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# Transfinite Systems Ltd

## Company Capability



### INTRODUCTION

Transfinite Systems Ltd is one of the leading consultancy and simulation software companies in the field of radio communications.

Transfinite consultants specialise in:

- Interference and spectrum sharing analysis
- Frequency co-ordination
- Regulatory advice and representation
- Support for spectrum management activities
- Technical training.

Operators and regulatory authorities throughout the world have used our expertise to develop new regulations, improve spectrum management, help protect existing services, facilitate the introduction of new systems, and to gain operating licences.

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### AREAS OF EXPERTISE

#### *Study Work*

Transfinite has extensive experience of study work for a wide range of clients, carrying out analysis of compatibility between satellite and terrestrial systems on topics such as:

- interference and spectrum sharing analysis
- assessing the impact of proposed regulations
- system compatibility
- frequency co-ordination

We have determined the potential for systems to suffer or generate interference, compared the impact of alternative architectures, and derived innovative mechanisms to enable sharing.

Studies have been used to support our clients in their activities at meetings of recognised bodies such as the ITU-R or during coordinations. Transfinite consultants have a proven record in study and research work that meets or exceeds client expectation.

## **Regulatory Advice and Representation**

Transfinite staff have a detailed understanding of the regulatory environment in which our clients operate, having actively participated in many meetings of the relevant bodies including development of regulations.

Our consultants have represented clients at numerous ITU-R and CEPT meetings in recent study cycles. Transfinite consultants have chaired meetings and drafting groups to ensure that work is progressed to the satisfaction of our clients.

Transfinite staff have attended a wide range of ITU-R groups, including SGs/WPs 1, 3, 4, 6, 7, 8, and 9, as well as CPMs and WRCs. We also have attended many CEPT SE, FM, and PT groups and national groups such as UK SGs. We have an in-depth knowledge of their working methods, study methodologies, and procedures, and we have a network of key contacts we can tap into.

We have a detailed understanding of national regulatory issues – for example providing advice to a member of the UK Joint Select Committee reviewing the progress of the Communication Bill and contributing to the Consultation on Spectrum Trading.

## **Spectrum Management and Engineering**

We have a client base that is world-wide and covers a wide range of services and systems. Providing technical support for Visualyse products gives Transfinite staff a deep and broad understanding of the key issues for today's spectrum managers.

We have a detailed understanding of the new techniques emerging for managing the radio spectrum – interference temperature, convergence, auctioning, secondary trading, change of use, UWB, MIMO, common or unlicensed bands, adaptive systems and so forth.

This understanding of different regulatory regimes, new concepts in spectrum management, new technologies, systems, sharing scenarios and study methodologies can be brought to bear on the tasks identified by our clients.

## **Visualyse Products**

As developers of the world's leading range of radio communication and interference study tools, we

have a complete understanding of their workings and potential.

We can use this experience to build complex simulations quickly and efficiently, allowing us to perform sharing studies and analysis of a wide range of communications systems.

We can provide you with "**Quick Sim**" services, to kick-start your studies by rapidly generating baseline simulation files.

The Visualyse product range includes:

- **Visualyse Professional** – the most widely used "Study Tool" for interference analysis.
- **Visualyse GSO** – power and usability to support the coordination of GSO satellites.

- **Visualyse Coordinate** – generate coordination contours and undertake detailed coordination of Earth Stations with terrestrial services.
- **Visualyse EPFD** – the leading implementation of the algorithm in Rec. ITU-R S.1503.

### ***Technical Training***

We can provide technical training in subjects relating to spectrum management and also in use of the Visualyse Product range.

These can be provided either at our offices or on-site, to maximise flexibility.

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## **EXPERIENCE IN SYSTEMS AND SERVICES**

One of the strengths of Transfinite is the wide range of experience of our staff. We have detailed understanding of both terrestrial and satellite systems that allows us to quickly understand our client's needs and rapidly generate solutions.

### ***Terrestrial Systems***

We have studied a wide range of terrestrial systems, from frequencies of around 150 MHz to nearly 50 GHz.

We have worked with Fixed Service systems that are both point-point systems (including line of sight and troposcatter) and point-multipoint, such as Broadband Fixed Wireless Access, and also multi-point to multi-point or

Mesh systems.

We have studied mobile systems including GSM, Business Radio and 3G. We have compared IMT-2000 system architectures and analysed the impact of interference from base stations or handsets, including out of band emissions into sensitive services.

We have analysed interference from unlicensed devices, such as WLANs / Wi-Fi / RLANs and specific standards such as 802.11x and Bluetooth.

### ***Satellite Systems***

We have extensive experience of satellite systems, both GSO and non-GSO at frequencies from 150 MHz to 40 GHz.

Transfinite consultants and associates have extensive experience in coordination of GSO satellites, and have access to the Visualyse GSO tool that allows us to support our clients' activities in the coordination of their satellite or

manage the entire coordination process.

We worked extensively with a non-GSO MSS operator during their design and regulatory approval stages and have an in-depth understanding of issues relating to non-GSO MSS and have a similar understanding of non-GSO FSS.

We have also undertaken sharing analysis with space science and navigation systems and have experience of earth station coordination for both GSO and non-GSO systems.

## **Maritime, Airborne, and other Systems**

Transfinite also has experience in undertaking sharing studies between maritime services, airborne services and other services including satellite and terrestrial.

This includes systems such as the proposed Connexion system, Microwave Landing Systems, and radar systems such as radiolocation and wind profilers.

We also have experience in other services, such as Space Science, Radio Astronomy, Earth Exploration, ... and almost all those in the Table of Allocations of the ITU-R Radio Regulations.

