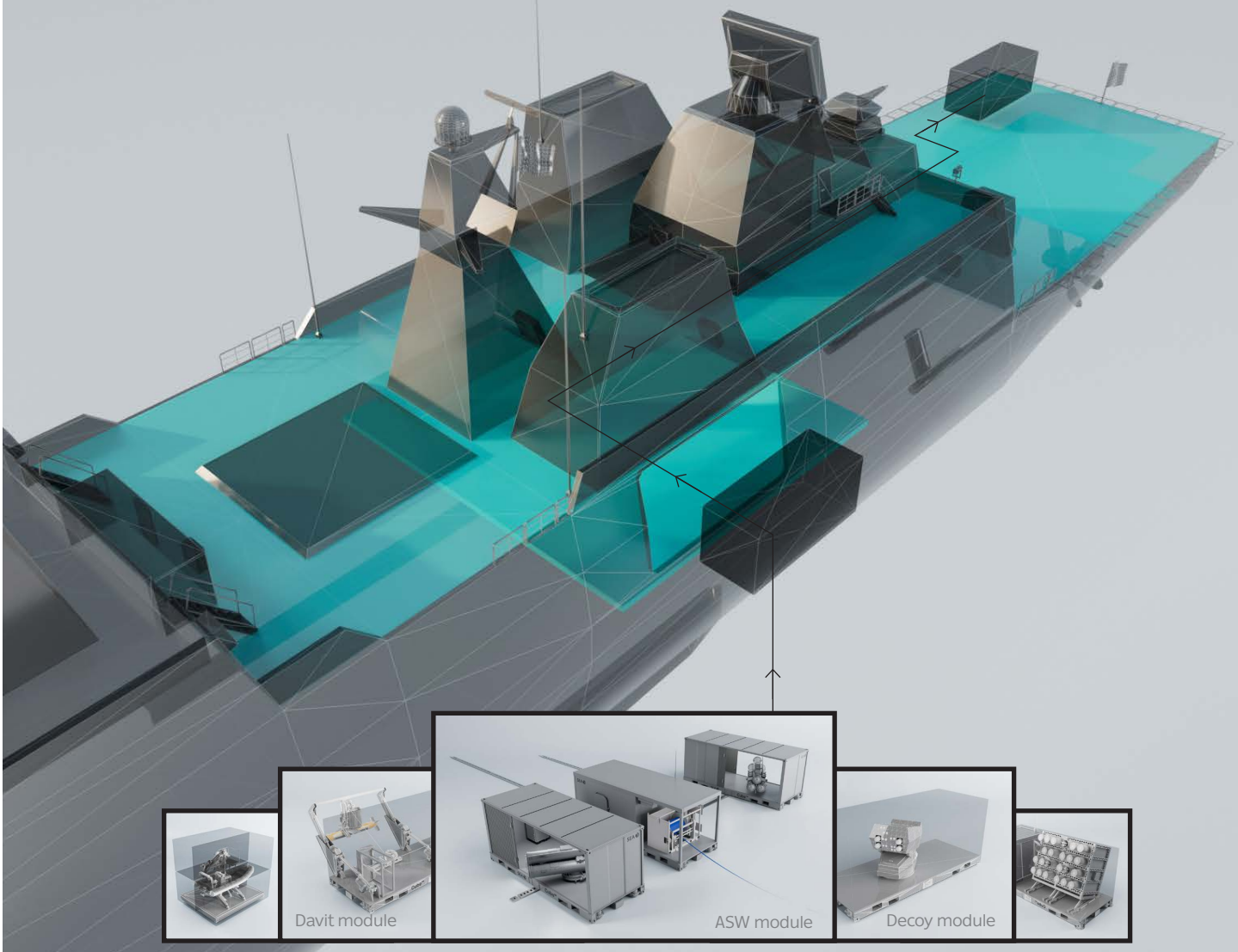
SH DEFENCE

The future in

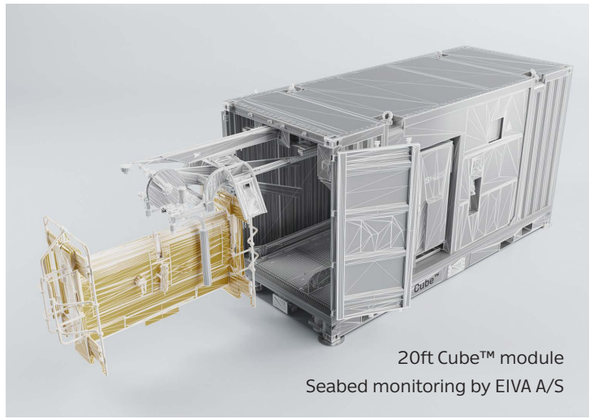
Naval Mission Modularity

A general description of The Cube™ System and selected mission modules

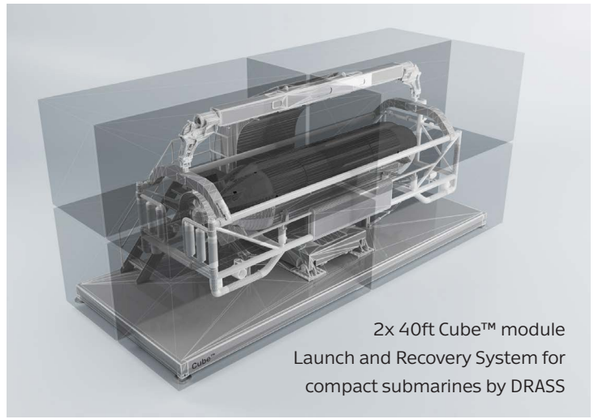


Securing Navies with flexible, adaptable, upgradeable and maintainable platforms with interchangeable mission modules based on The Cube™ System

