of Skylark SL1424, in 5th ESA-PAC Symposium on European Rocket and Balloon Programmes and Related Research, ESA SP 152, pages 301-307, ESA.

Cannon, P. S., and G. Richardson (1983), Meteor scatter communication in an air-ground environment in International Conference on Antennas and Propagation, Vol 2, pages 313-317, IEE, Norwich, UK.

Cannon, P. S., A. H. Dickson, and M. H. Armstrong (1985), Meteor scatter radio propagation at high latitudes, Paper 9.1, in Symposium on Propagation Effects on Military Systems in the High Latitude Region, edited, NATO AGARD EPP, Fairbanks, Alaska.

Cannon, P. S., and A. H. Dickson (1986), BLOSSOM - An air-to-ground meteor burst system., paper presented at IEEE Milcom '86, Monterey, USA.

Cannon, P. S., M. Lester, E. C. Thomas, A. H. Dickson, T. B. Jones, R. Maude, P. J. Rylah, and A. K. Shukla (1988a), Joint VHF Coherent Radar and Oblique Sounder Observations for Short Term Ionospheric Forecasting, Paper 41, in AGARD EPP Symposium, Munich, Germany.

Cannon, P. S., J. N. Tyler, A. K. Shukla, and A. H. Dickson (1988b), Space Diversity Reception in Meteor Burst Communications Systems, pages 110-114, paper presented at IEE HF Radio Systems and Techniques Conference.

Cannon, P. S., M. J. Rycroft, and T. Turunen (1990a), Oblique heating of the auroral ionosphere by LF/MF transmitters, Paper 16, in Ionospheric Modification and its Potential to Enhance or Degrade the Performance of Military Systems, NATO-AGARD-EPP, Bergen, Norway.

Cannon, P. S., A. K. Shukla, and M. Lester (1990b), Optimum antenna spacing for diversity in meteor burst communications systems, in Conf. 486 on Use or reduction of propagation and noise effects in distributed military systems, NATO-AGARD_EPP, Rethymno, Crete.

Cannon, P. S., J. Buchau, and B. W. Reinisch (1992a), Interplanetary magnetic field directions deduced by Digisonde measurements of the convection flow direction over the polar cap, , in High Latitude Ionospheric Propagation Colloquium, IEE, Leicester, UK.

Cannon, P. S., B. W. Reinisch, and J. Buchau (1992b), Interplanetary magnetic field directions deduced by Digisonde measurement, paper presented at 4th Solar Terrestrial Predictions Workshop, Ottawa, Canada.

Cannon, P. S., and P. C. Arthur (1993), ROSE - An oblique sounder with applications for ionospheric mapping, in PRIME COST 238 Workshop on Studies with emphasis on TEC and Topside Modelling, Part II, 313- 322, Graz, Austria.

Cannon, P. S., J. A. Weitzen, J. Ostergaard, and J. E. Rasmussen (1993), The relative importance of meteor burst and other long distance polar cap propagation modes in the low VHF band, in AGARD Conference on Multiple Mechanism Propagation Paths, edited, Rotterdam, Netherlands.

Cannon, P. S., J. A. Weitzen, J. Ostergaard, and J. E. Rasmussen (1994), Meteor burst and other long distance polar cap propagation modes in the low VHF band, in IEE

HF Radio Systems and Techniques Conference, Vol 392: 353-357,University of York, UK.

Cannon, P. S., N. C. Davies, M. J. Angling, V. Jodalen, K. W. Moreland, and B. Lundborg (1995), Initial results from DAMSON - a system to measure multipath, Doppler spread and Doppler shift on disturbed HF channels,, in 9th international Conference on Antennas and Propagation, v2, pp104, IEE, Eindhoven, Netherlands.

Cannon, P. S., and T. B. Jones (1995), The ionospheric environment and its impact on EW systems, in Symposium on Environmental factors in EW Related to Aerospace Systems, edited, NATO-AGARD-EPP, Pratica di Mare, Rome Italy.

