The Ultra Electronics Group manages a portfolio of specialist capabilities, generating highly-differentiated solutions and products in the DEFENCE & AEROSPACE, SECURITY & CYBER, TRANSPORT and ENERGY markets, by applying electronic and software technologies in demanding and critical environments to meet customer needs.

Ultra businesses constantly innovate to create solutions to customer requirements that are different from and better than those of the Group’s competitors. By applying these differentiated solutions to a wide range of international platforms and programmes, Ultra has built an exceptionally broad range of specialist capability areas. Where the Group has a number of complementary capabilities it can also combine these to offer wider solutions. Furthermore, the products, capabilities and the associated domain expertise uniquely position Ultra to be able to provide system and sub-system solutions. These solutions are underpinned by through-life management support offerings that ensure the capabilities are delivered and sustained in-service. The Group has an active programme of reinvestment of funds to strengthen its capabilities in its specialist markets.

Ultra offers solutions to its customers through the design, delivery and support phases of a programme. Ultra’s businesses have a high degree of operational autonomy so that they provide exceptionally agile and responsive support to customers and partners normally associated with a smaller business. These benefits of customer focus and agility are augmented by the access to wider and complementary technology and expertise that lies elsewhere in the Group and by Ultra’s strong financial position.

Ultra’s advanced underwater systems are developed to overcome the unique challenges of the underwater environment. The Group’s innovative solutions deliver dominance in the underwater battlespace, providing a critical operational advantage to its customers.

Sonar systems
For surface ship applications, Ultra has developed sonar systems that range from standalone hull-mounted and towed sonar installations to fully-integrated sonar suites, comprising hull-mounted and towed arrays, off-board sensors, and torpedo defence. This modular system fuses data from own-ship and off-board sensors to build a complete underwater tactical picture delivering a complete multistatic sonar capability. Ultra’s hull-mounted sonar with variants for bow, keel, and shallow-water craft can be combined with either its unique single tow active/passive array or with a more traditional dual tow solution. Either offering can incorporate Ultra’s torpedo detection and countermeasure capabilities.

Torpedo defence
Ultra is a world leader in towed torpedo detection. Drawing on its expertise in active and passive anti-submarine warfare (ASW) signal processing, Ultra has designed innovative signal processing algorithms for automatic detection, classification, and tracking of ASW threats. In the face of a range of advanced threats, Ultra’s family of acoustic countermeasure expendables include mobile and hovering devices that are specifically designed to complement towed systems, such as the SLQ-126 Hirsch and Ultra’s own towed torpedo defensive countermeasures system. Ultra’s Defender and Defender 2 represent the next generation of acoustic torpedo countermeasures.

Acoustic torpedo countermeasures
Ultra provides a range of towed and expendable off-board acoustic countermeasures systems to ensure the survivability of ships and submarines in the face of a range of advanced threats. Ultra offers a complete range of acoustic countermeasures to traditional naval vessels, including development of miniature sonobuoys optimised for use from unmanned underwater vehicles (UUVs). Ultra’s innovative signal processing algorithms and target classification architecture allow for the detection of a wide range of threats, from mine-like threats to advanced acoustic countermeasures. Ultras’ Sonobuoys and Sonobuoy Receivers
Sonobuoys and sonobuoy receivers
Ultra is the world’s leading provider of sonobuoys, with its products spanning the entire spectrum of types and sizes, including development of miniature sonobuoys optimised for use from unmanned underwater vehicles. In parallel, Ultra’s proven range of sonobuoy receivers extends from very lightweight helicopters to maritime patrol aircraft sonobuoy receivers. To the wideband software-defined receiver, Ultra’s multi-mission active capability enhances the detection of extremely quiet submarines, in both deep and littoral waters, by using a field of active and passive sonobuoys, controlled and monitored by an advanced airborne processing suite.

Ultra’s broad range of specialist capabilities

Ultra focuses on developing specialist capabilities that provide highly-differentiated solutions to customers’ requirements. Eight clearly defined market segments allow Ultra to provide more complex offerings from across the full range of the Group’s capabilities. The eight capability segments are:

Underwater warfare
Capabilities related to underwater warfare covering military, paramilitary and civil domains. These include transducers, hydrophones, sonobuoys, sonobuoy receivers, towed arrays, periscope detecting radars, torpedo detection systems, acoustic countermeasures, and surface ship sonar systems.