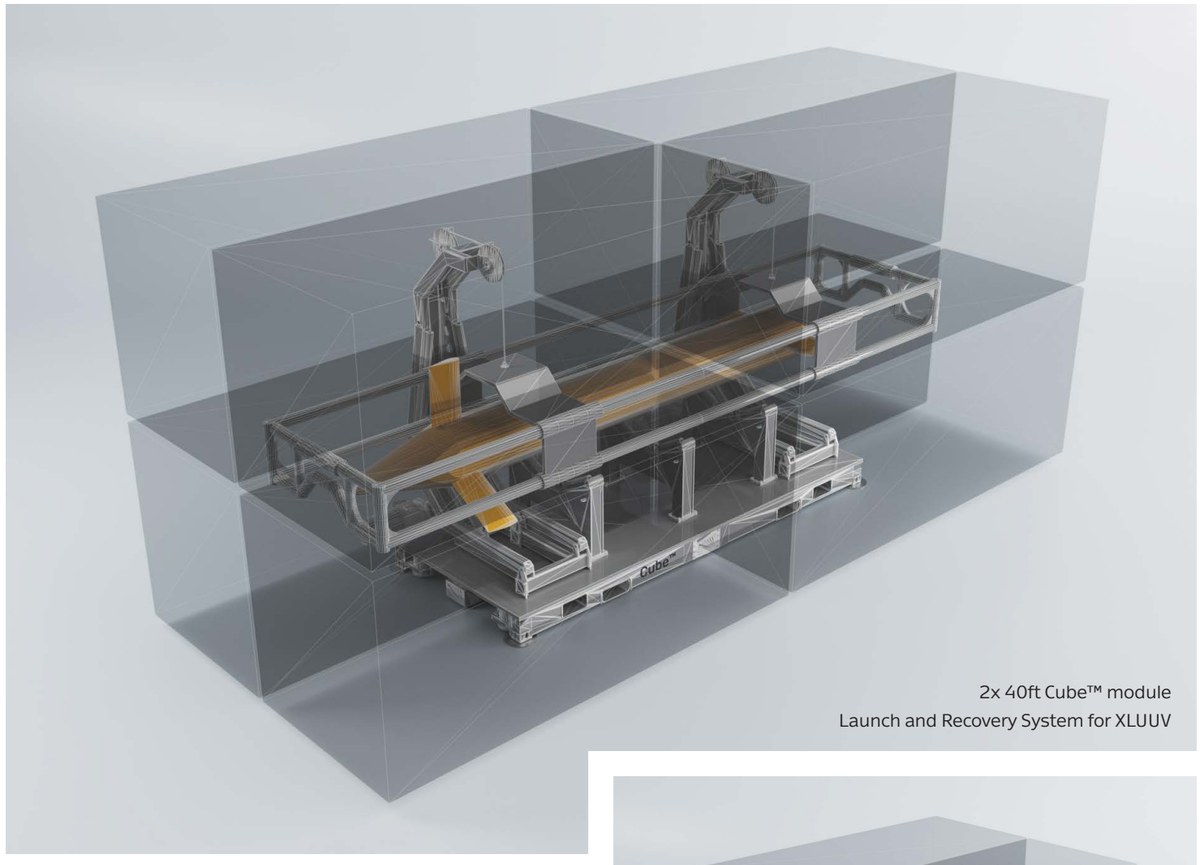
The Cube™ System



20ft Cube™ module
Seabed monitoring by EIVA A/S

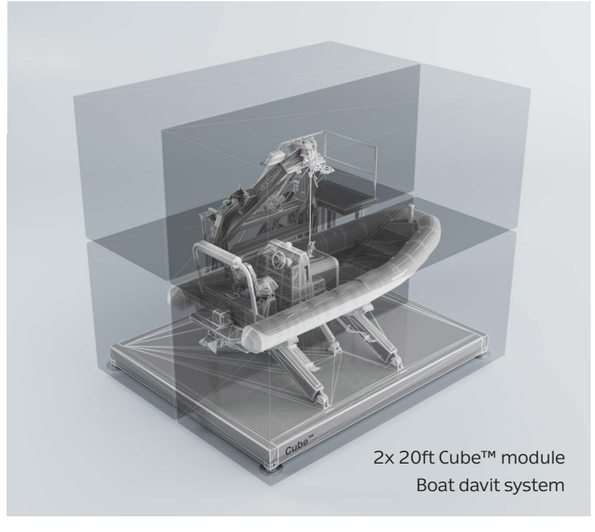


2x 40ft Cube™ module
Launch and Recovery System for
compact submarines by DRASS



2x 40ft Cube™ module
Launch and Recovery System for XLUUV

20ft Cube™ module
ISR or Loitering munition

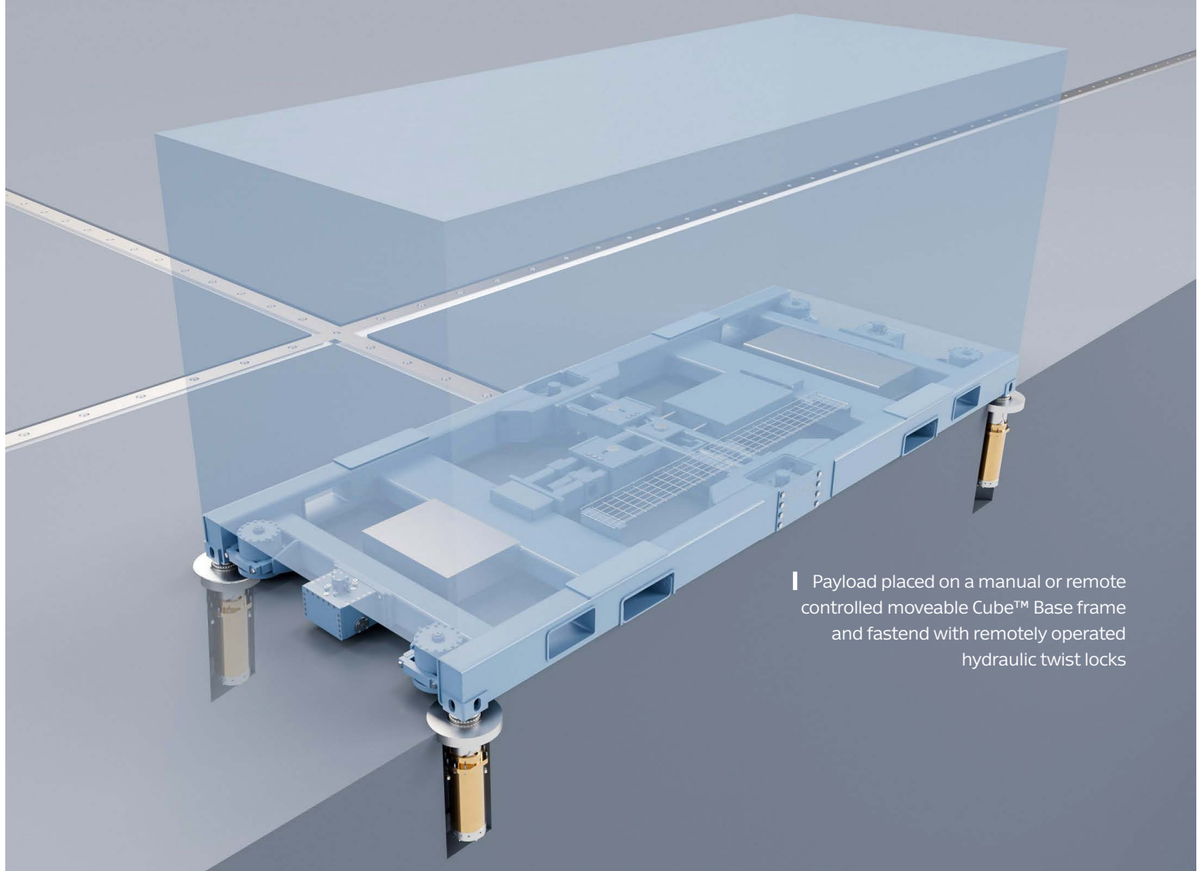


2x 20ft Cube™ module
Boat davit system

Patent pending

WHAT

With The Cube™ System, any Naval organization can turn (almost) any Coast Guard, SAR and Naval ship into a future-proof multi-mission platform with plug-and-play modules and the handling system to set them into operation.



Payload placed on a manual or remote controlled moveable Cube™ Base frame and fastend with remotely operated hydraulic twist locks

HOW

Place (almost) any equipment inside a 2x40 foot standard ISO-type container side by side onto a Cube™ Base frame. The total module is mechanically fixed to the deck and connects to any Ship Systems such as IPMS, CMS and MMS with a standard interface

Fully compliant with NATO STANAG 4830 / ANEP-99
Design and Interface Standards for Containerized Mission Modules

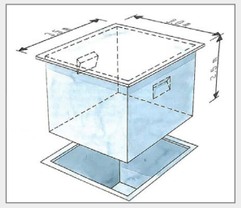
Innovation

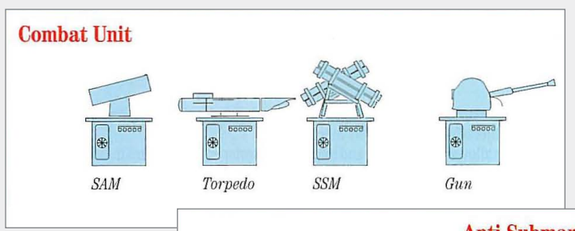
Denmark has been at the forefront of naval innovation for many years. The Royal Danish Navy was the first to adopt advanced modular capability with **the STANFLEX concept**, which has inspired the world's leading navies to incorporate varying degrees of modularity in almost all new surface combatants, patrol and auxiliary ships.

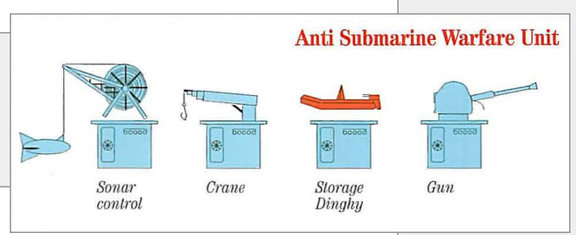
Other Danish innovations that other naval systems have sought to emulate include the large scale adaptation of commercial systems for naval purposes in order to bring down acquisition and sustainment costs, and the combination of naval missions previously considered incompatible. This concept is utilised for the Absalon-class and the Iver Huitfeldt-class frigates, which provide and combine the operational capabilities of a frigate with force projection capability previously associated with support ships.

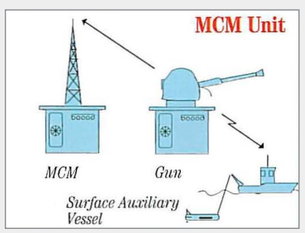
STANFLEX - The Danish Naval System

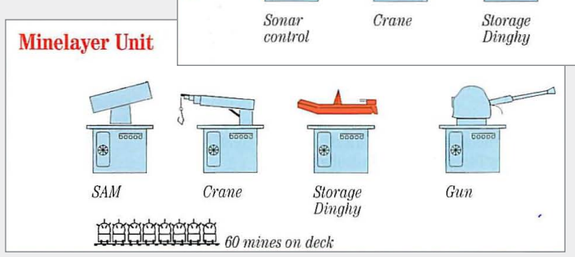
The Danish naval system comprises scientists, naval architects and shipbuilders working hand in glove with naval practitioners, with all participants receptive to innovative thinking. We believe that the SH Defence naval system is unique in the way it has developed innovative solutions to provide capability requirements of a small navy, and that this is evidenced by the extent to which Danish concepts including modularity and the adoption of commercial technology have been adopted by other countries.











With almost 40 years of operational and tactical use of the STANFLEX System, advantages and disadvantages have been considered and thought into the development of The Cube™ System. Among other things, the optimal size of modular equipment.

The Cube System™ The future in Mission modularity

The Cube is a system enabling the integration of capability modules based on standard ISO containers sizes and standardised interfaces with shipboard physical, data, and services architectures. It enables those systems to be rapidly installed, deployed, removed, and exchanged so that they can be moved around a modular space and each module is accessible to its operators. and maintainers and to the services and capabilities that needs to be operated.

SH Defence intent is to highlight the potential benefits delivered by The Cube system.
Having studied challenges seen in most navies, SH Defence believes that The Cube System will be a key enabler for navies and their future fleet structure, significantly expanding the arc of choice from which a navy are able to select and develop solutions.

The Cube and Fleet Standardisation
SH Defence suggest that the Cube system enables the adoption of standard platforms to be able to operate effectively and economically across the spectrum of operations, performing missions that have hitherto required specialised combat, patrol, mine laying, mine counter measures, hydrographic and oceanographic and scientific support ships.

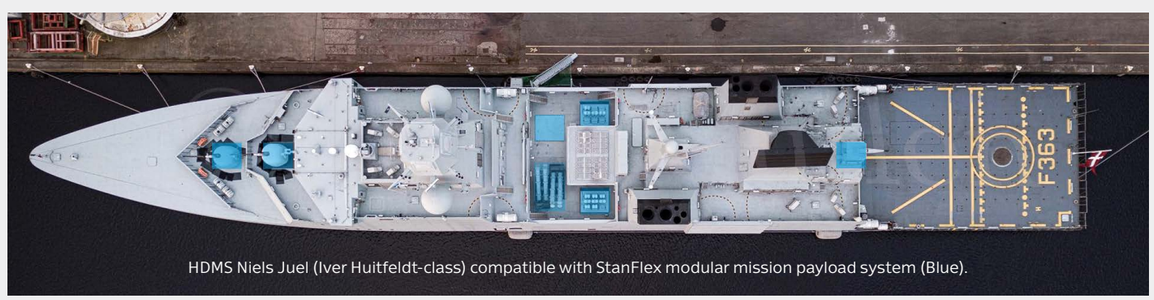
The Cube and Capability Management

One of the most significant benefits of the degree of modularity enabled by The Cube System relates to the management of obsolescence and future proofing. As the systems contained in a capability module become obsolescent, they can be upgraded or replaced while the host platforms remain available for continous operations.

Standardised physical and technical interfaces enable new or upgraded modules to be integrated with shipboard systems without changing the physical structure or technical systems architecture of the ship. As the system and its module form a complete technical package, testing and integration can be carried out ashore prior to installation, further de-risking capability upgrades. Operators and maintainers can likewise train with the full functionality of the modular systems prior to deployment, increasing readiness and availability.

The Cube System and Capability Flexibility

SH Defence is not a shipbuilder. SH Defence offer technology in partnership with shipbuilders and suppliers of naval and broader maritime technology. As a company, SH Defence have Memoranda Of Understanding (MOU) with some of the most advanced naval shipbuilders in the world enabling us to share information that enables their offerings to incorporate The Cube System from the outset.



HDMS Niels Juel (Iver Huitfeldt-class) compatible with StanFlex modular mission payload system (Blue).

