

TACTICOS

Worlds' favourite Combat Management System
The best got better



Preface

The combat management system (CMS) is the central command and decision-making element of a naval vessel combat system. Its function and performance – supporting sensor management, picture compilation, situation assessment, action support and weapon control – are critical to the operational effectiveness of a naval vessel. Maritime mission management systems have evolved to serve the needs of maritime security operations. Accordingly, they support constabulary functions of surveillance, anomaly detection, evidence gathering and, as necessary, interdiction and arrest. TACTICOS provides the perfect match between these two worlds.

Historical perspective

The computer-assisted action information organisation (AIO) can trace its origins back to the early 1960s. By this time, the new ways of warfare required naval forces to deal with large numbers of fast-moving targets and increasingly compressed reaction times. This drove the development of complex action data suites that used early digital computers and display systems. Conceived amid the Cold War, these first-generation combat direction and weapon control systems were optimised for ‘blue water’ operations in the relatively ‘empty’ waters of the deep ocean.

Early automated action data systems were based on custom-developed MIL-SPEC mainframe computers programmed in machine code. Tactical picture presentation was similarly bespoke; monochrome computer displays provided a rudimentary operator interface.

However, the demands on these systems grew rapidly, and lack of processing power, computer storage and display capability emerged as significant problems.

The advent of the microprocessor, and the commercial/personal computing revolution that accompanied it, changed everything. This enabled a fundamental shift from centralised mainframes to distributed architectures utilising large numbers of distributed processors communicating via databuses and local area networks.

This new generation of command and weapon control systems still relied on highly customised processing hardware and operating infrastructures. Over time, however, industry sought to increasingly exploit the performance gains and cost efficiencies offered by COTS hardware and software.

The next major change, and one still in progress, is the migration to open system architectures. An open architecture is a hierarchical data processing structure, based on well-defined mainstream interfaces, which permits the straightforward connection or import of devices and programs made by multiple manufacturers. This means that modifications and upgrades to system functionality or performance can be accomplished at one or more layers without altering the existing equipment, procedures, and protocols at the remaining layers.

“Maximized availability thanks to unique real-time OpenSplice DDS architecture, copied by competition.”

This ‘openness’ delivers a number of benefits. For example, design and development costs can be significantly reduced by avoiding the use of proprietary products and eliminating vendor ‘lock-in’. Also, the regular refresh of computer systems enables rapid additional operational capability to be inserted; and new support and maintenance schedules can be introduced which are aligned with performance reliability and hardware obsolescence.

TACTICOS pedigree

TACTICOS was conceived in the early 1990s as an integrated and highly automated multi-warfare combat management system (CMS) to manage command and weapon control functions on board naval surface combatants. In over two decades since it has found application in small, medium and large naval vessels.

Moreover, TACTICOS has been subject to a programme of ongoing improvement to address evolving mission requirements, integrate with a wide variety of sensors and effectors, and fully capitalise on accelerating advances in commercial information and communication technology.

A significant part of this evolution has been the migration to a certified open architecture, enabling TACTICOS to host third-party applications and rapidly accept new or modified functionality. This open system transition has been implemented using the OpenSplice DDS middleware product, an advanced realtime systems messaging standard that enables seamless, timely, scalable and resilient distributed data sharing.

Thales developed OpenSplice DDS as a very high-performance, real-time, data-centric publish/subscribe middleware platform able to deliver for mission critical applications. Indeed, DDS is now established as the data distribution standard of choice for realtime CMS applications, and OpenSplice DDS recognised as the leading OMG DDS-compliant COTS middleware available on the market. Incremental improvements have kept TACTICOS at the forefront of

technology, and maintained its position as the market-leading CMS solution. Its wide appeal is explained by its high level of maturity, an extensive library of functionalities, and an unrivalled record of proven equipment integrations.

Furthermore, TACTICOS is at the heart of a long list of ‘turnkey’ naval combat system solutions delivered by Thales on time and within budget. By combining expertise in combat system engineering and integration with extensive experience in programme management, the company has consistently performed to achieve outstanding levels of customer satisfaction in both new-build and modernisation projects.

This pedigree with regard to function, performance and delivery explains why TACTICOS is firmly established as the surface ship CMS of choice in the international naval marketplace. It is a track record of success that extends across over 20 navies and approaching 200 platforms – ranging from coastal patrol craft to guided missile destroyers – and includes licensed software development and transfer of technology to meet specific user needs and business models.

