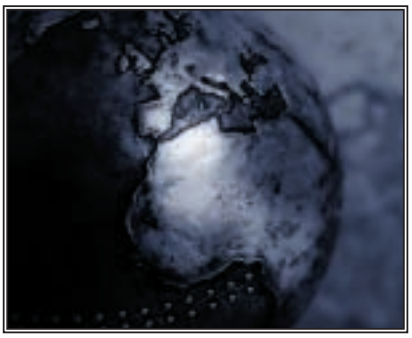


Digital Defences

When programme managers purchase test equipment for a military system that may take five or more years to develop, appropriate test systems often have to perform outside the normal parameters of electronic equipment and could be obsolete even before they are deployed. Teradyne helped one defence specialist, Marconi Selenia Communications, to leverage the power and openness of its Digital Test Instrument and create a flexible, future-proof test solution for defence applications across the globe.

Marconi Selenia Communications, a Finmeccanica Company, has a long tradition in the field of defence communications dating back to early 1900 when military forces came to understand the importance of radio communications still in its infancy. The inventor of the radio and Nobel Prize winner, Guglielmo Marconi, founder of the Wireless Telegraph and Signal Company in 1897 and of the Officine Marconi in Genoa in 1906, was asked to market apparatuses and communications systems for the defence sector. These two companies are the forerunners of Marconi Selenia Communications (formerly known as Marconi Mobile).

Marconi Selenia Communications is a leading supplier in the defence communications sector world wide, meeting the needs of Defence Ministries, NATO Agencies, Ministries of Home Affairs and other Government Agencies. The company designs, manufactures and supplies communication and information systems, primarily for defence and security applications, including ground, naval, avionic communication / command and control systems.

Marconi Selenia Communications had sales of £308 million (Euro 502 million) in the financial year ended 31 March 2002 and currently employs about 4,000 people world wide. Its main offices and manufacturing plant are located in Italy, the UK, Germany and Turkey. Based in Northern Italy, Marconi Selenia Communications has responsibility for developing cockpit communications, 'mission' equipment, identification and navigation equipment for a wide range of military transport. The GPATE (General Purpose Automatic Test Equipment) platform developed by the company is based on flexible architecture and designed to be easily reconfigured and upgraded to cope with variances in product test requirements and field conditions.

Alessandro Buzzoni, a Systems Engineer at Marconi Selenia Communications, explains, "A good example of our customers' typical requirements is the EH101 helicopter, widely used in European and Canadian defence forces. The GPATE system can be configured to test numerous Line Replaceable Units (LRUs), a term which we use to describe the 'black boxes' which contain the various communications and control systems on board the aircraft. Teradyne's M910 Digital Test Instrument (DTI) forms a key component within the system and required tight cooperation and development between Marconi Selenia Communications, Teradyne and local test specialist, Test Technologies, to enable full integration. Within each LRU there will be a number of SRUs (Shop Replaceable Units) which will be tested and repaired in workshops in the field or at a local base, down to component level in some cases. For SRU testing more complex communication is needed and has required even greater effort. The custom serial bus on the EH101 computer system is RS422 compatible but with a 2.5MHz clock and separate clock, sync and data lines. Each unit transfers data to other LRUs but not always using the same timing or protocols. Testing each unit therefore requires a test system which is adaptable to these differences."

Mattia Lugari, Avionic Test Systems R&D Manager at Marconi Selenia Communications describes the project further, "In the development of GPATE, two areas required high levels of knowledge - the switching matrix and the Digital Test Unit. Collaboration was an important part of increasing our knowledge in both areas. The system needed access to digital tests via a number of non-standard busses which are typically used on LRUs in military aircraft. There can be as many as 15 separate systems, and often the communication

> *We chose to integrate an existing digital test instrument rather than develop our own, which gave us considerable development savings.*

busses do not have standard timing signals or I/O protocols, so we needed a facility which could be modified quickly in software to cope with unexpected test requirements. We chose to integrate the existing digital test instrument from Teradyne, rather than develop our own, which gave us considerable development savings."