Cannon, P. S., M. J. Angling, N. C. Davies, B. Lundborg, V. Jodalen, and M. Bröms (1996), Requirements on Channel Probes For Automatic Channel Selection, in Colloquium on Frequency Selection and Management Techniques for HF Communications, edited, IEE, London.

Cannon, P. S., J. H. Richter, and P. A. Kossey (1997a), Real time specification of the battlespace environment and its effects on RF military systems, paper presented at Future Aerospace Technology in Service of the Alliance, AGARD multi-panel symposium, Ecole Polytechnique, Palaiseau, Paris, 14-16 April 1997.

Cannon, P. S., J. H. Richter, and P. A. Kossey (1997b), Real time specification of the battlespace environment and its effects on RF military systems, Invited paper, , in Multi-panel symposium Future Aerospace Technology in Service of the Alliance, edited, NATO-AGARD, Paris.

Cannon, P. S., and R. Norman (1997), The relative performance of numeric and analytic ray tracing, page 145, in 7th Int. Conference on HF Radio Systems and Techniques, edited, IEE, Nottingham.

Cannon, P. S., M. J. Angling, C. Clutterbuck, and G. Dickel (2000a), Measurements of the HF Channel Scattering Function Over Thailand, paper presented at Millennium Conference on Antennas and Propagation, AP2000, ESA, Publications Division, c/o ESTEC, PO Box 299, 2200 AG Noordwijik, The Netherlands, Davos, Switzerland.

Cannon, P. S., M. J. Angling, C. Clutterbuck, and G. Dickel (2000b), Measurements of the HF Channel Scattering Function Over Thailand, paper presented at International AP2000 Conference, Davos, Switzerland.

Cannon, P. S., M. J. Angling, N. C. Davies, T. Willink, V. Jodalen, B. Jacobson, B. Lundborg, and M. Bröms (2000c), DAMSON HF channel characterisation – A review (Invited Review), in MILCOM edited, Los Angeles, USA.

Cannon, P. S., A. K. Shukla, P. C. Arthur, M. J. Angling, and P. L. Cotterill (2002), Towards an HF Prediction Program for Digital Modems, paper presented at Ionospheric Effects Symposium, JMG Associates Ltd, Alexandria, Virginia.

Cannon, P. S., K. M. Groves, D. J. Fraser, W. J. Donnelly, and K. Perrier (2005), Signal Distortion on Trans-Ionospheric Paths: First Results from WIDE, paper presented at Ionospheric Effects Symposium, JMG Associates Ltd, Alexandria, Virginia, USA.

Cannon, P. S. (2008), Awareness, Mitigation and Exploitation of the Ionosphere – A perspective on Ionospheric Effects, in Ionospheric Effects Symposium, edited, JMG Associates, Alexandria, Virginia, USA..

Chan, A. H. Y., and P. S. Cannon (2001), Degradation in neural network prediction models of foF2 with time, paper presented at 11th ICAP, IEE, Manchester.

Davies, N. C., P. S. Cannon, and M. Maundrell (1992), DAMSON -A system to measure multi-path dispersion, Doppler spread and Doppler shift on HF Communications Channels, in Colloquium on High Latitude Ionospheric Propagation, edited, IEE.

Davies, N. C., and P. S. Cannon (1993), DAMSON- A System to Measure Multipath Dispersion, Doppler Spread and Doppler Shift, paper presented at AGARD Symposium on Multi-Mechanism Communication Systems, NATO AGARD/RTO, 7 Rue Ancelle, 92200 Neuilly sur Seine, France, Rotterdam, Netherlands.

Davies, N. C., M. J. Maundrell, P. C. Arthur, P. S. Cannon, R. C. Bagwell, and J. Cox (1997), Modern Aircraft HF Communications - into the 21st Century, I, in Air Ground Communications Colloquium., edited, IEE, London.