“Mission System Integration knowledge is leveraged as achieved in e.g.:

- Indonesia (Diponegoro & PKR)
- Morocco (Sigma)
- Colombia (Padilla)
- Malaysia (Kasturi)
- Oman (Khareef & Al Ofouq)”

TACTICOS

Allows the Command Team to monitor and control today’s missions ranging from swarm attacks and counter-piracy tasks to tactical ballistic missile defence.



TACTICOS Persistent Evolution

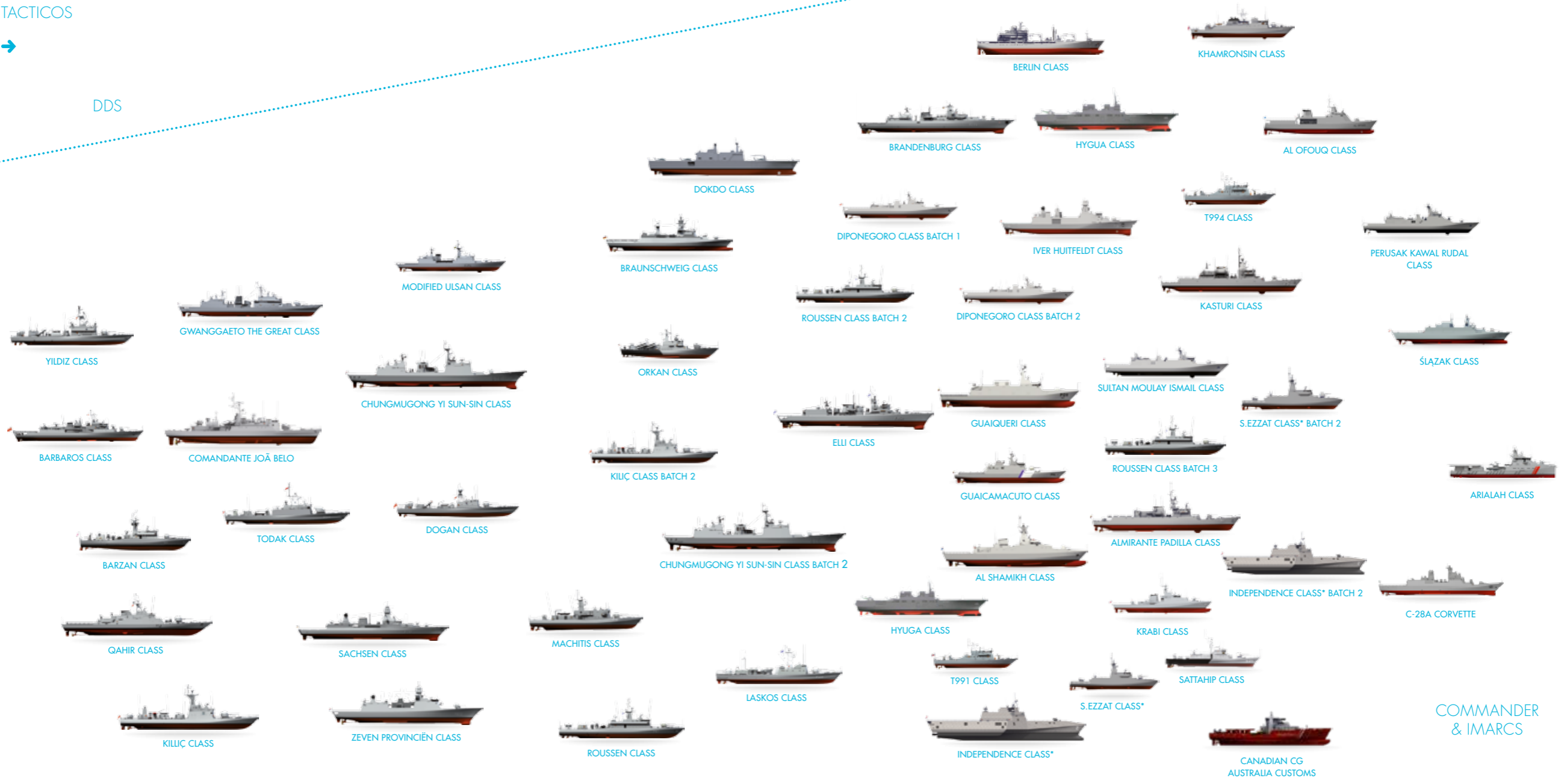
MARITIME SECURITY OPERATIONS

DAISY STACOS
WM-SERIES TACTICOS



DDS

NET CENTRIC



'80 '90 '92 '94 '96 '98 '00 '02 '04 '06 '08 '10 '12 '14 '16

Proprietary HW

SPARC VME, SunOS
68xxx VxWorks

SPARC VME, Solaris

Ultra SPARC, Workstation,
Power PC, VxWorks

INTEL / Linux

Digital Radar
& TV Video

GIS OpenGL
Web Services

Integration Patterns
Java Substance HMI

New missions demand new solutions

Recent years have seen multiple new security challenges emerge in the maritime arena. Navies, coast guards and other maritime security agencies face a proliferation of security challenges. These include: illegal fishing of territorial waters; incursion of mineral exploitation across legal boundaries; maritime terrorism; narcotics smuggling; pollution as a result of shipping accidents or malpractice; trafficking of illegal immigrants; and avoidance of tax duties through smuggling.

Military threats endure, but their character has also changed. Navies find themselves increasingly operating in the near-land environment of the littoral, a cluttered and congested sea space where picture compilation and track identification is complicated by high air and sea traffic densities, and sensor degradation attributable to aggregated atmospheric, environmental, geographic and man-made factors.

Furthermore, it is in littoral zones, narrow seas and maritime chokepoints that navies are confronted with a new breed of 'asymmetric' surface threats, such as small boat swarms. Such threats pose unique and stressing challenges for the command team with regard to situational awareness, threat evaluation, effector control and Rules of Engagement.