Marpitne
Capabilities related to signal and power management, operating, controlling, supporting and maintaining maritime (surface and sub-surface) military platforms, both manned and unmanned.

Land
Capabilities related to operating, controlling, supporting and maintaining land military platforms, both manned and unmanned, and the dismounted soldier.

Aerospace
Capabilities related to the design, manufacture, production, operation, support and maintenance of commercial and military aircraft, both manned and unmanned.

C2ISR*
Capabilities related to C2, Security and Surveillance solutions, covering both military and civil domains as well as military Electronic Warfare, reconnaissance and targeting systems, and forensic solutions for law enforcement.

Communications
Capabilities related to the secure communication and timely exchange of data, voice and video information providing some of the most capable communication systems, platforms and integration support in the world.

Nuclear
Capabilities related to nuclear, covering both civil energy, national radiation monitoring systems through defence to radiation monitoring on tactical platforms.

Infrastructure
Capabilities related to airport and maritime information systems, rail freight power conversion and control, as well as non-nuclear civil energy related capabilities.

2017 revenue by segment

<table>
<thead>
<tr>
<th>Segment</th>
<th>Revenue Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underwater warfare</td>
<td>25%</td>
</tr>
<tr>
<td>Maritime</td>
<td>8%</td>
</tr>
<tr>
<td>Land</td>
<td>3%</td>
</tr>
<tr>
<td>Aerospace</td>
<td>17%</td>
</tr>
<tr>
<td>C2ISR*</td>
<td>19%</td>
</tr>
<tr>
<td>Communications</td>
<td>16%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>8%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>4%</td>
</tr>
<tr>
<td>Command &amp; Control</td>
<td>8%</td>
</tr>
<tr>
<td>Surveillance and Reconnaissance</td>
<td>8%</td>
</tr>
</tbody>
</table>

Did you know?
Ultra’s broad range of specialist capabilities are positioned over 350 platforms and programmes worldwide, often in high integrity or safety critical applications.

To see how Ultra’s capability segments map to each business, see pages 9-10.
Sonobuoys and sonobuoy receivers

Ultra is the world’s leading provider of sonobuoys and software defined sonobuoy receivers with its products spanning the complete spectrum of airborne and shipborne ASW requirements.

Sonobuoys

Due to the proliferation of modern, stealthy submarines, traditional anti-submarine techniques continue to be challenged in their ability to deliver effective submarine detection and tracking capability. With facilities in the US, UK, and Canada, Ultra remains at the forefront of the design, development, and manufacture of air-launched, expendable sonobuoys. Ultra’s latest generation of multistatic sonobuoys have just entered service and they are once again restoring NATO’s ASW advantage. In order to enable more nations to access the capabilities associated with the latest generation of sonobuoys, Ultra’s STS has developed its multistatic active application that empowers traditional acoustic processors to achieve the benefits associated with multistatic operation. Through Ultra’s partnership in ERAPSCO and Sonobuoy TechSystems (STS), Ultra is able to meet all US Navy sonobuoy requirements for the P-8, P-3 and MH-60R air platforms. Internationally, STS sonobuoys have been selected by more than 20 countries to meet their ASW needs.

Miniature Sonobuoys

Ultra is driving innovation in collaboration with key government and industry partners and is undertaking the development of a miniaturised sonobuoy system. The aim is to create a series of sonobuoys optimised for carriage and deployment from small patrol aircraft, helicopters, and unmanned air vehicles (UAVs). This will allow non-traditional assets to be successfully introduced into the ASW force mix. The miniaturisation activity encompasses the broader system including the sonobuoy, the sonobuoy carriage system, sonobuoy receivers and the wider communications network. This exploits the Group’s leading capabilities in network communications and tactical data links such that the platform, and the sonobuoy it has deployed, can contribute to the integrated underwater warfare picture and the ASW mission.

Sonobuoy Receivers

Ultra has over 5,000 receivers installed around the world, supporting a variety of helicopters, maritime patrol aircraft, surface combatants and laboratories. Ultra continually builds upon its experience gained with existing systems, new developments, and technology advances to push performance and functional envelopes for these highly sophisticated advanced receivers, while reducing the cost per channel. The latest sonobuoy receivers are software-defined wideband solutions, which receive signals over long ranges and with very low distortion. The flexibility of the systems allows customers to vary data rates, enabling a greater flow of information in today’s increasingly multistatic ASW operations. Ultra’s systems save the customer weight and power and are compatible with outputs from area networks. Ultra’s products range from lightweight systems for use on UAVs and helicopters, to the wideband software defined receiver currently found on the P-8 Poseidon maritime patrol aircraft, which offers the ultimate in flexibility and performance. The wideband receiver has the ability to manage the RF spectrum dynamically, to find and amplify the signals of interest and remove interference.