"Teradyne is a market leader in Europe with bases in Paris, London, Milan and Munich. Each location has teams of specialist engineers with expertise in Military / Aerospace markets, and longstanding relationships with local contractors around Europe," says Gianpaolo Peiretti, Marconi Selenia Communications Marketing Manager. "The collaboration with Teradyne and Test Technologies was important for developing and increasing our knowledge. The challenge was to create a software interface that would link the high level ATLAS test development environment used on GPATE, with Teradyne's digital drivers, which required significant work on timing and translation functions."

Beside the flexibility of Teradyne's DTI which drove the technical team's decision, Marconi Selenia Communications was interested in the widespread utilisation of Teradyne's DTI on Military / Aerospace programmes and the long term commitment they could gain. Teradyne's M9-Series DTI consists of versatile C-size VXI instruments for high-performance digital testing which provides customers unparalleled flexibility. With a VXI*plug&play* software driver and hardware that complies with VXI interface standards, M9-Series instruments integrate easily with other instruments in VXI-based test systems. Though the M9-Series

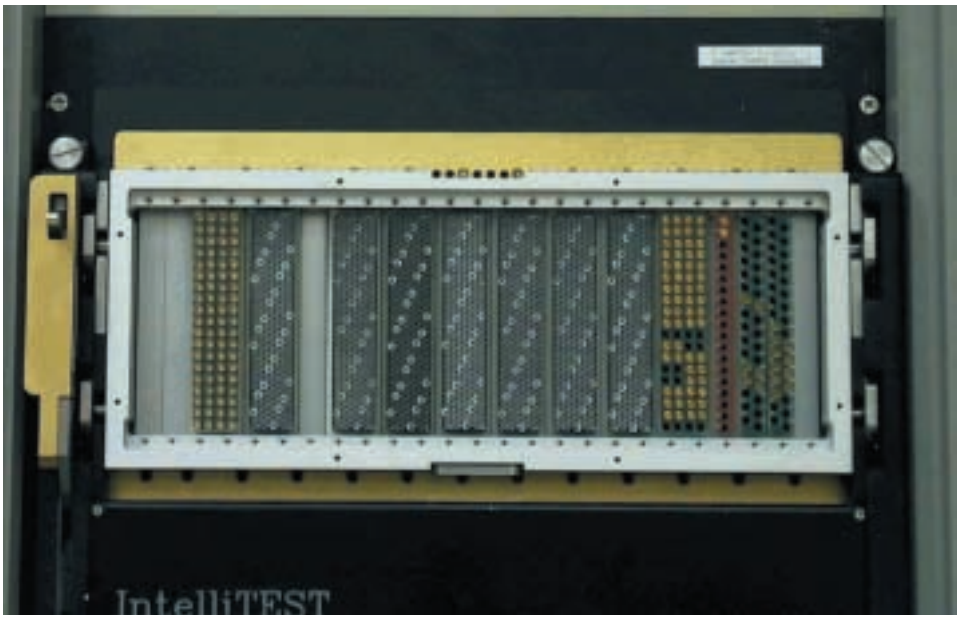
The project development team meeting at Marconi Selenia Communications - from left to right: Pantano (Teradyne), Gatti (Test Technologies), Peiretti, Lugari and Buzzoni (Marconi), with founder Guglielmo Marconi pictured above.

attracted Marconi Selenia Communications for its high performance and flexibility, the key aspect of their decision was the widespread usage of this unit in Military/Aerospace programmes world wide. Adopting this solution gives Marconi Selenia Communications access to a technology that can be used in other international programmes.

M9-Series instruments consist of one central resource board (CRB) and up to 11 channel cards. The CRB supplies clock generation, central timing, guided probe, and other instrument-wide functions. The instruments are self-contained and require no external power or circuitry outside of the VXI backplane-simplifying integration into larger test systems. M9-Series instruments accurately emulate complex test signals and reliably deliver tests to the UUT, significantly reducing the time required to develop or translate test programs.

When programme managers purchase test equipment for a military system that may take five or more years to develop, the test systems could be obsolete even before they are deployed. Teradyne was able to help leverage the power and flexibility of the DTI on legacy programs as well as new ones. The modularity and openness of the software fostered close teamwork between customer and vendor to deliver the solution.