Changing the Game at Sea

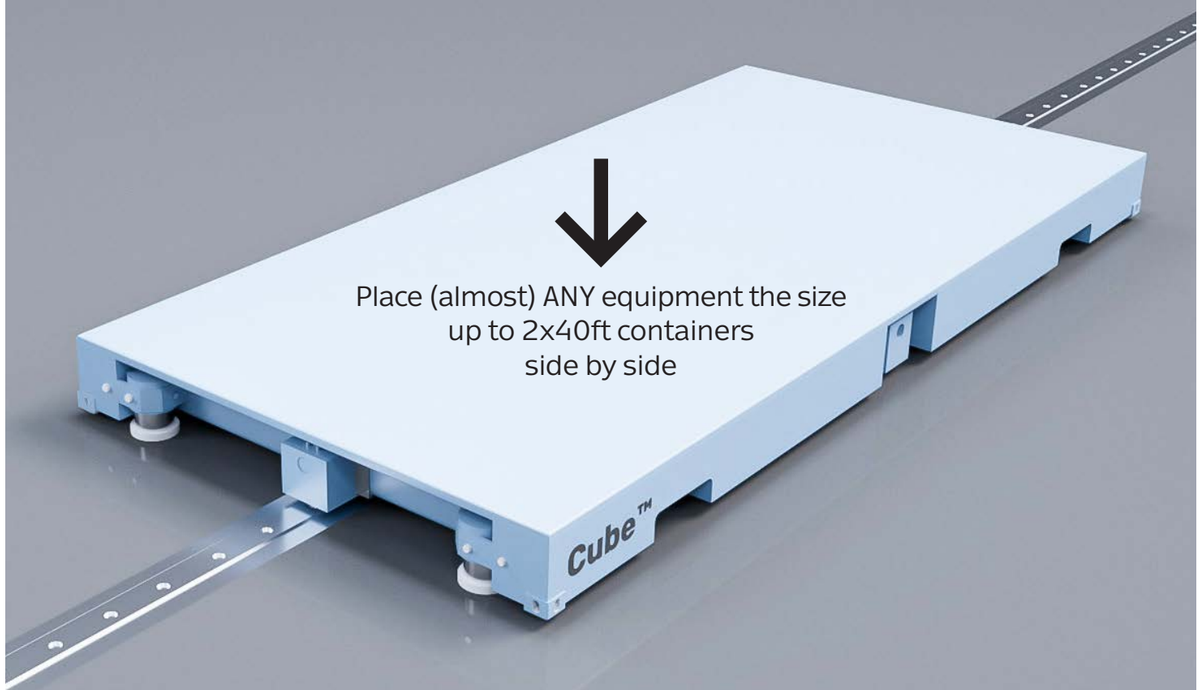
For the past years, SH Defence has been in close dialogue with the most significant equipment suppliers so that The Cube System can incorporate modular capacities for the following naval missions (not an exhaustive list):

- Anti-Submarine Warfare (ASW) (towed body sensors, autonomous vehicles, and ASW torpedo tubes)
- Offboard torpedo decoys
- Mine Counter Measures (MCM) (autonomous vehicles and support for diving operations with recompression chambers and diving air supply)
- Close in missile defence (including Close In Weapon Systems (CIWS) and decoys) and AAW
- Anti-Surface Warfare (ASuW) (advanced missile systems such as the RBS15 from SAAB to be accommodated in our containers/modules)
- Humanitarian Assistance and Disaster Relief (HADR) (advanced medical facilities, reverse osmosis water treatment plant and electrical generation plant can be accommodated in our modules)
- Special Forces (SF) support (SF mission planning and Command and Control capability can be securely accommodated in our modules)
- Maritime Interdiction Operations (MIO) and Resource and Border Protection Operations (RBPO) (the Cube system can provide stowage and launch and recovery systems for additional boats in addition to modular accommodation for boarding parties and other government agency staff)
- Sea Mine Laying module that consists of a container-based minelaying module and one or more storage modules
- Research Support modules for for inspection, surveillance and repair of subsea installations
- Launch and Recovery module for ROV´s, drones (UAV's), USVs, AUV's, UUV's and mini-subs

In addition, the modular capability offered by the Cube is a natural fit for autonomous, uncrewed aerial, surface, and sub-surface vehicles for a range of missions, including Intelligence, Surveillance, and Reconnaissance (ISR), advanced force operations, and support to environmental science – the latter is identified by navies under the northern and southern hemispheres as important in the light of the challenges created by climate change.

The Cube™ Modules

The Cube™ System is open source and for free use by any ship designer, shipyard, software integrator or equipment supplier.



Selected suppliers of equipment for The Cube™ System

DC SUPPLY · KRAKEN · DESMI · ATLAS ELEKTRONIK · THALES
KYSTDESIGN · L3HARRIS · LEONARDO · RHEINMETALL DEFENCE · SEALARTEC
uni-safe · STROBELTEK · Raytheon Missiles & Defense · ULTRA · STADT
MSI-Defence Systems Ltd · TERMA · Corvus Energy · TELEDYNE TECHNOLOGIES · LIQTECH
BAE SYSTEMS · ULTRA · SAFRAN · saes · IAI
VESTDAVIT · PRO:ZERO · BluMetric Environmental · GeoSpectrum Technologies Inc · thyssenkrupp
MAN Energy Solutions · SEA A COHORT PLC COMPANY · Elbit Systems EW and SIGINT - Elisra · SAAB
DA GROUP · FORCIT GROUP · DRASS DEFENCESOLUTIONS · ANSCHÜTZ · EIVA

The Cube™ System - Mission modules

The future is modular. Adaptability and interchangeability are at the heart of next-generation maritime platform design for leading navies worldwide. The Cube™ System enables rapid mission assignment and interchangeability between platforms, made possible with plug-and-play mission modules and the handling system to put them into play.

The Cube™ System prepares navies for future challenges, such as defence against new, complex, and changeable threats or opening up new possibilities like bringing an unseen and unexpected capability into a theatre.

Modularity offers a Maritime Force multiple benefits, and with The Cube™ System, any Navy can turn (almost) any platform (Navy, SAR or Coast Guard) into a future-proof multi-mission capability.

The Cube™ System is two things:
It is a modular encapsulation of equipment for air, surface, and subsea domains, ready-made for integration into naval, coastguard or SAR platforms.

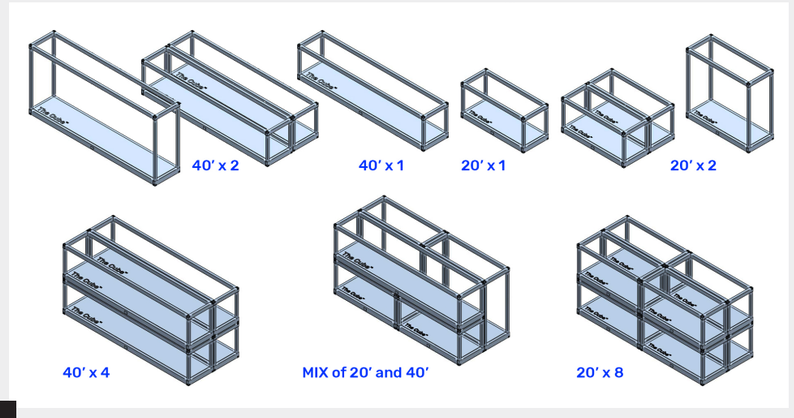
Secondly, it is an infrastructure to safely handle and move mission modules from the quayside into the mission bay, around the hangar, and further out on the open deck from bow to stern, up and down and from Port to Starboard side - No more heavy overhanging cranes or sophisticated and expensive handling solutions or welding the equipment to the deck structure.

The lifting from the quayside is done with the Cube™ Side Loader or Cube™ Transfer Davit. Fastening and moving mission modules is done using specially developed hydraulic twist locks and a manual or remote-controlled skidding system being operational at sea.

Cube™ Mission modules, the footprint of single or double 20ft and 40ft standard ISO containers, represent equipment from leading defence primes within all maritime warfares, such as combat operations, sea mine laying, MCM, ASW, ISR, SAR, Humanitarian Assistance and Disaster Relief, Science and Research Support.

Being adaptable to The Cube™ System, a platform can bring an unseen and unexpected capability into the theatre and put it into play. This gives some obvious tactical and strategic advantages.

The Cube™ System enables rapid mission assignment at sea and interchangeability between Cube™ Ready platforms platforms and replacement of critical equipment at port.




Fast swap between platforms


Training and maintenance

The Cube™ Sea mine laying system

The Cube™ Mine laying system is easy to store and transport on land and fast to load from quayside to vessel.

The Cube™ Mine laying system consists of a 20ft module-based mine launching module and one or more storage modules capable of handling all known brands and types of sea mines.

The system allows the sea mines to be deployed individually or in patterns, and their locations are recorded for future retrieval or deactivation.

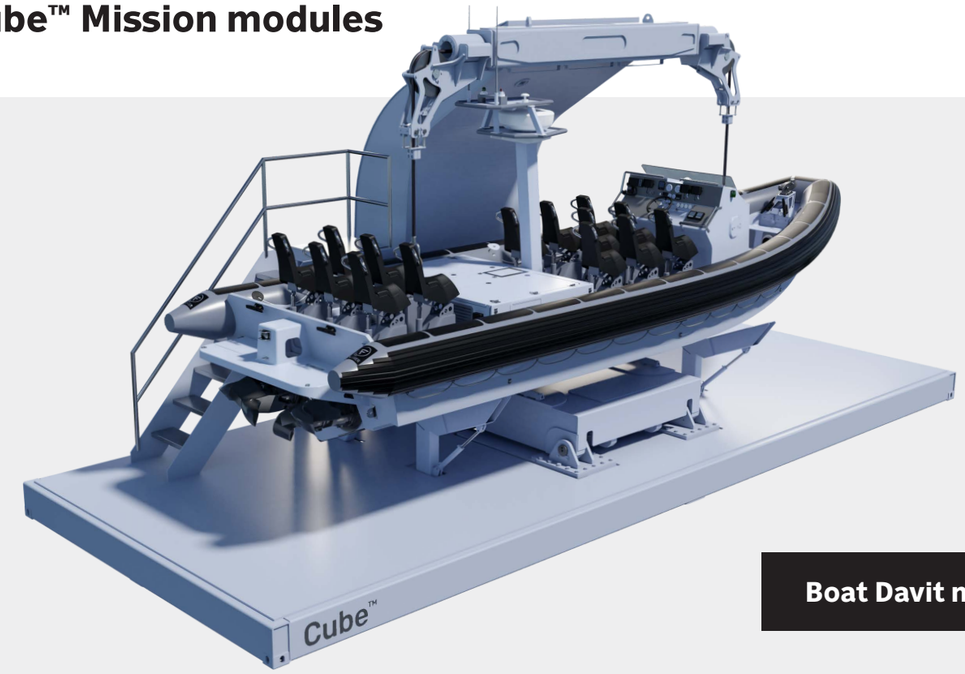
Since The Cube™ Mine laying system is a semi- or fully automatic system, the manual and often unsafe handling and deployment of mines at sea in the past can now be replaced with safe handling in high sea states and with a minimum of people involved. Down to one person if the doctrines of the individual Navy allow it.

With a modular mine laying and storage approach, costly rebuilding or even the building of new platforms can be avoided. With The Cube™ Mine laying system, a Navy can turn existing frigates, OPVs or Multi-role ships into effective mine layers in days or even a few hours.

The Cube™ Mine laying system solves a wide range of practical and safety challenges, such as logistics, manpower and safe handling at sea. By using The Cube deck skidding system, modules can be stored in the vessel's hangar and quickly mobilized.