Multinational task groups, under formal alliances or increasingly as part of ad hoc coalitions, have become a common thread of contemporary naval operations. Effective coalition operations require common understanding and information sharing to ensure acceptable interoperability.

Another new dimension in maritime operations is the growing employment and contribution of unmanned vehicles in the air, surface and subsurface domains. Unmanned systems are seen as significant force multipliers. However, they demand careful integration and deconfliction with manned assets.

Evolving TACTICOS

Recognising these changing dynamics, and keeping with its philosophy of continuous improvement through constant innovation, Thales has introduced a new TACTICOS to address both maritime security and defence mission system needs. Modular, scalable, adaptable and futureproofed, this latest CMS product line has been explicitly tailored to the tasks and missions of navies, coast guards and maritime security agencies.

In improving what is already the world's most popular CMS, Thales has given careful consideration to all aspects of system design and function. The result of this analysis is a refreshed TACTICOS incorporating new techniques and features based on three overriding principles:

- **optimised Command Team cohesion and effectiveness**
- **intrinsic scalability to suit specific platforms and/or user applications**
- **a product-oriented philosophy and accompanying development roadmap**

Optimised Command Team cohesion and effectiveness

Understanding is the key to effective decision-making. Accordingly, it is essential that Command Team operators are able to rapidly assimilate and appreciate tactical information to inform command and react quickly and decisively to potential threats.

