



UK Capabilities: Looking back to look forward

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Aneurin Bevan who established the NHS on 5th July 1948 was reported as saying:

“If you want to see the future, don’t look in the crystal ball, look back at history!”

In 1974

There was a looming oil (energy) crisis and a shortage of radio spectrum for mobile radio. RF bandwidth for FM and AM had been reduced to 12.5kHz at VHF and 25kHz at UHF. What next as demand growing rapidly for PMR and bandwidth reduction no longer possible?

Applied in 1974 to the then Science Research Council (SRC) for a research grant

What could I do if anything as a young researcher?

I applied for and obtained a grant for £9,600 to undertake the “Computer simulation of multipath fading in the mobile radio environment and means for its reduction” based on a topographical description of the radio environment.



PDP8e Mini computer and signal sampling kit linked to an ICL4-50 mainframe

Mobira Securicor RC25 (or Mobira BT Emerald MC25 radiophone)



Cartesian Loop Lineariser Chip Securicor/LMT

N.B.: Did you know that a second
Cartesian Loop chip was designed
for Ericsson under an NDA with the
CCR at Bristol by Plessey
Semiconductors in Swindon



Tokyo Skytree Tower, Sumida City

- The Tower houses 3 Toshiba Digital Video Broadcast RF power amplifiers covering Metropolitan Tokyo area
- Based on the original research of Toshiba Research Bristol in collaboration with University of Bristol
- RF PAs were so efficient they did not require water cooling saving a large amount of energy for such a tall tower



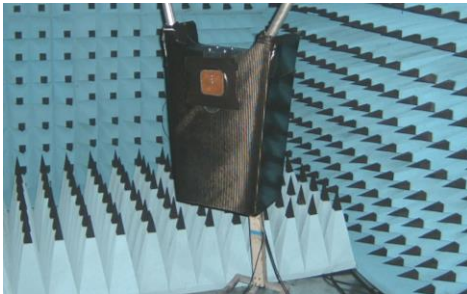
Further achievements associated with SRC Award



Speech Scrambler



Wideband CDMA (pre 3G)



Conformal Antennas



Selection of key achievements

- Raytracing for network planning
 - Outdoor, indoor, hotspot...
- State of art RF Power Amplifiers
 - Highly linear, power efficient
- Linear modulation techniques for high throughput data wireless communications, e.g., HIPERLAN and 802.11
- Smart antenna arrays
 - Diversity, SIMO, MIMO, testbeds
- Wideband Code Division Multiple Access (WCDMA) and Block Spread CDMA for use in 3G and 4G mobile systems respectively
- Spatial temporal propagation measurements and prediction
 - Modeling and measurement
- Physical layer/MAC layer interactions
 - Novel protocols and radio resource management
 - Smart Metering/Smart Grid and HEMS
 - SDR commencing with the Intel 2920 in 1979

FIVE LIVES IN ONE

An Insider's View
of the
Defence and
Intelligence World



PROFESSOR R. BENJAMIN CB

Professor Ralph Benjamin CB FREng (1922 – 2019)

Professor Ralph Benjamin CB FREng was a visiting Professor at the University of Bristol following his retirement from GCHQ where from 1971 he held the position of Senior Superintendent Director and Chief Scientist. He was Security Advisor to Margaret Thatcher. During World War 2 he joined the Royal Naval Scientific Service to work on the secret development of radar. In 1960 at the age of 37 he became Deputy Chief Scientist at the Admiralty Surface Weapons Establishment and in 1964 at the age of 41 he became Chief Scientist at the Admiralty Underwater Weapons Establishment. At Bristol, he collaborated with Prof Joe McGeehan and his research teams within the Centre for Communications Research on a range of projects in communications, networks and medical electronics. He was awarded the honorary degree of Doctor of Engineering in July 2000.



Enabling Next Generation Industrial Internet

Please contact:
Professor Mahesh Sooriyabandara, MD of Bristol Research
& Innovation Lab, Toshiba Europe Limited for more details
on the IIoT Testbed

Four Observations!

- Next Gen Industrial Internet -Thinking beyond Data and AI
 - Building eco-systems and lowering barriers
- Greening the Aerospace industry – The unsolved carbon challenge
 - Accelerating innovation in electric aircraft industry
- Semicon – Will it be new “oil” or “data” industry?
 - Core building block of Industrial and consumer internet ?
- Analogue in a digital world
 - Addressing limits faced by digital technology

•6G – Industry Opportunities and Tech/logistical Challenges

•Towards CPS technology Company



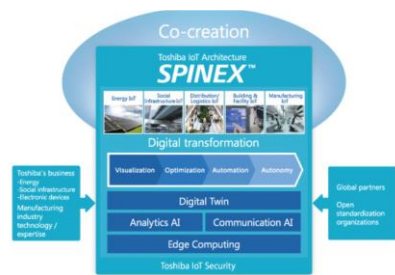
Energy



Semi Conductor



Infrastructure



ICT

Toshiba Group's Vision

Become world's leading CPS*¹ technology company, ensure profitability by implementing the Toshiba Next Plan

2018

Secure core earning power,
Grow with technology
Toshiba Next Plan

Infrastructure
Energy
Storage & Electronic Devices
Industrial ICT solution
R&D

2023

Help solve social issues
Maximize enterprise value

An excellent company
with core earning power
and growth potential

Contribute to social development
through the combination of cyber
& physical technologies

Evolution

Incubation

2028

2030

World's
Leading CPS
Technology
Company

SUSTAINABLE
DEVELOPMENT
GOALS

2030年に向けて
世界が合意した
「持続可能な開発目標」です



Open Programmable IIoT Testbed in South Gloucestershire



Industrial IoT Testbed



230 Edge Nodes

5 Use Cases

7.2 Km Network

1000+ Wireless Radio Nodes

20+ Robotics Nodes

1500+ Sensors

2 Industrial 5G Networks

10+ Industrial Sectors supported

100 Edge AI Nodes

LoRA, Federated Learning, 5G, AI, IoT, Virtualisation, Edge Computing, Security, Localisation

R&D Network

South Gloucestershire Council, Toshiba Europe Ltd and the West of England Local Enterprise Partnership are investing to revolutionise the research and development capacity of the South West of England.

UMBRELLA has created open... universal... internet of things testbed that will act as a globally-significant R&D playground. There will be field trials for 5 use cases, demonstrating network capabilities including areas of; Multi-Radio Connectivity, Private 5G, City Sensing, Collaborative Robotics, Remote Maintenance.

The playground of the future

UMBRELLA will be open and programmable. It will deploy more than 200 modular IoT units across the testbed area, each providing state-of-the-art IoT enabling technologies and with the capability to remotely configure to develop a broad range of use cases to support investment in the future of mobility, low carbon technology, healthcare, robotics and much more.



Reflections

The UK has had a long history of leading edge innovation in many areas of Electrical and Electronic Engineering including RF Engineering and Communications, Electromagnetics and Antennas, Networks, Semiconductors and Device Technology. Going forward we have to select areas for funding that are capable of being transformed from research to products and services that will create wealth and jobs. All of the above areas still amongst our research strengths and in particular activities such as RF power amplifiers, IIoT, autonomous systems and AI, SDN, compound semiconductors, wireless and optical devices and systems, Reflective Intelligent Surfaces (RIS) and Software Defined Materials should be part of our consideration for support.



A sincere thank you to all my colleagues and former colleagues at Plessey Research (Caswell), University of Bath, University of Bristol and Toshiba for their contribution, support and collaboration over many years.