Sea Mine laying

Cube™ Mission modules

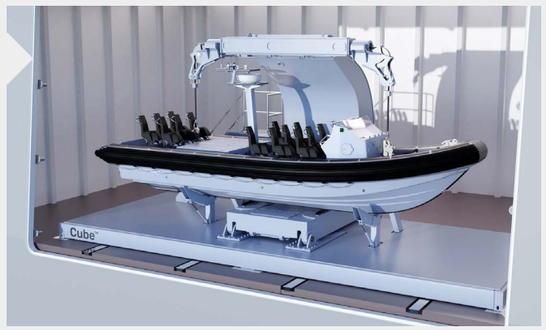


Boat Davit module

The Cube™ modules are the backbone of multi-mission platforms. The examples on the following pages shows selected interchangeable modules within various warfares.

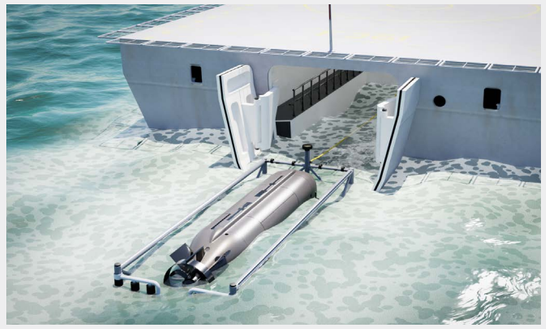
The Cube™ Module Side Loader
Modular systems enable rapid reconfiguration, increases operational effect and presents adversaries with more dilemmas. The Module Loader solution supports a platform designed to handle Cubes™ and enable the platform to change modules within each mission bay areas.

Modules with footprint from 1 TEU up to 8 TEU and payloads up to 40 tons can be loaded on and off in less than an hour. The loader automatically compensates for ship movement to ensure the safe transfer of high value mission modules.



Fast Interceptor Boat Module - Side launched
Complete launch and recovery system with integrated painter line for interceptor boat. The Fast Interceptor Boat is a solution from **MST Group** engineered onto a 2x40ft Cube™ frame with a davit from e.g **VestDavit, Fairbanks Morse Defense** or **SH Defence**.

Launch and Recovery System



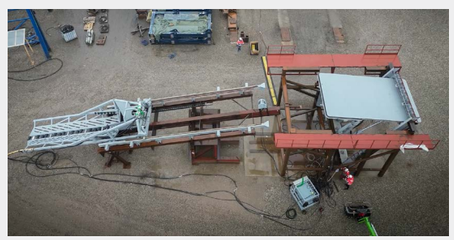
DRASS DS8 Cube™ Launch & Recovery module
The DS8 SDV is a highly effective, insidious and stealthy warfare submersible craft for sabotage and intelligence missions.

By joining forces, DRASS and SH Defence combine their respective expertise, experience, and technological advancements to unlock new game-changing possibilities in the maritime defence sector.

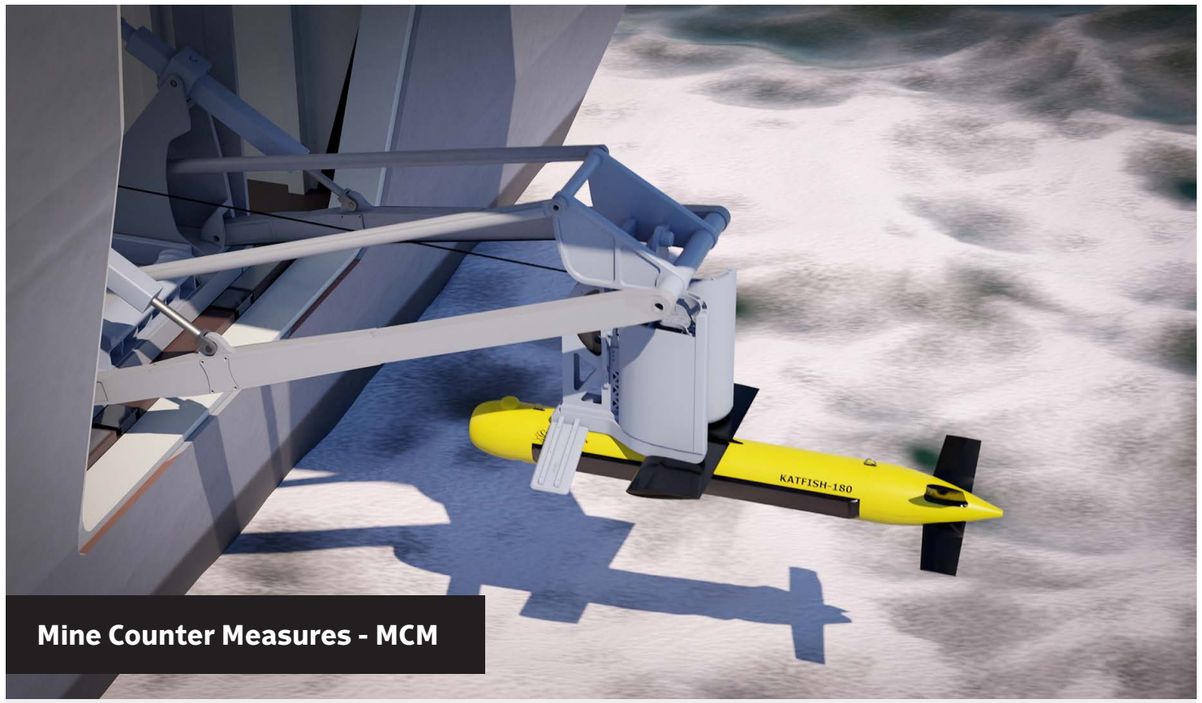
The possibility of bringing an unseen and unexpected capability into theatre launched from a “random platform” has obvious advantages for missions requiring absolute secrecy.

With The Cube™ System making (almost) any platform modular, this is now possible.

DRASS®

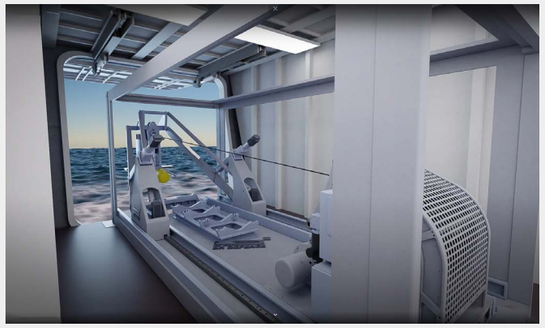


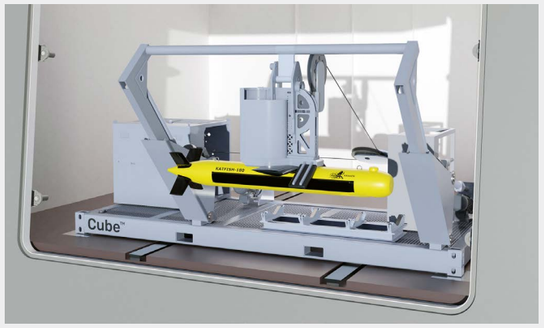
Boat cradle with stern door.
Slipway tailor-made for drones and USV. Designed and produced by SH Defence.

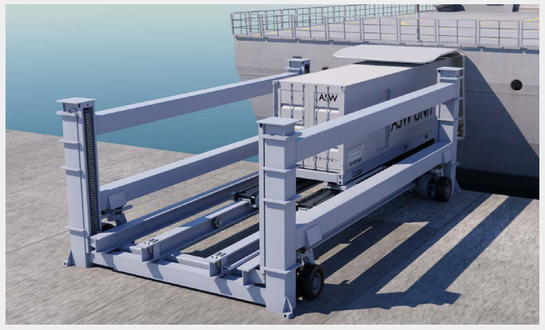


Mine Counter Measures - MCM

MCM Module - Stern launched
The Katfish is a towed SAS sonar from Kraken Robotic Systems. Engineerd as a 20ft Cube™ module - Side or stern launched. Launch and Recovery system by SH Defence. The solution consists of a winch and an A-frame with a gripper





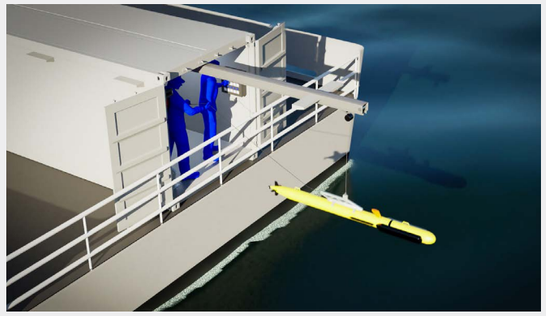


MCM Module - Side launched
The Katfish is a towed SAS sonar from Kraken Robotic Systems. Engineerd as a 20' Cube™ module - Side or stern launched. Launch and Recovery system by SH Defence.

Module Stern Loader
The fast conversion is enabled with the Mobile Cube™ Stern Loader, capable of loading and unloading Cube™ modules up to 40ft into and out of Cube™ ready mission bays in the vessel's stern, thus eliminating the need to install heavy lifting equipment in the vessel's mission bays.

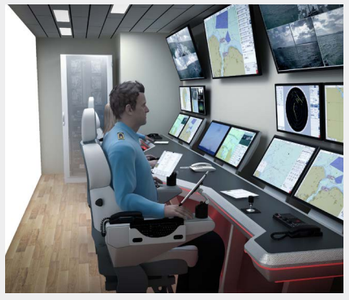
Mine Counter Measures - MCM

The Seagull™ unmanned surface vessel (USV) system from **Elbit** provides naval forces with significant tactical advantages in underwater and surface warfare. Featuring modular and switchable mission payload suites with advanced sonars and subsystems, the fully autonomous Seagull USV can be deployed for multiple manned and unmanned missions with The Cube™ System. The Seagull USV incorporates mine counter measures (MCM), anti-submarine warfare (ASW), maritime security (MS), electronic warfare (EW) and other advanced systems and technologies.