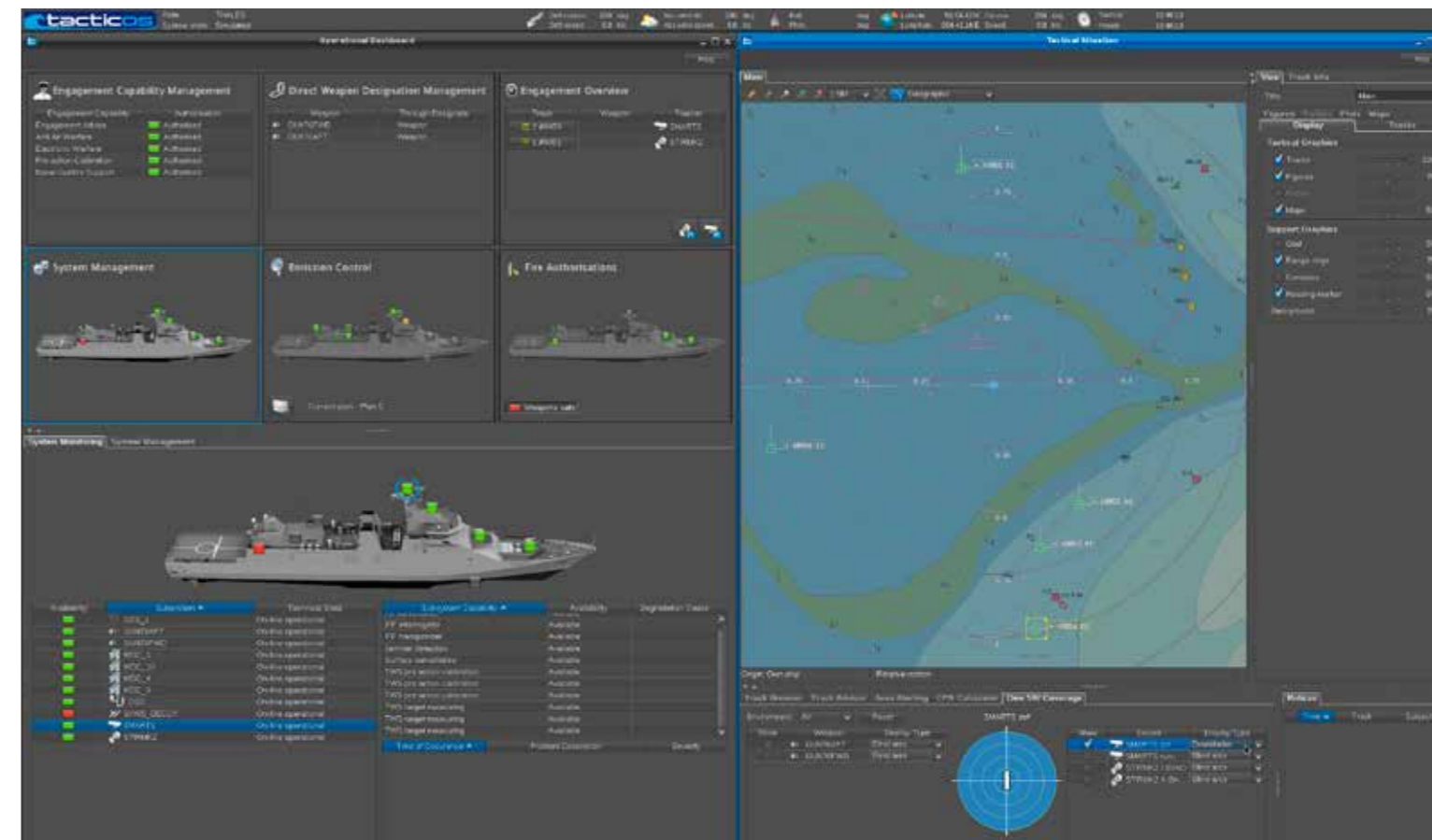
This has become an increasingly onerous task as the volume of organic and non-organic data available to the command has continued to grow. Cognitive overload has become a significant problem, increasing the risk that information may be misidentified, misinterpreted or simply ignored.

Thales has addressed these challenges in the latest TACTICOS system through two complementary innovations: a new workflow-oriented human machine interface (HMI) that offers improved

decision support to the operator; and the introduction of new console infrastructure hardware in the Operations Room. The combined effect of these updates is to reduce workload, improve the output efficiency of individual operators, and maximise the overall performance of the Command Team.

The HMI has been prototyped, iterated and implemented by a multidisciplinary development team combining experienced naval operators, human factors specialists and software engineers. Thales has designed an intuitive and user-centric HMI that is simple to operate and provides exceptional clarity in both presentation and function.

"TACTICOS delivers notifications to the right users, at the right moment, and in the proper format."



Human factors specialists and Navy personnel collaborated on the design of the TACTICOS HMI. The HMI stands out by adhering to the operator workflow which reduces the operator workload to a minimum.

Operator roles and tasks are organised in selectable pre-defined worksets at each console. For each workset the HMI development team analysed typical workflow actions in order to identify a logical and consistent ordering of information matched to the operational task in hand. A common graphical user interface 'look and feel' is maintained throughout; however, the console itself is customisable (for example, it can accept different combinations of joysticks, trackballs or mouse-type interactive devices), and individual users can create and save preferred settings.

