

# Global satellite communications technology and systems

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This special issue of *Space Communications* contains nine papers derived from a study, 'Global satellite communications technology and systems', sponsored by NASA and the NSF. The purpose of this study was to compare the position of the US in commercial satellite communications technology, research, development and markets with that of the rest of the world. It included visits to over 65 satellite manufacturers, service providers and R&D Institutes located in North and South America, Europe, Asia and Africa. These papers include overviews and country by country material on R&D activities, technology status, markets and trends from this study. The conclusions of this panel indicate that the US continues to have a strong presence in this large and rapidly growing global industry but that European and Asian entities are making significant investments in their manufacturing and R&D activities and are becoming major participants in this satellite communications industry. The migration of US aerospace corporations from being primarily manufacturers of spacecraft to being primarily satellite service providers could serve to undercut necessary longer term R&D to develop new technologies.

## 1. Introduction

This special issue of *Space Communications* consists of nine papers

- Global satellite communications technology and systems – An overview, by A.U. Mac Rae and J.N. Pelton
- Key trends in the field of global satellite communications, by J.N. Pelton and A.U. Mac Rae
- Market forces and future drivers, by J.V. Evans
- Key technology trends – Satellite systems, by C.W. Bostian, W.T. Brandon, A.U. Mac Rae, C.E. Mahle, S.A. Townes
- Key technology trends – Ground terminals, by W.T. Brandon and C.E. Mahle
- Launch systems, by A.U. Mac Rae
- Satellite network technology, by D.M. Chitre and J.V. Evans
- Key policy, regulatory and standards issues in global satellite communications, by J.N. Pelton and K. Bhasin
- International cooperation and country-by-country assessment, by N.R. Helm, A.U. Mac Rae, C.W. Bostian and C.E. Mahle.

A study, 'Global satellite communications technology and systems', was sponsored by the National Aeronautical and Space Administration (NASA) and the National Science Foundation (NSF) and administered by the WTEC Division of the International Technology Research Institute of Loyola College, Baltimore, MD. The purpose of this study was to compare the position of the United States in commercial communications satellite research and development, technology, systems and markets with that of countries located all over the globe and report thereon [1]. These papers are an updated result of this study. For the sake of completeness, background material on numerous topics is also included.

A similar study was conducted and reported on in 1992 [2], with the conclusion that the US satellite communications industry was at risk of losing its leading position in several critical satellite technologies and that its leading market position was at risk. Clearly,

the US market position is now stronger than ever, with the US financial environment supporting new satellite ventures and the US satellite manufacturers delivering a majority of the commercial satellites. However, the US has lost its leading position in the launching of commercial satellites to the European backed Arianespace, Inc. The panelists of this present study concluded that commercial satellite communications is a large and rapidly growing industry, with direct TV broadcast, mobile and Internet related applications contributing to much of this growth. They observed that this industry is becoming increasingly global, with satellite communications being an integral part of the communications systems of most countries. In addition, many parts and subsystems of satellites are provided by global suppliers for assembly into the final manufactured satellites. Recognizing that this has become a large, global industry, many countries have increased their R&D and expanded their manufacturing capability in this field. The panelists expressed concern that the US position in satellite R&D is not strong compared with the rest of the world and that this failure to support a strong R&D program may eventually result in further erosion of the US market share. The filing for bankruptcy by the mobile satellite ventures Iridium and ICO, has weakened the enthusiasm of the investment community for new satellite business concepts and this is disturbing. While the US position in the manufacture of communications satellites and in the development of new services and applications continues to be strong, this position may be in long term jeopardy, based on the present level of investment in satellite R&D and facilities by several nations.

## 2. Panel composition

The members of this panel consisted of experienced satellite technologists and scientists from industry, government and academia. Their names and affiliations are:

- Dr. Joseph Pelton (Chair of study), Director of the Accelerated Masters Program in Telecommunications and Computers and Research Professor, Institute for Applied Space Research, George Washington University. He is also Director of the Arthur C. Clarke Institute for Telecommunications and Information (CITI). He currently is Chairman of the Board of the Triana Worldcast Corporation and also on the Boards or is a Senior Advisor to a number of other space and electronics related start-up companies. He is a former Chairman of the Board and Dean of the International Space University and has been elected to full membership in the International Academy of Astronautics.
- Dr. Alfred Mac Rae (Chair of study), Mac Rae Technologies, Berkeley Heights, NJ, consultant, Senior Research Scientist at the Institute for Applied Space Research at George Washington University and retired Director of Satellite Communications, AT&T Bell Laboratories. He is a Fellow of APS and IEEE; Scientific Fellow-Böhmische Physikalische Gesellschaft.
- Dr. Kul Bhasin, Chief, Satellite Networks and Architectures Branch, NASA Lewis Research Center, Cleveland, OH.
- Dr. Charles Bostian, Director, Center for Wireless Telecommunications, Virginia Tech, Blacksburg, VA.
- Mr. William Brandon, Principal Engineer, the MITRE Corporation, Bedford, MA.
- Dr. John Evans, Vice President and Chief Technical Officer, COMSAT Corp., Bethesda, MD.
- Mr. Neil Helm, Deputy Director, Institute for Applied Space Research, George Washington University, Washington, DC.
- Dr. Christoph Mahle, Communications Satellite Consultant, former Vice President of the Satellite Systems and Technologies Division, COMSAT Laboratories, Washington, DC.
- Dr. Stephen Townes, Deputy Manager, Communications Systems and Research Section, Jet Propulsion Laboratory, Pasadena, CA.