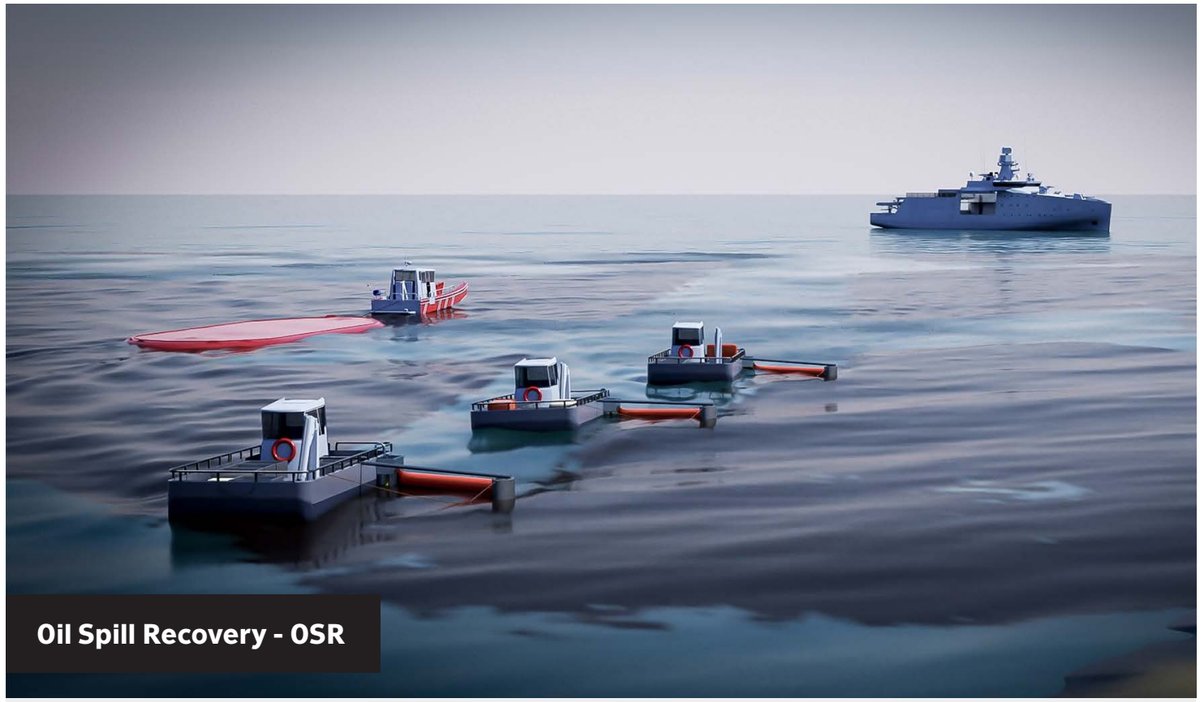


MCM Side launched Cube™ Boat module
The **ECA Group** 'INSPECTOR 120' 12 Meters USV as a side launched Cube™ module. The Inspector is an autonomous platform for mine counter measures

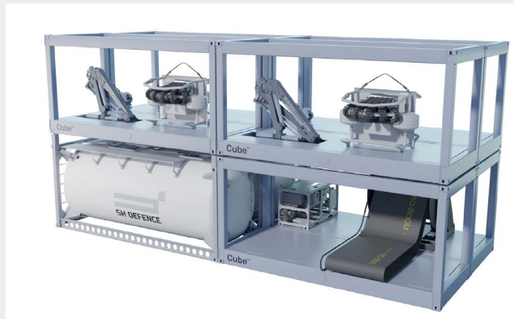
Stand-alone Mine Disposal capability
This mine hunter capability is a stand-alone system that includes several suppliers: C2 container and Launch and recovery system from **SH Defence**. A REMUS AUV from **HII** with a multi-sensor platform from **Kraken Robotic Systems.** The mine disposal system is a SeaFox from **ThyssenKrupp AG**.
The system can be put on any prepared Naval vessel, Coast guard or commercial ship.



Command & Control System Module
The **SYNTACS** Command and Control System by **ANSCHÜTZ** is designed to provide platforms with the capability for above-water warfare missions. Adapted to the growing mission profiles of naval platforms.

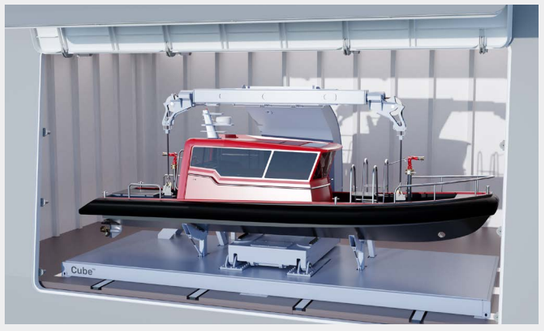


Oil Spill Recovery - OSR



Cube™ Skimmer system module
DESMI Ro-Boom System in a Cube™ module. Fast response for coastal and near-shore use.

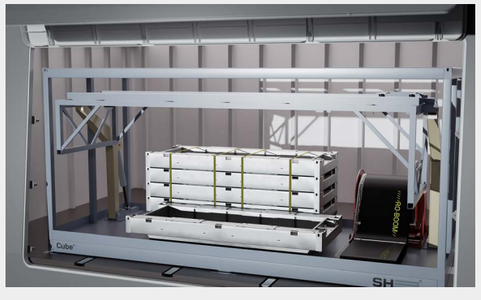
The systems being able to recover a wide range of oils including emulsions and weathered compounds to high capacity. This Ro-Boom Clean system fits in a 40ft Cube™ - ready mission bay. Other relevant modules: Floating barrier module, Skimmer system modules, Grab system module, Chemical dispenser module



Cube™ Work boat module
The modular solution is tailor made for handling workboats of various sizes from several OEMs with lengths up to 13 meters. The solution is to be used from a side located mission bay on a naval platform of opportunity.

With a number of different boat types as a modular solution, it is possible to solve many different tasks such as transfer operations, oil spill clean-up, inspections or fire fighting.

Relevant maritime operations
Oil Spill Recovery, OSR
Maritime Search and Rescue, SAR
Naval Disaster Relief Operations, NDRO and Humanitarian Aid

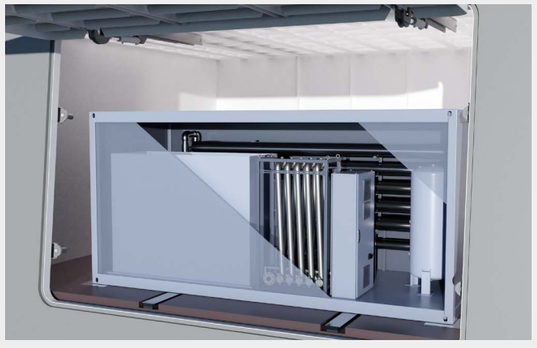


Cube™ Flexible Environmental Protection Barge module
A flexible environmental barge from **FLEX-FEB** deployed at short notice for collecting oil in shallow waters.

Disaster Relief Operations

Life support module
This module is a stand-alone 3-1 unit. The first part contains a complete turnkey water treatment system and provides unlimited desalinated potable or technical water anywhere, anytime. The second part is a Genset designed to run at full capacity in land-based harsh environments. The third part is a boiler system for heating of houses, supply to hospitals or other mobile container solutions like offices, field kitchens and hospitals.

Naval Disaster Relief Operations
Over the past decade, there have been numerous disasters for which navies have provided a significant amount of effective assistance in terms of scope, scale, and timing due to their many unique and critical capabilities. Not all ships are equally suited to contribute effectively to each disaster. With modularity NDRO and HD operations can be facilitated from any type of platform or put ashore.



Water purification
Complete turnkey water treatment systems providing unlimited drinking water (or or technical water) for Coast Guard, SAR, and Navy Vessels. The solution shown is a module from LiqTec but can be from any manufacturer.

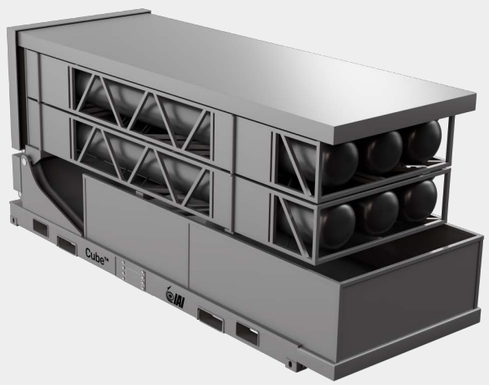
BARAK MX - Naval Air & Missile defense system

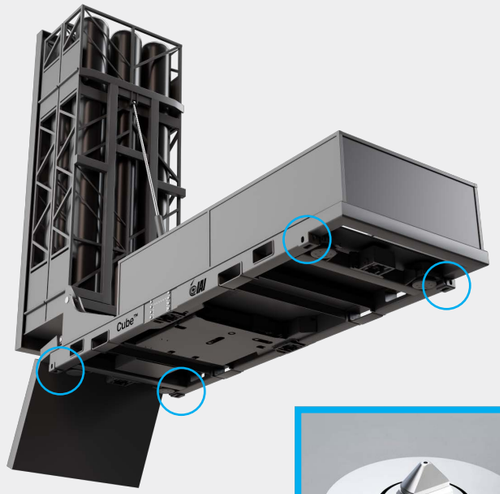
Full flexibility in Air & Missile defense System

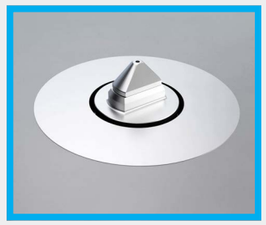
- All-Threats battle management capability
- System configuration by the users for different missions
- Modular architecture for future capabilities
- Network centric configuration supporting advanced joint operation and Air defense redundancies

System exceptional capabilities:

- All threat capability – fighters, sea-skimming and cruise missiles, TBMs, UAVs, helicopters and gliding bombs
- Naval & Land unified system configuration
- Automatic interceptor selection (optimized cost/threat operation)



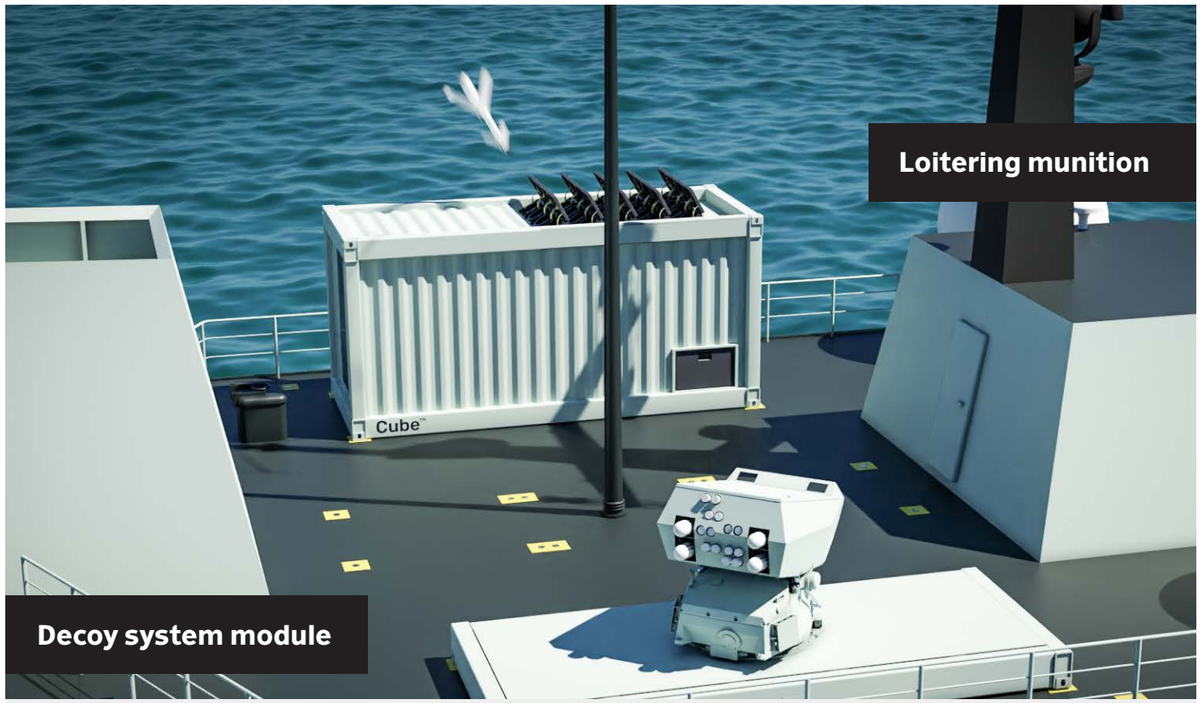




Twist locks
Module is fixed and secured with remotely operated hydraulic Twist locks.