This new HMI is implemented on a new Multifunction Operator Console (MOC Mk 4), or 'team station', featuring a large (30-inch) high resolution display. The MOC Mk 4 offers a small footprint to simplify physical installation, and a low-set, easy-to-view display to provide an uninterrupted field of view through the CIC. Single screen operation is realised by embedding the concept of 'intelligent automation' in the user interface so as to guide the operator through each individual task. On screen, the new workflow-oriented HMI presents the operator with a label plan tactical display area (TDA), together with a series of tabular windows and 'dashboard' representations. Only the information relevant to the task in hand is presented, and automatically generated proposal or execution prompts are embedded to aid decision-making and reduce decision timelines. Furthermore, the system HMI uses 'intelligent automation' to

anticipate the operator's logical next step in the workflow sequence (for example, to bring up data on a specific contact or track). Again, pre-emptive automation serves to significantly reduce operator workload and compress decision timelines.

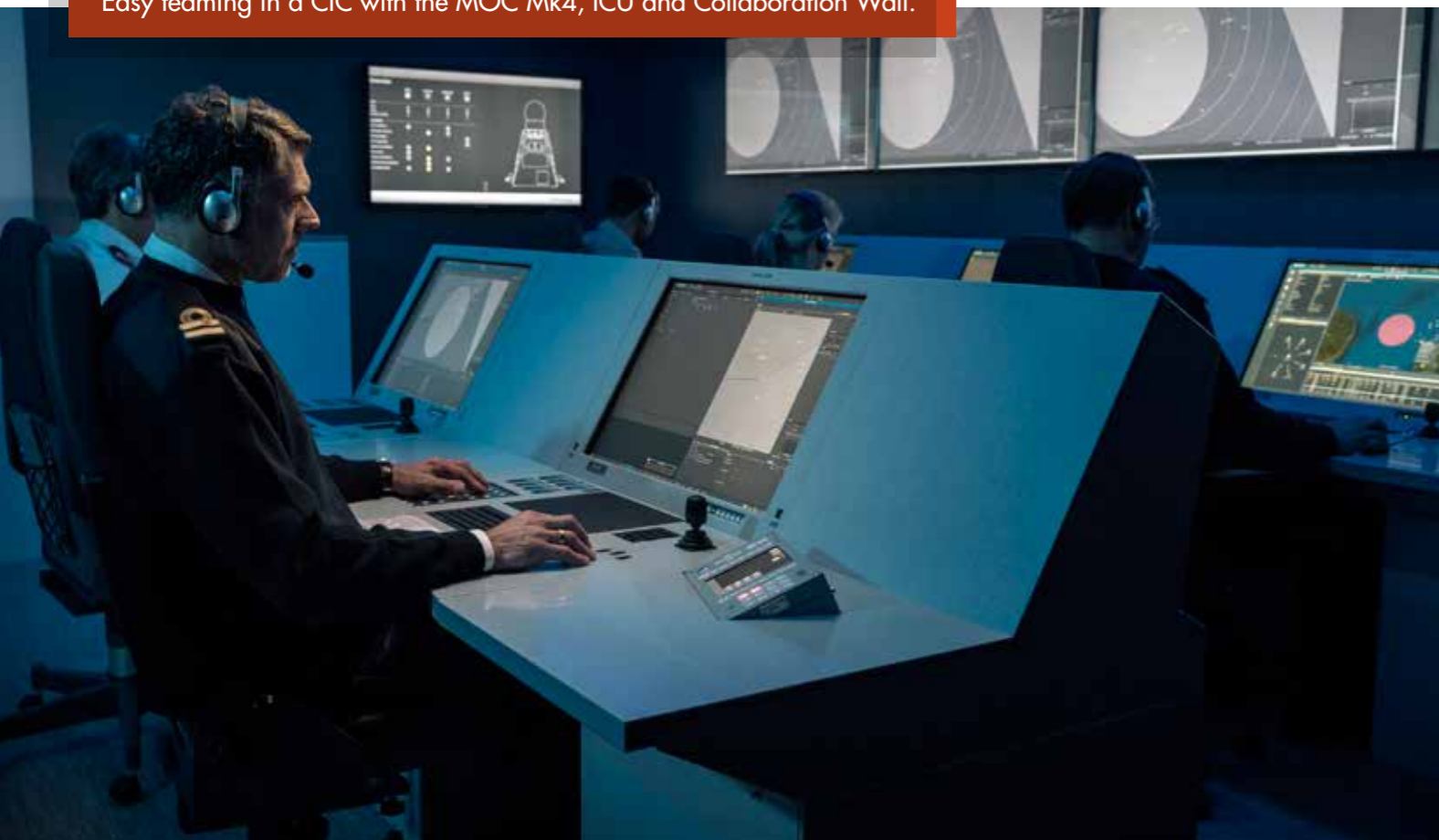
As well as enabling the operator to improve his or her performance during operations, the new HMI model also reduces training requirements, and allows command team staff to 'fight the battle, not the machine'.