Teradyne's technical development team worked closely with Milanese specialist, Test Technologies, to create the software interface. Test Technologies employs 20 people in total and is more than just a test house, providing a wide spectrum of services which are focussed on the defence market. Iber Gatti, Project Manager and Daniele Basile, Engineering Manager at Test Technologies, explain how the timing issue was overcome: "It wasn't



possible for us to use standard clock timing signals to synchronise the collection of data from the LRU, so we used a system of 'counting' data in order to find the start of each packet of information, effectively checking for new data in a continuous loop. Once we overcame the timing problems it was then a matter of developing a database of parameters to interface standard ATLAS software instructions to the low level API functions supported by Teradyne software drivers."

"The result is impressive since we now have the ability to emulate a Synchronous Serial Interface electronically compatible with RS422 but with the ability to test a wide range of avionic busses, often with non-standard protocols and timing requirements, with a single test solution," says Lugari.

The two year project continues Marconi Selenia Communications' work towards creating a common test architecture for the world's defence industry. But the company is not just a manufacturer. Marconi Selenia Communications is involved in a European team, comprising EADS Test & Services in France, EADS Airborne Systems in Germany and Stork Fokker Services in the Netherlands, for the NH90 European Helicopter GPATE. The team has been awarded with a contract for a feasibility study of a "common interface between different GPATEs" in order to get a high exchangeability of the applications (both hardware and software). The NH90 is the largest collaborative avionics study of its kind and involves five EEC partners. The test specifications that will be developed as a result of the study will ultimately cover testing of up to 60 LRUs.

"The challenge is to identify common test interface requirements between the many systems being used on the NH90 aircraft and the regional requirements of future customers. In particular there is a requirement to be able to share the test applications between test systems in different nations (including proprietary French, German and Italian systems)," explains Peiretti.

Needless to say, the skills and knowledge of Teradyne's Military / Aerospace team will continue to be a valuable asset for Marconi Selenia Communications and it is not surprising that the partnership between the two companies is one that will develop over many years to come.

M9-Series of VXI Digital Test Instruments

M9-Series instruments consist of one central resource board (CRB) and up to 11 channel cards. The CRB supplies clock generation, central timing, guided probe, and other instrument-wide functions.

The channel cards, configurable with any VXI*plug&play* slot 0 controller, plug into contiguous backplane slots to provide up to 704 bidirectional, programmable-voltage digital test channels in a single 13-slot C-size VXI chassis. Channel cards can be added in the field, expanding pin count while maintaining TPS compatibility.

M9-Series instruments are self-contained and require no external power or circuitry outside of the VXI backplane — simplifying integration into larger test systems and minimising cost, size, and weight.

With a distributed-resource architecture and optimised data handling, M9-Series instruments set a new standard for digital functional testing in VXI-based systems.

The M9-Series is fully compliant with the C-size VXI standard (IEEE Std 1155-1992) interface specifications. The VXI bus supports all internal and external communications, including synchronisation and triggering for bus testing, mixed-signal and precision digital testing.

The VXI*plug&play* software driver supports a soft front panel and programmatic interface to all Windows NT Applications Development Environments (ADEs).

M9-Series instruments accurately emulate complex test signals and reliably deliver tests to the unit under test, significantly reducing the time required to develop or rehost test programs.

Benefits:

- No-compromise In-Circuit Test
- Highest-performance digital test capabilities available in a fully compliant C-size VXI instrument
- VXI*plug&play* driver supports all Windows NT Framework Application Development Environments
- Choice of 25 or 50 MHz channel cards offers solutions for a range of performance requirements
- Programmable logic levels of up to +/- 30 V
- Up to 704 bidirectional, programmable-voltage digital test channels in a single C-size VXI chassis
- Superior timing and voltage level flexibility allows accurate emulation of complex system waveforms
- High-throughput testing of complex digital modules, boards, and boxes
- Fast, accurate fault isolation using guided probe and fault dictionary
- Direct import of SVF and LASAR-generated test vectors for efficient test development
- Rugged, easily maintainable design minimises support costs

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