System Components – Effectors

- Three (3) BARAK Interceptor types available
- MR for 35 Km – single pulse rocket motor
- LR for 70 Km – dual pulse rocket motor
- ER for 150 Km – dual pulse rocket motor with booster (supporting TBM defense capability)
- Active high-end RF seeker for low RCS and highly maneuvering targets



Loitering munition

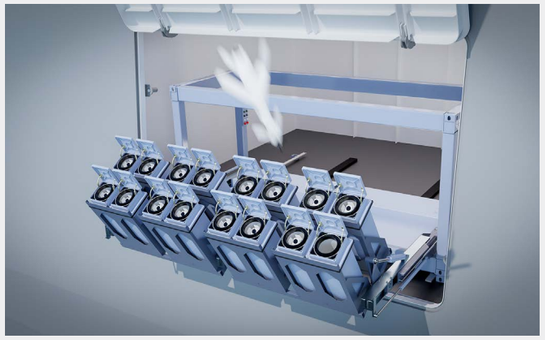
Decoy system module

Extra fire power to platforms of all sizes
The Loitering Munition Cube™ module can be configured for different suppliers' Loitering Munition types, quantities and operating systems. It integrates into a 20ft or 40ft container. The model shown is with Loitering Ammunition from Uvision.

The Loitering Munition Cube™ module is a fully autonomous multi-canister launcher, land- or sea-based.

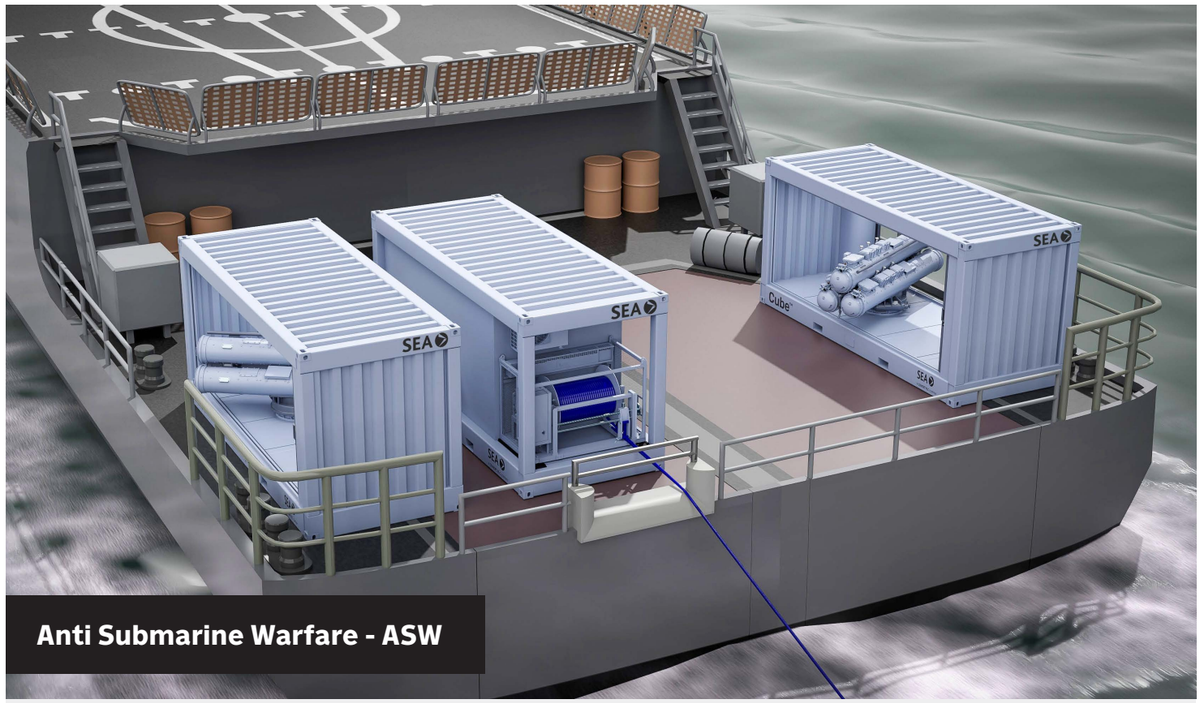
Naval and Coast guard platforms
Multi-canister side launch system consisting of a dock for loitering munition on a Cube™ 20ft frame.

A hydraulically operated telescopic arm extends the canisters from the vessel's Mission Bay, allowing almost vertical launch of loitering munition.

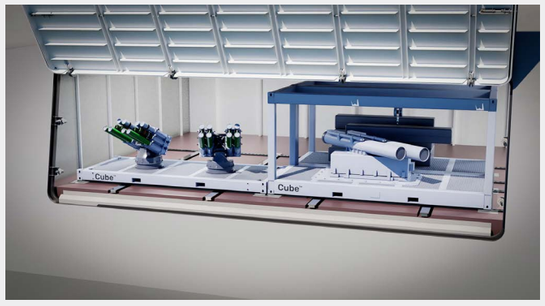


Drone launch modules
Drones are suitable for recon and attack missions and come in all sizes and configurations. Modules that support drone take-off are available in countless varieties as Stand-alone units with integrated C2/C4 control room.

Drones and loitering munition is ideal for supporting deployed forces doing rapid entry to the fight as e.g littoral strike groups.



Anti Submarine Warfare - ASW



SEA

Krait Defence System enables flexible, scalable, modular and small footprint Anti-Submarine Warfare (ASW) capabilities.

A modular system like KraitSense from SEA comprises a passive thin line towed array sonar KraitArray™, the handling system, processing cabinet and user consoles.

This approach allows passive ASW to be achieved from a wide range of both naval and non-specialist platform types. In addition SEA's proven Decoy and Torpedo Launcher Systems enable rapid threat response and vessel mission system reassignment. The SEA Torpedo Launcher is weapon agnostic and capable of firing a range of NATO compatible standard lightweight torpedoes.

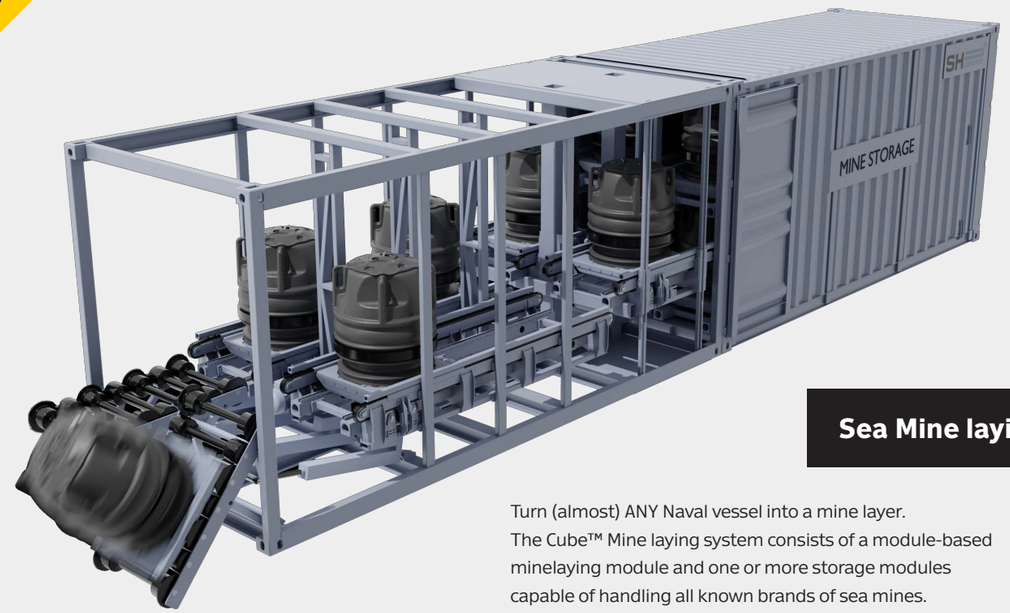
Combined with The Cube™ Infrastructure solution, the handling system within SEA's KraitSense can remain within The Cube™ or alternatively be mounted separately to suit the particular vessel layout.

Anti-submarine warfare
Successful ASW operations typically involve a combination of sensor and weapon technologies. Sophisticated sonar equipment is used for first detecting, then classifying, locating, and tracking a target submarine. Weapons for attacking submarines include torpedoes and naval mines.

With the The Cube™ system, all these technologies can be integrated into one extremely capable, adaptable and easily upgradeable solution.

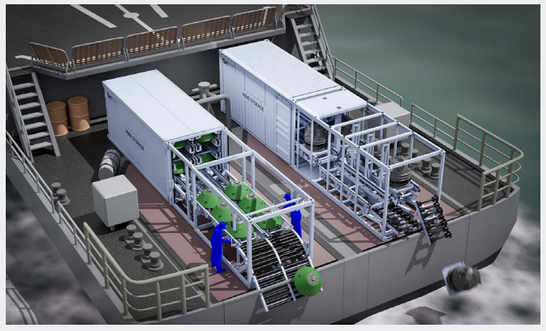
The Cube™ ASW modules
Passive Towed Array - Active Acoustic Search
Acoustic Decoy System - Lightweight Torpedo Launcher

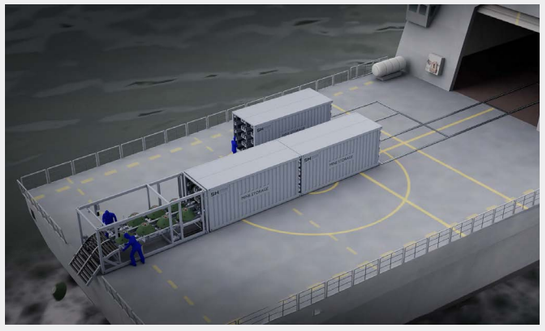
Patent pending



Sea Mine laying

Turn (almost) ANY Naval vessel into a mine layer.
The Cube™ Mine laying system consists of a module-based minelaying module and one or more storage modules capable of handling all known brands of sea mines.