"Cumulative experiences in customer programs are reflected in the TACTICOS human machine interface."



The small footprint and low height of the MOC Mk4 and the Inter Console Unit provide a large field of view for the Command Team.

Easy teaming in a CIC with the MOC Mk4, ICU and Collaboration Wall.



The low-profile MOC Mk 4 console design allows individual operators to maintain an unobstructed sightline to a team-centric 'collaboration wall'. Designed to provide the command team with a collective appreciation of the operational picture and shared awareness of other mission-critical information, this uses high-resolution colour displays to present a variety of system, sensor or external information feeds according to the mission priority. Examples could include a wide-area operational picture, an external ship view using infrared or TV sensors, an 'operational dashboard' providing an overview of sensor/weapon system status, and an open-source media feed such as TV networks.

Partnering with CAMS-Force vision on maritime security applications

In 2012 Thales entered into a collaborative agreement with the Royal Netherlands Navy's CAMS-Force Vision combat system software house to co-develop a new suite of functionalities supporting maritime security operations (MSO). This reached fruition in the operational domain with sea trials on board the patrol ship HNLMS Zeeland in April 2013. These new MSO application modules are now available for TACTICOS.

TACTICOS embedded training

Using the simulation and stimulation facilities embedded within TACTICOS, a complete training environment can be created on board the host platform in order to support both operator skills training and full command team tactical training. Furthermore, TACTICOS can be configured so that even if a part of the CMS is being used in training mode, the rest of the system can remain fully operational.

Ensuring maximum availability and performance

TACTICOS continuously monitors its own health status, as well as the condition of all integrated subsystems. Maintenance at the first line is supported by Interactive Electronic Technical Manuals. Customers can also log into a web-based 24/7 support service to access information on service requests, technical bulletins and available updates.

Scalability to suit platform, mission and user applications

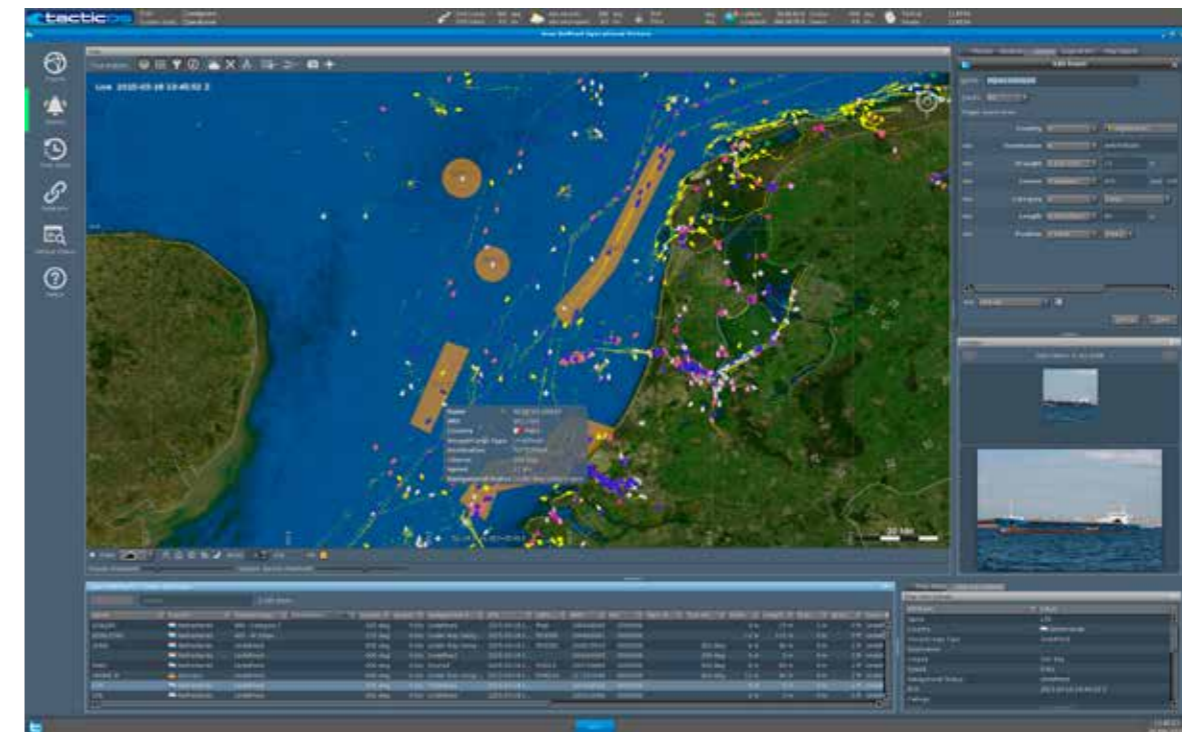
TACTICOS is inherently scalable to suit specific user requirements. Furthermore, its single core architecture running on a common hardware platform, is designed to seamlessly serve both real-time combat management and lower latency maritime security operations.