Transducers and Hydrophones

The genesis of Ultra’s underwater capability can be traced back to the specialised design techniques and high-quality fabrication processes it developed decades ago to meet the unique challenges of deep-ocean, high-pressure applications, associated with ASW. Today Ultra’s transducer and hydrophone offerings include flexiensional, tunable, segmented rings, striped rings, bander, and more conventional ceramic rings, plates, discs and cylinders. In addition, Ultra is recognised for its work in broadband single crystal transducers, which has led to it becoming the US Navy’s preferred source for this capability.

Multistatic Active (MSA)

Innovation in sonobuoys, software-defined sonobuoy receivers, and airborne acoustic processing has enabled Ultra to develop state-of-the-art multistatic active solutions for the maritime patrol aircraft community. Ultra’s MSA application enhances a legacy airborne acoustic processors to enable the detection of quiet submarines, in both deep and littoral waters. MSA uses multiple sources and receivers, positioned in different locations, so that echoes from active sources are picked up by a pattern of receivers, which take advantage of multiple returns from the submarine at multiple aspects. These multistatic combinations of sonobuoys are collectively exploited to produce an accurate target track.

MSA provides the ability to both enhance the probability and the range of detection of potential threats.

Underwater warfare
**Underwater warfare**

**Torpedo defence**

A proven comprehensive sensor-to-countermeasure capability, that delivers torpedo detection, classification, threat evaluation and neutralisation.

Ultra is a world-leader in torpedo defence for both submarines and surface ships, with systems currently operational with the US Navy, UK Royal Navy and the Turkish Navy. Using a combination of passive and active sonar systems, Ultra’s technology provides platforms with the ability to detect and classify all known torpedoes.

To counter the identified threats, the systems integrate with anti-torpedo torpedoes to automatically recommend the optimum evasion course, whilst simultaneously using both towed and expendable countermeasures to confuse and defeat the threat. Ultra has fielded two Surface Ship Torpedo Defence (SSTD) systems.

Ultra’s Sea Sentry SSTD can be either standalone or incorporated into its Integrated Sonar Suite (ISS). As a stand-alone system, it is designed to be operated by minimally-trained operators and provide simple operator actions on sounding a torpedo alert. Furthermore, Ultra’s ISS enables the SSTD Function to be augmented by off-board sensors such as sonobuoys. Ships steaming through a previously laid sonobuoy field can therefore re-use the same field for area torpedo defence at no additional cost or effort. Torpedo countermeasures could also be deployed by organic assets, such as helicopters or unmanned air systems, well away from threatened ships.

Ultra’s Torpedo Warning System (TWS) is a highly automated active and passive sonar system integrated with the US Navy’s Countermeasure Anti-Torpedo (CAT) to provide hard kill torpedo defence solutions for US aircraft carriers. Current upgrades will include active detection of the incoming torpedoes to enable a more rapid and precise anti-torpedo engagement sequence.

**Acoustic torpedo countermeasures**

Ultra provides a complete range of expendable and towed acoustic countermeasures.

**ACOUSTIC TORPEDO COUNTERMEASURES**

As a pre-eminent supplier of acoustic countermeasures, Ultra provides a range of towed and expendable off-board systems to ensure the survivability of ships and submarines in the face of a range of advanced torpedo threats. Ultra’s family of acoustic expendables, including a complete array of NATO standard devices, is complemented by towed systems, such as Nixe or Ultra’s flexible towed torpedo countermeasure. The flexible towed torpedo countermeasure permits an active countermeasure jammer to be towed in-line with the active-passive towed receive array. This eliminates the need for a separate winch and handling system, normally associated with stand-alone towed countermeasures.

**COUNTERMEASURES**

Ultra is able to supply a complete torpedo countermeasures sub-system incorporating Expendable Acoustic Devices (EADs), Expendable Device Launchers (EDLs) with a Launcher Control Unit (Remote) and a flexible towed torpedo countermeasure. It also can supply individual EADs that have the ability to ‘hover’ in the water mass or are self-propelled enabling them to draw the incoming torpedo away from the intended target. A range of countermeasures to ensure the survivability of ships and submarines in the face of advanced torpedo threats.

visit: ultra-electronics.com
Underwater warfare

Sonar systems

Ultra’s world-leading capabilities are delivering dominance in the underwater battlespace.