Davies, N. C., T. J. Willink, M. J. Angling, and P. S. Cannon (2001), Initial Results from WHISPER; a Wideband HF Ionospheric Sounder for Propagation Environment Research., paper presented at Nordic Shortwave Conference, Enator Inforum AB, S-351 80, Vaxjo, Sweden, Vaxjo.

Dickson, A. H., J. N. Tyler, P. S. Cannon, J. J. Spicer, and P. Wright (1987), BLOSSOM - A technical description of the UK Meteor Burst Communications System, in TTCP STP-8 Workshop on " Meteor Burst Communications in the 1990's", edited by P. S. Cannon, Farnborough, UK.

Dickson, A. H., P. S. Cannon, and J. N. Tyler (1988), BLOSSOM - A technical description of the RAE meteor burst communications system, pages 105 -109, in IEE HF Radio Systems and Techniques Conference Vol 284, IEE, London.

Dickson, A. H., P. A. Arthur and P. S. Cannon, (1991), ROSE - A DSP enhancement to the Barry ionospheric sounder, pages 141-145, in HF Radio Systems and Techniques Conf, Edinburgh, UK, Volume 339, IEE, Edinburgh, UK.

Francis, N. M., A. G. Brown, A. Akram, and P. S. Cannon (1997a), Non-linear prediction of ionospheric parameters important for forecasting the battlespace environment,, in Symposium on multi-sensor systems and data fusion for telecommunications, remote sensing and radar, edited, NATO RTO Lisbon.

Francis, N. M., A. G. Brown, D. Broomhead, P. S. Cannon, and A. Akram (1997b), Non-linear Prediction of Ionospheric Indices (foF2), in Proceedings for Application of AI to STP, edited, Lund, Sweden.

Francis, N. M., A. G. Brown, and P. S. Cannon (1998), Non-linear Interpolation of Missing Points within the Hourly foF2 Time Series, paper presented at Workshop on Space Weather, ESTEC, Noordwijk.

Francis, N. M., A. G. Brown, A. Akram, and P. S. Cannon (1999), Non-linear prediction of hourly foF2 time series and the non-linear interpolation of missing points, in Colloquium No 99, on Frequency Selection and Management Techniques for HF Communications, IEE.

Heaton, J. A. T., P. S. Cannon, N. C. Rogers, C. N. Mitchell, and L. Kersley (1999a), Electron density profiles derived from oblique ionograms, paper 2B6-1 in Ionospheric Effects Symposium, JMG Associates, Alexandria, USA.

Heaton, J. A. T., P. S. Cannon, N. C. Rogers, C. N. Mitchell, and L. Kersley (1999b), Validation of electron density profiles derived from oblique ionograms, pages 341-344, in Conference on Antennas and Propagation, Vol 461, IEE, University of York, UK,.

Jacobsen, B., V. Jodalen, and P. S. Cannon (1998), HF radio propagation at high latitudes, paper presented at Workshop on Space Weather, ESTEC, Noordwijk.

Jacobson, B., V. Jodalen, P. S. Cannon, and M. J. Angling (2000), HF Radio Propagation at High Latitudes Under Quiet and Disturbed Geomagnetic Conditions, paper presented at Eighth International Conference on HF Radio Systems and Techniques, Institute of Electrical Engineers, Guildford, Surrey, UK.

Jacobsen, B., V. Jodalen, P. S. Cannon, M. J. Angling, and O. J. Smith (2001), HF radio propagation at high latitudes: Observations and predictions for quiet and disturbed conditions, paper presented at Nordic Shortwave Conference, Fårö, Sweden, August.

Jodalen, V., T. Bergsvik, P. S. Cannon, and P. A. Arthur (1998), The high latitude performance and availabilities of robust and non-robust modems, using multiple

frequencies, in Nordic HF Conference, HF98, edited, Fårö, Sweden.