Capitalizing on these attributes, Thales has developed a family of standardized Mission Solutions, with TACTICOS as the core element and matching sensors and sensor/weapon integrations, to match the diverse mission requirements of navies, coast guards and other maritime security organizations.

These are:

- Mission Solution 100 (MS-100) for littoral security operations
- Mission Solution 150 (MS-150) for ocean security operations
- Mission Solution 300 (MS-300) for low-intensity naval operations
- Mission Solution 400 (MS-400) for medium-intensity naval operations
- Mission Solution 500 (MS-500) for high-intensity naval operations
- Mission Solution 1000 (MS-1000) with an additional theatre ballistic missile defence capability

These standardized “shrink-wrapped” Mission Solutions are aligned to the full spectrum of maritime operations; safety & security, interdiction, sea control, area control and power projection.



The UDOP enables discovery of anomalies in traffic patterns and represents data therefore geographically, tabular, in-time and with modelled intel relations.

TACTICOS also addresses the specific requirements of maritime safety and security organisations. While warfare operations typically follow a classic detect-classify-identify-track-engage cycle, the MSO functional chain has evolved to reflect different temporal dimensions and threat criteria. This begins with detection, ascending through trend analysis, anomaly detection, legal evidence gathering and, as necessary intervention and arrest.

System functionality has been optimised to support MSO operations. Normal traffic behaviour is visualised in trend lines, with embedded anomaly detection algorithms providing automatic alert of unusual deviations or suspicious behaviour. Track data, admissible as legal evidence, can be stored for up to 90 days; a ‘time slider’ function enables captured track data at a particular point in time to be accessed, replayed and reviewed.

The new TACTICOS embodies a full suite of functionalities and tools to deliver against these requirements. A key aspect is the facility to create a User Defined Operational Picture (UDOP) that integrates information from multiple sources and sensors in a single, enriched multi-layered interactive display to create shared awareness and facilitate combined inter-agency operations.

TACTICOS also provides facilities for the integration of offboard assets into the tactical picture. For example, connectivity and Blue Force tracking for small boats executing boarding operations, and control and exploitation of unmanned air vehicles providing persistent wide area surveillance.