ACTIVE-PASSIVE VARIABLE-DEPTH SONAR

Ultra’s family of variable depth sonars (VDS) include both an innovative single tow, in-line, horizontal projector array coupled with a directional passive-receive array as well as a modular dual tow solution combining the additional source level and bandwidth available in tow body with echo reception occurring on a separate directional receive array. Ultra’s fully-modular in-line VDS marks a step change in technology and capability, away from the constraints of traditional towed sonars. It needs only a single, lightweight winch, which can be operated by two personnel. Additionally, the tow weight and footprint of the in-line VDS allows it to be fitted to smaller warships and those vessels not specifically designed for ASW operations. In its full specification, Ultra’s modular VDS combines both systems to offer the option to use the in-line tow for littoral operations and torpedo defense and stream the tow body when additional detection ranges are required in deep water ASW operations.

HULL-MOUNTED SONAR

Ultra’s digital acoustic module hull-mounted sonar (HMS) is a combined active/passive array, with dual-frequency transmit flexibility. This HMS can be operated in omnidirectional mode, or in sector search and employs a range of FM and CW waveforms to optimise the probability of detection and avoid clutter. It has a heavy weather mode to increase sonification during high sea states and a close contact mode for detection and tracking of close targets. Ultra’s HMS also incorporates mine avoidance capabilities. It can transmit in a wide bandwidth to avoid mutual interference from other ships, enabling increased freedom of manoeuvre during multi-ship operations.

PASSIVE TOWED ARRAYS

Ultra has developed passive towed array systems for conventional and nuclear submarines and surface ships from small patrol vessels up to aircraft carriers. With array diameters ranging from less than 30mm to 100mm, Ultra’s towed array solutions can be configured to provide a wide variety of acoustic solutions across deep and shallow water environments. Ultra’s towed array system is designed to enable integration with multiple types of radar systems to enable a common data-acquisition and processing environment.

NEXT GENERATION SURFACE SEARCH RADAR

Ultra has exploited modern hardware and software data fusion technologies to develop a robust real-time data aggregation and synchronisation radar architecture. This has enabled the development of an affordable, operationally effective next generation surface search radar. This system is based on the AN/SPS-74 system that is deployed on the US Navy’s aircraft carrier fleet and is designed to detect submarine periscope targets with high probability while maintaining a low probability of false alarm. Its open architecture is designed to enable integration with multiple types of radar systems to enable a common data-acquisition and processing environment.

INTEGRATED SONAR SYSTEM

For surface ship applications, Ultra has developed a comprehensive, fully integrated sonar system (ISS), comprising both hull-mounted and towed arrays. It is a modular system, built on a common multi-sensor processor, within an open architecture ‘system of systems’. It fuses data from own-ship and off-board sensors to build a complete underwater tactical picture and delivers a bi-static sonar capability from hull-mounted and towed array sonars. To maximise detection and localisation of underwater threats, this system further facilitates interoperability with sensors on third-party co-operating platforms, including underwater, underwater, surface and airborne sensors. In all aspects, ISS therefore includes sensor information from active sources and passive arrays, whether on-board or off-board, and to capture many more detection opportunities, increasing the probability of detection through integration gain. Ultra has taken an innovative approach in displaying the output from ISS. The aim is to minimise the training burden and workload of operators, whilst maximising their ability to utilise the full capability of the system to detect contacts.

Detected and deterred, the submarine threat by using multiple sensors and multiple frequencies simultaneously, thus defeating the submarine’s primary weapon by detecting, classifying and localising the heavyweight torpedo, coupled with threat neutralisation through a comprehensive towed and expendable countermeasure suite.
Ultra has a broad portfolio of specialist capabilities which can be combined flexibly to generate innovative, highly-differentiated solutions, which are delivered in close collaboration with customers, partners and suppliers. Ultra is well positioned to support customers and provide solutions to complex needs across the Defence & Aerospace, Security & Cyber, Transport and Energy markets.

<table>
<thead>
<tr>
<th>Business</th>
<th>Underwater warfare</th>
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<th>Land</th>
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</tr>
</tbody>
</table>

The matrix on the left shows how Ultra’s core capabilities map to each Ultra business.