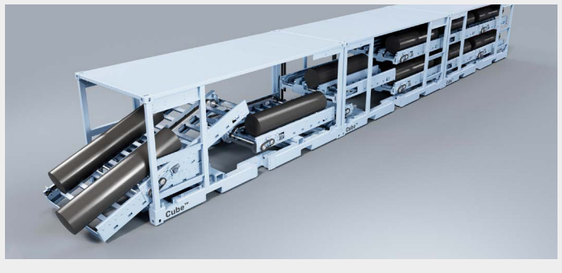
The Cube™ Mine laying module
Fully-automatic, Semi-automatic or manual handling depending on doctrines at sea combined with easy and safe logistics on land.

Avoid costly rebuilding of platforms to handle mines the old, manual and often unsafe way, and NO more building of expensive single-purpose platforms for mine laying.

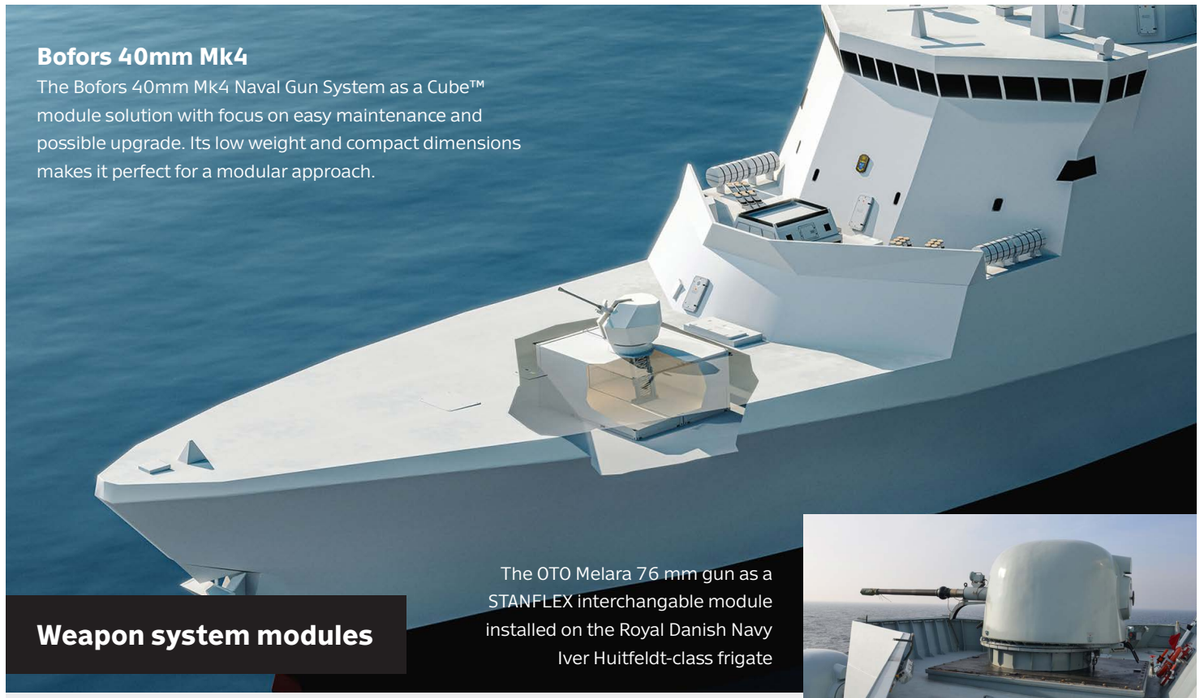
With The Cube™ Mine laying system, any Navy can turn existing frigates, OPVs or Multi-role ships into effective mine layers in a few hours. The Cube™ Mine laying system offers a Minelaying Planning and Execution System, e.g. from Atlas Elektronik.

The Cube™ System provide the capability to lay different types of sea mines simultaneously. Vessels with sufficient space and outfitted with a sea state skidding system will obtain the capability to lay more than 400 sea mines continuously without having to pause the operation when changing the storage module.

Flexibility
Because the 20-foot size corresponding with ISO containers, the modules can be locked in place with Twist locks or equivalent. This makes it possible to use the system on various deck structures, such as helicopter landing decks or stern hangar decks with open access to the stern.



ATLAS ELEKTRONIK
RWM ITALIA SPA
A RHEINMETALL COMPANY
DA GROUP
saes®
FORCIT DEFENCE

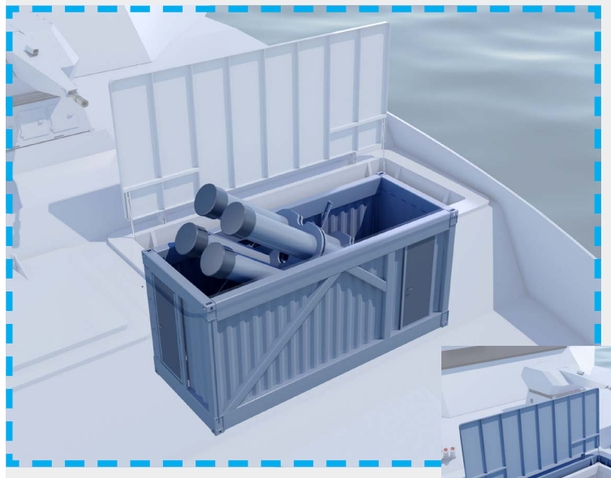


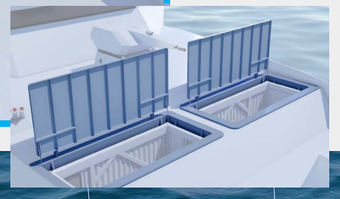
Bofors 40mm Mk4

The Bofors 40mm Mk4 Naval Gun System as a Cube™ module solution with focus on easy maintenance and possible upgrade. Its low weight and compact dimensions makes it perfect for a modular approach.

Weapon system modules

The OTO Melara 76 mm gun as a STANFLEX interchangable module installed on the Royal Danish Navy Iver Huitfeldt-class frigate



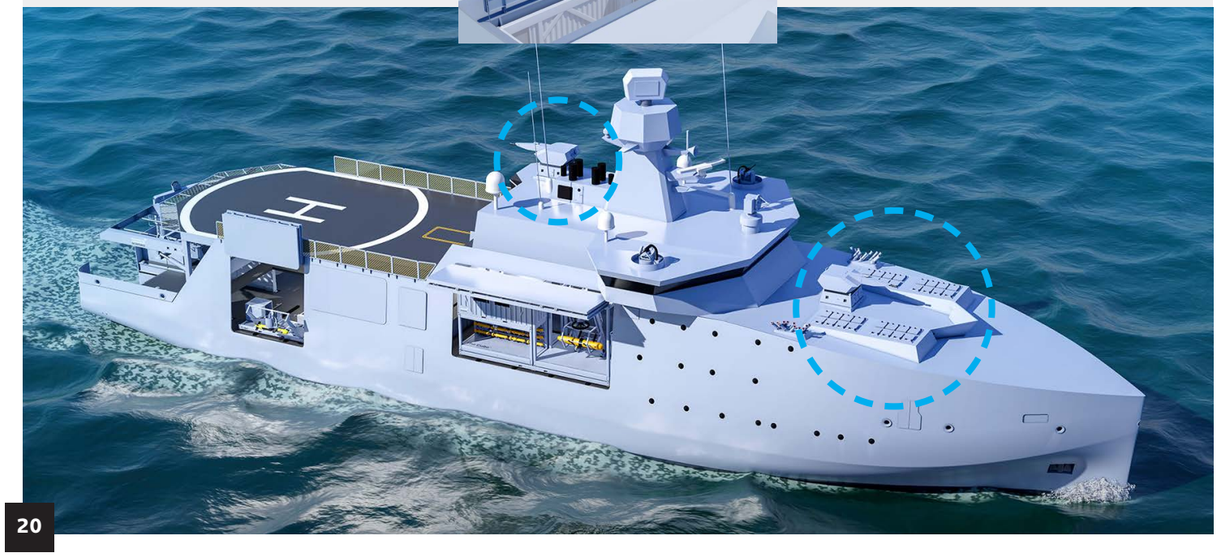


Anti-ship missile module

RBS15 from SAAB is a highly optimized anti-ship missile launched from a replaceable module.

With a modular approach to missile systems, a fleet can use the “built-for-but-not-with” mindset and thereby integrate a future missile type when needed. The RBS15 is currently being engineered into an interchangeable Cube™ module solution giving a platform the ultimate flexibility.

We are currently in dialogue with missile manufacturers for integration into The Cube™ System.



The list below shows interchangeable mission modules for all dimensions of modern warfare.