## 3. List of institutions visited

The panelists either visited or interviewed over 60 satellite manufacturers, service providers and R&D institutions located in North and South America, Europe and Asia. These organizations are:

### *North and South America*

Aerospace Corporation  
Boeing (2)  
COM DEV  
Communications Research Center  
COMSAT  
FCC

Hughes Space and Communications Company  
 Hughes Network Systems  
 Instituto Nacional De Pesquisas Espaciais, Brazil  
 Iridium  
 JPL  
 L-3 Communications  
 Lincoln Laboratory  
 Lockheed Martin  
 Motorola Satellite Communications Group  
 NASA Goddard Space Flight Center  
 NASA Headquarters  
 NASA Lewis Research Center  
 NTIA, Dep't of Commerce  
 Orbital Sciences, Corp  
 Qualcomm  
 Space Systems Loral, Corp  
 SPAR Aerospace  
 Teledesic

#### *Europe*

AEG Electronische Rohren  
 Alenia Spazio  
 Bosch Telecom  
 Centre National d'Etudes Spatiales (CNES)  
 Cometa  
 Contraves  
 Daimler Benz Aerospace  
 European Space Agency (ESA)  
 European Space Technology Center (ESTEC)  
 International Maritime Satellite Organization  
 (Inmarsat)  
 Krasnoyarsk State University  
 Matra Marconi Space (France)  
 Matra Marconi Space (UK)  
 Moscow Aviation Institute  
 Nuova Telespazio  
 Third Ka Band Utilization Conference

#### *Africa, Israel*

Gilat  
 Israel Aircraft Industries

#### *Asia, Japan*

Communications Research Lab  
 Fujitsu  
 Institute of Space & Aeronautical Science (ISAS)  
 Japan Satellite Systems  
 Kansai Advanced Research Center (KARC)  
 Kokusai Denshin Denwa (KDD)  
 Ministry of Post and Communications

Ministry of International Trade and Industry  
 Mitsubishi Electric  
 National Space Development Agency of Japan  
 (NASDA)  
 NEC  
 Nippon Hoso Kyokai (NHK)  
 Nippon Telegraph and Telephone (NTT)  
 Space Communications Corporation (SCC)  
 Toshiba

#### *Asia, Korea*

Electronic & Telecommunications Research  
 Institute (ETRI)  
 Halla Engineering and Heavy Industries, Ltd  
 Hyundai Electronic Industries Co., Ltd (HEI)  
 Korea Aerospace Research Institute (KARI)  
 Korea Advanced Institute of Science & Technology  
 Satellite Technology Research Center  
 Korea Telecom  
 LG Electronics  
 Ministry of Information and Communication (MIC)

#### *Asia, India*

India Space Research Organization

#### **Acknowledgements**

The authors of the papers in this special issue on global satellite communications technology and systems would like to thank Ramon DePaula of NASA and Steve Goldstein of NSF for their support of this study. In addition they would like to thank the Advisory Committee, drawn from the US aerospace and telecommunications industry, of Thomas Brackey, Burton Edelson, Hans-Werner Braun, Stephen Burrin, Frank Gargione, Robert Kinzie, Peter Swan, Prakash Chitre, Len Golding, Wilbur Pritchard, Randolph Bricker, Chris Hoerber and Walda Roseman, who provided guidance to the panel and reviewed the original draft of the WTEC report. Special gratitude is expressed to Geoffrey M. Holdridge, R.D. Shelton, Chris McClintick and the staff at WTEC for their organization of this study, for travel arrangements and the detailed preparation of the original report. Chris McClintick helped in the insertion of many of the figures in the present papers. The authors would like to express their sincere appreciation to the Editor-in-Chief of this journal for his stimulation, guidance and assistance in the preparation of this issue.

These papers are based on material extracted from the WTEC Panel Report Global Satellite Communications Technology and Systems, December 1998 [1]. The help of the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF) and the International Technology Research Institute of Loyola College in Maryland is appreciated.

## References

- [1] J.N. Pelton, A.U. Mac Rae, K. Bhasin, C.W. Bostian, W.T. Brandon, J.V. Evans, N.R. Helm, C.E. Mahle and S. Townes, Global Satellite Communications Technology and Systems, 1998, This report is available on <http://itri.loyola.edu/satcom2/> and the National Technical Information Service of the Dep't of Commerce. Published by the WTEC Division of International Technology Research Institute Of Loyola College, 4501 N. Charles St., Baltimore, MD.
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