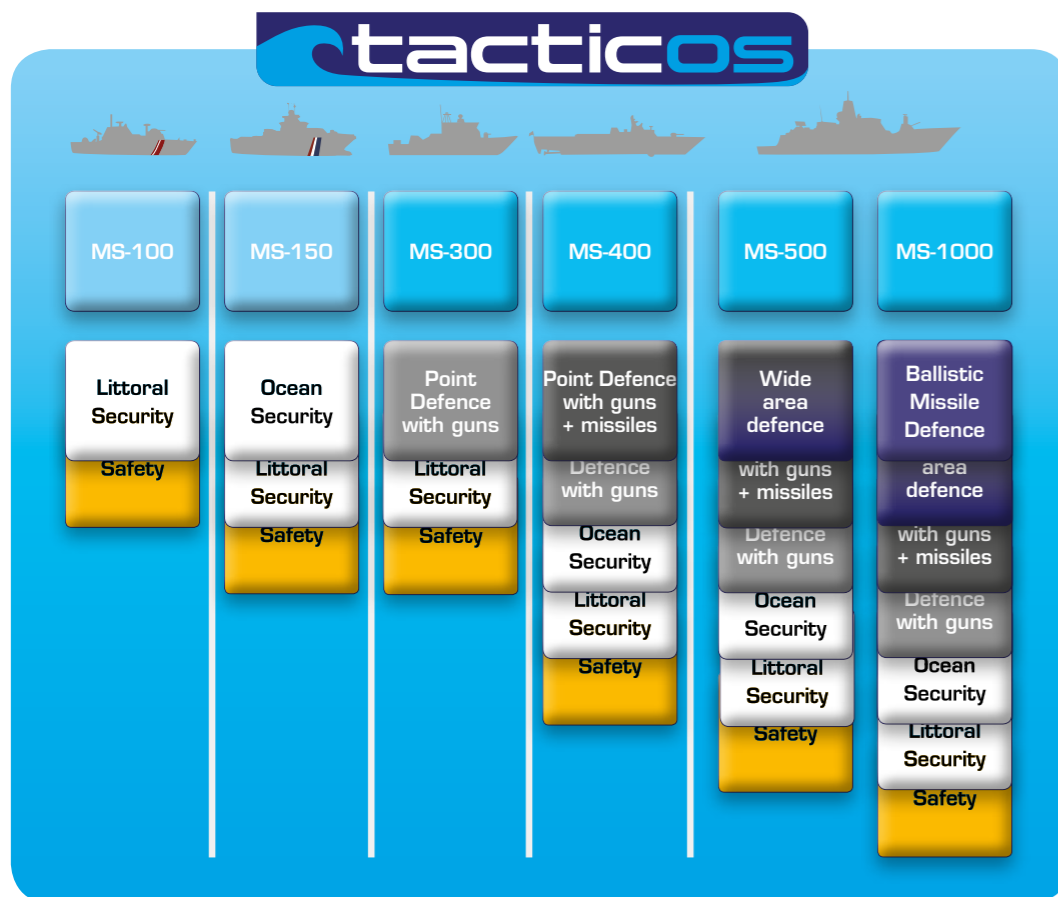
Inherently customisable, the UDOP provides a wide range of options with regard to information management and presentation. Data sources may include real time tracks, and all relevant open and proprietary sources, including AIS, ADS-B, multiple geo-spatial information products, meteorology, accessible databases (such as IMO, Lloyds, and IHS Jane’s) and appropriate restricted/classified intelligence feeds.

TACTICOS incorporates a secure gateway to enable internet browsing. This same mechanism also supports the import of files from the open domain into the secure CMS environment, allowing classified and unclassified information management in the same workspace.

A product-oriented philosophy and development roadmap

Thales uses a product-driven business model for TACTICOS that recognizes market demands, and captures customer requirements to catalyze continued innovation and rapid development of new functionality. In addressing the priorities of the TACTICOS user community, Thales has committed to self-invest in a defined product development roadmap with biannual updates. This is delivered by a dedicated team established to receive and review user needs in order to inform priority functionality for inclusion in biannual software updates.

This new model meets the aspirations of users in an accelerated timeframe. It also overcomes the latency issues traditionally associated with the freezing of software baselines at the point of contract.



TACTICOS is the core of a family of solutions tailored to maritime security and defence tasks of Navies and Coast Guards.

*“Functions and qualities
of high relevance to
one or more customers obtain a
higher priority on the roadmap.”*

Thales also recognizes the value of a business model that is open, flexible, and meets the sovereign industrial and operational requirements of customers and partners. In the latter case, the company has extensive experience and proven expertise in the transfer of knowledge and technology to local industry.

The mainstream architecture and technologies used in TACTICOS allows in-country partners to configure and adapt TACTICOS to meet their own unique requirements. This includes post-design adaptations to accommodate new subsystems or peripherals, new or modified interfaces, and new functionalities matched to specific systems/operating doctrines.

Furthermore, Thales is totally agnostic with regards to shipyards, co-contractors, platform types and weapon systems. That flexibility is enabled by the modular and scalable architecture of TACTICOS, and a corporate ethos based on the principal of partnership. This is evidenced by the successful relationships forged with shipbuilders and prime contractors in e.g. Columbia, Germany, Greece, Indonesia, Malaysia, the Netherlands, the Republic of Korea, Spain, Thailand, Turkey, the United Kingdom and the United States.

One CMS for Naval Defence and Maritime Security Operations

With its certified openness and scalability of the underlying architecture, Thales delivers a modular Combat Management System that is matched to a variety of mission profiles for a variety of vessel types.

TACTICOS combines combat operations and Maritime Security Operations in one CMS. Open standards technology and a massive amount of subsystems interface realizations make TACTICOS the core of any naval mission solution. With new looks and new features which are carefully designed for mission packages and are released according to the TACTICOS roadmap.



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