Lundborg, B., R. Skartlien, V. Jodalen, B. Johansson, M. Bröms, P. S. Cannon, M. J. Angling, N. C. Davies, and K. W. Moreland (1995), Scandinavian DAMSON measurements of multipath and Doppler characteristics over high latitude HF paths, in Nordic HF Conference, HF95, , edited, Fårö, Sweden.

Lundborg, B., M. Broms, P. S. Cannon, M. J. Angling, N. C. Davies, T. Willink, and V. Jodalen (1996), Measurements of Doppler and multipath effects on high latitude HF paths, pp. 345-349, in RVK 96, edited, Lulea, Sweden.

Mitchell, C. N., L. Kersley, S. E. Pryse, J. A. T. Heaton, and P. S. Cannon (1998a), A new approach to modelling of the main ionospheric trough over Europe using tomographic images, in COST251 Workshop, El Arenosillo, Spain, pp10, 1998.

Mitchell, C. N., L. Kersley, S. E. Pryse, I. K. Walker, and P. S. Cannon (1998b), The role of radio tomography in monitoring the near-earth space environment, paper presented at Workshop on Space Weather, ESTEC, Noordwijk.

Mitchell, C. N., L. Kersley, and P. S. Cannon (1999a), The latitudinal position of the mid-latitude trough - seasonal variations, in 4th COST 251 Workshop, Madeira.

Mitchell, C. N., L. Kersley, S. E. Pryse, C. A. Willson, J. A. T. Heaton, P. S. Cannon, and N. C. Rogers (1999b), Imaging and modelling of the main ionospheric trough using radio tomography, pp 192-195, in Conference on Antennas and Propagation, Vol 461 IEE, University of York, UK.

Moreland, K. W., T. J. Willink, G. O. Venier, P. S. Cannon, N. C. Davies, M. J. Angling, V. Jodalen, and B. Lundborg (1995), Comparison of mid-latitude and high latitude HF channel measurements of Doppler and multipath effects, in Wireless'95, 7th Int. Conf on Wireless Communications, edited, Calgary, Alberta, Canada.

Musman, S., C. N. Mitchell, and P. S. Cannon (2001), Short Term Prediction of TEC, paper presented at Beacon Satellite Symposium, Boston, USA, June.

Norman, R. J., I. G. Platt, and P. S. Cannon (1995), An analytic ray tracing model for HF Ionospheric Propagation, Paper 2-1, in Symposium on Digital Communications Systems: Propagation Effects, Technical Solutions, System Design, CP 574, NATO-RTO, Athens, Greece.

Platt, I. G., and P. S. Cannon (1994), A propagation model for the high and mid-latitude over Europe, pp 86-90, in HF Radio Systems and Techniques, Vol 392, IEE, University of York, UK.

Rogers, N. C., P. S. Cannon, M. J. Angling, J. E. N. Field, and C. Griffin (2005), Validation of an ionospheric pseudo-range error correction model for Galileo, paper presented at Ionospheric Effects Symposium, JMG Associates Ltd, Alexandria, Virginia, USA.

Rogers, N. C., P. S. Cannon, J. A. T. Heaton, C. N. Mitchell, and L. Kersley (1999), Ray tracing through tomographic images of the ionosphere, pp 345-348, in National Conference on Antennas and Propagation, Vol 461, IEE, University of York, UK.

Rogers, N. C., P. S. Cannon, and D. J. Fraser (2006), Wideband modelling and measurement of trans-ionospheric radar waveform propagation, paper presented at Ionospheric Radio Systems and Technology Conference, IET, London, 18-21 July 2006.

Rogers, N. C., and P. S. Cannon (2009), The Synthetic Aperture Radar Trans-Ionospheric Radio Propagation Simulator (SAR-TIRPS), in Ionospheric Radio Systems and Techniques, edited, pp. 112-116, Institution of Engineering and Technology (IET), London, UK, Herriot-Watt University, Edinburgh, UK.

Rycroft, M. J., and P. S. Cannon (1977), Some applications of time series analyses to recordings of radio signals with frequencies between 1 Hz and 10 kHz, in Applications of Time Series Analyses, Southampton University, England.