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## **EXAMPLE STUDIES**

Transfinite have a successful track record of previous consultancy studies for clients that include Ofcom / Radiocommunications Agency, Alcatel, New Skies Satellites, Qualcomm Wireless Business Solutions, ICO Global Communications, Inmarsat, Intelsat, Boeing Space Systems, and Comsat.

An example of the range of Transfinite's expertise can be shown from the list of topics that Transfinite have addressed for one particular client, Ofcom (and previously for the Radiocommunications Agency):

- Analysis of methods of defining Spectrum Usage Rights (SURs) in a way to allow flexibility while protecting licensees from interference.
- Series of studies to determine the feasibility of sharing the band 14.0 - 14.5 GHz between the Fixed Service and the Aeronautical Mobile Satellite Service.
- Study of how to evaluate spectrum occupancy and efficiency for systems operating in licensed-exempt allocations including the 2.4 GHz band.
- Inputs to the consultations on Spectrum Trading and the Radio Spectrum Management Review.
- Series of studies of sharing between satellite and terrestrial IMT-2000 systems including between HEO broadcast satellite service and IMT-2000 systems.
- A study to compare potential architectures for IMT-2000 infrastructure.
- A study to assess sharing between the Fixed Service and other services at 32 GHz.
- A series of studies sharing the 43 GHz band between Radio Astronomy Service and Multimedia Broadband Fixed Wireless Access (BFWA) systems.
- A series of studies of interference between multiple non-GSO systems and GSO FSS systems.

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## **CONSULTANT PROFILES**

The lead consultants of Transfinite are Ian Flood, John Pahl and John Parker.

## **Ian Flood**

Ian Flood is an experienced engineer specialising in spectrum sharing studies and interference management problems.

Working for the Radiocommunications Agency and then Ofcom in the UK, Ian was responsible for the development of frequency assignment criteria for microwave fixed links.

Since joining Transfinite in 2013, Ian has worked on studies involving Wi-Fi, fixed links, satellite services and mobile services. Specific problems include adjacent channel compatibility between mobile and fixed satellite services, interference from terrestrial mobile networks into mobile satellite user links and the development of a mathematical method for precise service apportionment in spectrum sharing and compatibility studies. His work includes representation at various fora including within CEPT and ITU.

Ian is a Chartered Engineer and holds a PhD in graph-theoretic studies. He is a member of the Institution of Engineering and Technology and the London Mathematical Society. He has published several peer reviewed journal papers and other articles on aspects of spectrum engineering.

## **John Pahl**

John Pahl has a Master's degree in Mathematics from Cambridge University and over 20 years' experience in the Satellite Communications industry. John was a founding director of Transfinite Systems and led the development of Visualyse Professional and Visualyse Spectrum Manager.

John Pahl is recognised within the industry as an authority on spectrum management issues and in particular modelling the behaviour of radio communication systems. He has a track record in developing innovative solutions and new methodologies that can be used to manage and analyse compatibility between radio systems.

He has written papers on subjects related to spectrum issues which have been published in peer reviewed journals and given presentations at industry conferences. He has chaired meetings at forums such as the ITU-R and participated in panel sessions and familiar within the wider industry at a global level. John understands how involvement in these bodies can assist in an organization's objectives, and how to develop a plan to manage an organisation's requirements.

John has led Transfinite's Consultancy activities and has first-hand, detailed and thorough knowledge and experience of:

- Technical analysis, considering topics such as interference analysis, coordination studies, system design, radiowave propagation, spectrum efficiency, and spectrum occupancy.
- Characteristics of a wide range of systems and services, from satellite (GSO, non-GSO, and HEO), terrestrial (including IMT-2000, FS, BFWA, Wi-Fi, ENG, and UWB) and others including maritime and aeronautical.
- Regulatory issues, including review of the Communications Bill that founded Ofcom, chairing ITU-R groups that developed Recommendations, detailed understanding of working practices of international forums such as CEPT and ETSI and their instruments including the Radio Regulations.

- Management, leading a team and responsible for allocation of resources to projects.

John Pahl is the author of the book "Interference Analysis: Modelling Radio Systems for Spectrum Management".

### ***John Parker***

John Parker is a founding director of Transfinite Systems. He has worked in the field of radio communications since 1990 and has a solid academic background in theoretical physics and an MBA with a specialisation in Financial Strategy.

John has a First-Class degree in Astrophysics and a Doctorate in Theoretical Physics. His PhD concentrated on aspects of theoretical particle physics. After graduating he spent 18 months in post-doctoral research and 6 months in simulation modelling of nuclear fast reactor cores, before beginning to work in the satellite communications industry at Eutelsat in 1990. He is an expert in radiocommunications and satellite communications systems analysis.

John worked on the original specification and development of the Visualyse product range in the early 1990s and has continued to support the Visualyse user community since then. John has developed and delivered training courses for Transfinite and other training bodies. Courses cover Satellite Coordination procedure, theoretical elements of interference analysis, ITU-R structures, and procedures as well as all technical aspects of Transfinite's software range.

John has in depth experience of the ITU-R process, having represented clients in Study Groups 4 and 3, Working Party 9D, JRG8/9, and also at the TIA in Washington. John's analytic ability is complemented by his experience in the international arena and ability to present a technical case clearly and authoritatively.

John also works as a business advisor and mentor to SMEs and start-ups, providing support in company formation and in the definition of routes to market for innovative products and services.

### ***ASSOCIATES***

Transfinite has developed a network of Associate Consultants that provide us with access to the leading experts in the industry. Contact us for more information about the Transfinite Associate Consultant network.

## **CONTACTS**

For further information about Transfinite products and services, please contact us at:

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