Shukla, A. K., P. S. Cannon, A. Stocker, and M. Lester (1991), The effect of space diversity on a broadcast meteor burst system, pp 31-34, in HF Radio Systems and Techniques, vol 339, IEE, Edinburgh, UK.

Shukla, A. K., and P. S. Cannon (1993), Seasonal variation of diversity gain in a broadcast meteor scatter communications system, in Ionospheric Effects Symposium, edited, J MG Associates, Alexandria, USA.

Shukla, A. K., and P. S. Cannon (1994), Prediction Model Updating Using the ROSE-200 Oblique Ionospheric Sounder at Mid and Higher Latitudes, paper presented at HF, Radio Systems and Techniques Conf, IEE, York, UK.

Shukla, A. K., and P. S. Cannon (1995), A Jamming and Interception Vulnerability Estimator for HF Communications Systems, in CP 673, NATO-AGARD, Rome, Italy.

Shukla, A. K., P. S. Cannon, and M. Moore (1996), A HF tactical decision aid for conventional and automated radio control systems, in Battlespace Atmospherics, edited, NRAD, San Diego, US.

Shukla, A. K., P. S. Cannon, S. Roberts, and D. Lynch (1997), A tactical HF decision aid for inexperienced operators and automated HF systems, paper presented at 7th International Conference on HF Radio Systems and Techniques, IEE, Nottingham, UK, July.

Smith, O. J., M. J. Angling, P. S. Cannon, J. Jodalen, J. Jacobsen, and O.-K. Gronnerud (2001), Simultaneous measurements of propagation characteristics on non-contiguous HF channels, paper presented at Eleventh International Conference on Antennas and Propagation, IEE, Manchester, UK, April.

van de Kamp, M., and P. S. Cannon (2009), Spatial Decorrelation of VHF AND UHF Trans-Ionospheric Signals Measured at Ascension Island, in Ionospheric Radio Systems Technology, edited, IET, Edinburgh.

van de Kamp, M., and P. S. Cannon (2009), Spatial Decorrelation of VHF AND UHF Trans-Ionospheric Signals Measured at Ascension Island, in European Conference on Antennas and Propagation, edited, Berlin

Weitzen, J. A., P. S. Cannon, J. C. Østergaard, and A. D. Bailey (1991), Seasonal variations in meteoric and non-meteoric duty cycle in the polar cap region, pp 162-166, in HF Radio Systems and Techniques, vol 339, IEE, Edinburgh, UK.

Books and Book Chapters

Cannon, P. S., M. J. Angling, and B. Lundborg (2002), Characterisation and Modelling of the HF Communications Channel, in Reviews Of Radio Science 1999-2002, edited by W. R. Stone, pp. 597-623, IEEE-Wiley.

Cannon, P. S., and P. A. Bradley (2003), Ionospheric Propagation, in Propagation of Radio Waves, Chapter 16, edited by L. W. Barclay, IEE London.

Cannon, P. S. (2003), Ionospheric Prediction Methods and Models, Chapter 17, in Ionospheric Propagation, in Propagation of Radio Waves edited by L. W. Barclay.

Cannon, P. S., M. J. Angling, J. A. T. Heaton, N. R. Rogers, and A. K. Shukla (2004), The Effects of Space Weather on Radio Systems - with a Focus on HF Systems, in NATO Advanced Research Workshop: Effects of Space Weather on Technology Infrastructure, edited by I. Daglis, Kluwer.

Cannon, P. S., and C. R. Harding (2007), Future Military Wireless Solutions, in Wireless Communications - The Future, edited by W. Webb, Wiley, London.

Theses

Cannon, P. S. (1976), A radio receiver for the frequency range 1 Hz to 1 kHz, MSc thesis, University of Southampton, UK.

Cannon, P. S. (1981), A ground based investigation of high latitude ELF radio signals, PhD thesis, University of Southampton, UK

© University of Birmingham 2014