Anti Surface Warfare - ASuW:
- SSM/ASM modules
- GUN modules
- CIWS modules
- Decoy modules
- Small weapons modules
- Torpedo modules
- Counter torpedo modules
- Laser directed energy modules
- Different radar modules
- Surface Drone modules

Anti Air Warfare - AAW:
- ASM modules
- CIWS modules
- Decoy modules
- Small weapons modules
- Laser directed energy modules
- Different radar modules

Anti Submarine Warfare - ASW:
- Towed array Active Sonar
- Multibeam Sonar modules
- Retractable Sonar modules
- Side Scan Sonar
- Submarine module
- Sonar boys and pods modules
- Depth charge modules
- Anti-Submarine Torpedo modules
- Anti-Submarine Missiles modules

Mine Laying:
- Mine Laying modules flexible for different type of mines
- Mine storage modules

Mine Counter Measures - MCM:
- Mine Clearance UUW-ROV
- Small weapons station modules
- Mine Clearance Side Scan Sonar modules
- Battery power plant modules
- USV 20-foot module
- USV Recovery cradle

Electronic Warfare - EW:
- EM launching modules
- Laser/directed modules
- Battery power plant modules

Naval gunfire support - NGFS:
- ASM modules
- CIWS modules
- Decoy modules
- Small weapons modules
- Laser directed energy modules
- Different radar modules

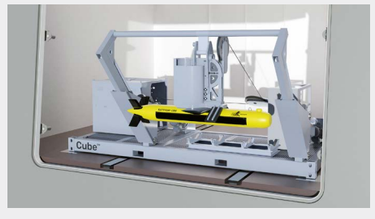
Maritime interdiction operation- MIO

Naval Disaster Relief Operations - NDRO:
- Drone control system
- Transportable Command Center
- Surface work boat
- CBRN Modules
- Medical lab modules
- Medical treatment module
- Pandemic Test modules
- Morgue modules
- Rescue and Evacuation modules
- Staff workplaces module
- Additional accommodation
- Detention modules
- Fresh water plant module
- Generator unit module
- Disaster relief packages modules
- Battery power Plant modules
- RHIB modules
- Hydraulic powerpack modules
- Crane modules

Maritime Search and Rescue, SAR:
- Medical treatment module
- Fire Fighting module
- Maintenance & Repair module
- Air Diving module
- Hyperbaric chamber module
- Crane module
- RHIB, MOB module

Research Vessel, RV:
- Drone control system module
- Crane module
- Winch module
- Research lab module
- Workshop modules
- RHIB 10, fast interceptor

Oil Spill Recovery - OSR:
- Floating barrier module
- Skimmer system modules
- Grab system module
- Chemical dispenser module
- Oil spill tank module
- Chemical spill tank module
- Oil barge modules
- CBRN module
- Crane module
- Surface Work Boat module



Naval Capability Acquisition and Management – the Challenges

Keeping Pace with Requirements.
Recent history demonstrates that the security threats faced by any nation and, thus, the missions required of its defence forces can change drastically in a very short space of time. A focus on bipolar Cold War tensions was followed by a shift to peace support and stabilisation and operations to counter the rise of mass terrorism and transnational crime. Force structures acquired and postured for the former had to be adapted to the latter.

The strategic wheel has now turned full circle, and liberal democracies are again faced with the possibility of large-scale inter-state conflict between peer or near peer competitors without any reduction in contingencies requiring stabilisation and humanitarian intervention capabilities.

Exploiting Transformational Technology.
Transformational technologies, including autonomy, open architecture computing systems, and highly advanced weapons and sensors, are increasingly available. Exploiting these technologies can enable defence forces to accomplish almost any mission, provided the technology is backed by sound doctrine and a committed, values driven workforce. However, it must acquired in sufficient quantity to be available when and where it is needed. Enabling this availability is one of the main challenges facing modern navies.

Managing Obsolescence.
Warships have traditionally been designed to carry specific systems for specific missions – the ship's structure, propulsion, and general platform systems are tightly coupled to the weapons and sensor (or mission) systems it is designed to carry. Although almost all warships have a weight and stability growth margin built into their initial designs, actually modifying a ship with new systems for new missions or to exploit new technology is a risky, expensive, and time-consuming business.

Systems can be iteratively upgraded in situ to some extent, but for the most part, the obsolescence clock starts ticking as soon as the design of a traditional warship is fixed, which is usually years before it enters operational service.

Obsolescence can usually only be comprehensively addressed by half-life upgrade programmes, the duration of which is measured in years and the cost in hundreds of millions of dollars, pounds, or euros.

Costs almost always escalate as the true scale of the integration task emerges, and schedules are almost always exceeded. As with initial design, systems installed in half life refits start to become obsolescent as soon they are selected for installation.

A warship's mission systems usually wear out or become obsolescent well before the life of the ship's structure and platform systems has expired. If a way could be found to de-couple the life of the ship's mission systems from its platform systems, it might be possible to extract a longer life and, thus, greater value from the former. US aircraft carriers are a case in point. The air groups they embark on are their mission systems. By the time the ship de-commissions, it will have operated several generations of aircraft while operating the aircraft mix best suited to operational missions at any one time.

Effectiveness and Efficiency – Value for Money.
As indicated above, geo-strategic policy drivers and, thus, the missions that navies are required to perform can change significantly in a relatively short space of time. Ships equipped primarily for ASW missions with tightly coupled platform and mission systems can be (and often are) employed on stabilisation operations in which the main task is Maritime Interdiction Operations (MIO), but this wastes the very substantial investment made in their primary systems and in the people who maintain and operate those systems. Opportunities to maintain ASW proficiency are likely to be few and far between during stabilisation operations, causing the capability to decay rapidly.

Conversely, a ship designed purely for low-threat operations also represents a significant investment for a capability that can only be used for a narrow range of missions. Patrol ships may be cheap when compared with combatants, but whether they represent value for money is a question that could be asked, particularly when naval workforce costs are considered. The ideal naval platform would be able to operate effectively and efficiently over a wider arc of operational missions than the dedicated, high-end combatant and the low-capability, relatively low-cost patrol vessel.

Cost Escalation. Over the last 60 years, the procurement cost of frontline naval combatants has increased at an annual rate in real terms of between 3% and 6%. High-end frigates and destroyers can cost in excess of USD1B, making it very difficult for the navies of those countries that support the international rule of law to afford enough naval platforms for even the most essential missions. These navies face significant numerical overmatch in relation to potential adversaries with almost no prospect of being able to redress this imbalance through traditional naval combatant design and procurement practices. A means must be found to enable high-quality naval capability to be fielded in sufficient numbers to match potential threats.

Work Force Effectiveness.
A traditional multi-mission combatant generally carries with it all the people needed to maintain and operate the systems with which it is fitted, regardless of the nature of the missions it is undertaking. The ship is, in theory, ready to respond to rapidly evolving threats in all dimensions with little warning. In practice, however, a frigate that has been deployed for MIO for five months will have very seldom had an opportunity to practise ASW operations.

Even with onboard simulation, the skills of the ASW operators will decay to the point where the ship is by no means actually ready to deal with an ASW threat. In addition, carrying people aboard deploying ships whose primary skills are not required for the mission at hand can be a major dissatisfier, increasing attrition in highly skilled branches and trades.

Readiness and Flexibility.
The wide range of missions required by many smaller navies creates severe challenges in determining the most appropriate fleet structure. Combat, patrol, and force projection capabilities

are often all required, and they must often be operated over very wide oceanic spaces and in very challenging environmental conditions.

Using combat platforms for patrol missions is wasteful and inefficient while using patrol platforms on missions where there is a risk of combat creates unacceptable risks (and could actually invite attack from hostile actors). To date, this has meant the acquisition of a diverse range of platforms and systems, which creates major sustainment challenges, as outlined below.

The management of obsolescence such that capability keeps pace with requirements without costly, risky, and time consuming mid-life refits. Acquiring capability that represents value for money by effectiveness across a wide arc of missions. Acquiring capability of sufficient quality in sufficient quantity in the face of cost escalation, finite defence budgets, and competing priorities.

Making the most effective use of the available workforce and minimising dissatisfaction caused by unnecessarily high deployment tempo.Multiple ship

System Diversity.
Fleets comprised of a number of different specialised ship types are usually faced with the support of a range of different systems performing the same function in different ship types. This creates multiple supply chains and training pipelines and increases the cost of spare holdings. Different systems become obsolescent at different rates. As they are replaced at different times with modern systems, diversity is perpetuated. The problem is amplified for small navies operating multiple ship types.

The Naval Capability Challenge Summarised
In maintaining sufficient naval capability to meet current and future security challenges, governments and defence planners are faced with the following:

Geo-strategic capability drivers that evolve more quickly than the capability procurement cycle. Identifying ways in which rapidly evolving technology can be exploited so as to achieve and maintain strategic, operational, and tactical advantage.

types create system diversity that amplifies training and support challenges.

Modularity

There is no such thing as a panacea solution to naval capability requirements. However, a strategy known as modularity has evolved that goes a long way to addressing the challenges identified above. In brief, a modular ship is essentially a standard platform able to receive capability “modules” tailored to the needs of specific operations. Modules are based on standard containers, which might contain anti-submarine warfare sensors, autonomous vehicles for mine countermeasures, long range surface strike missiles, or other specialised capabilities. Modules are integrated with the ship’s physical and computing architectures by standardised interfaces to the ship’s structure, digital backbone systems, electrical power, cooling systems, and ventilation.

Modularity is a feature of almost all contemporary naval ship designs. Some feature modular spaces as

an adjunct to primary fixed capability and are thus variations on the traditional tightly coupled naval design theme. Others, however, feature modularity as the primary capability concept, with almost all effector systems being contained in modules. The extent to which a navy is able to benefit from modularity is a function of the extent to which its platforms feature modular capability for primary mission systems, but even a less extensive adoption can deliver greatly enhanced mission flexibility.

The high-level benefits delivered by modularity are detailed below in relation to the challenges described above.

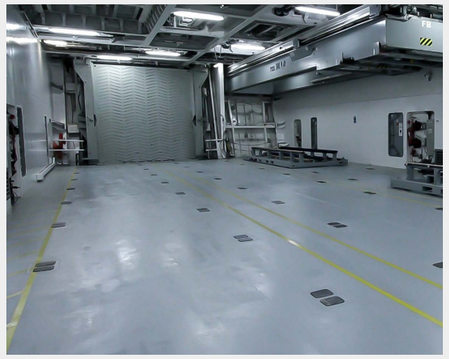
Rapidly Evolving Capability Requirements.
As indicated above, geo-strategic circumstances can evolve more quickly than procurement processes and defence budgets can deliver capabilities able to meet them. For example, the decline of the Soviet submarine threat saw NATO navies divesting in ASW capabilities and switching emphasis to stabilisation operations and the platforms needed to support them.

Submarine threats have now re-emerged, albeit in a different and arguably more lethal form. Baltic navies divested in anti-surface capability and are now faced with the re-emergence of a significant surface threat. Whereas a traditionally designed combat would require expensive and risky modification to meet new threats, a modular platform can exchange one type of capability for another and remain relevant in the face of evolving missions. New modules may be required, but not new ships.

Exploiting Transformational Technology.
The development cycle for transformational technology far outpaces traditional procurement cycles. Modularity allows new technology (such as new forms of autonomous vehicles) to be fielded, tested and experimented with much more quickly than with traditional platforms, which would likely have to undergo structural modification to field new systems. Technology can be rapidly and repeatedly inserted using modules as testing processes are carried out, improvements made, and doctrine developed.

Managing Obsolescence.
Upgrading traditional tightly coupled platforms to deal with emerging threats and missions generally requires that they be taken out of service for risky, costly, and lengthy refits, as detailed above. Modularity allows obsolescence to be addressed by upgrading systems contained within a module or by replacing the entire module. In either case, the host platform remains available for other operations.

Value for Money.
An Offshore Patrol Vessel is much cheaper to acquire and operate than a multi-mission frigate. However, it is only effective across a narrow arc of missions. A fleet comprised of platforms that are cost-effective to both acquire and operate across Humanitarian Assistance/Disaster Relief (HADR), patrol, and combat operations represents greater value for



money than one which consists of specialised HADR, patrol, and combat platforms.

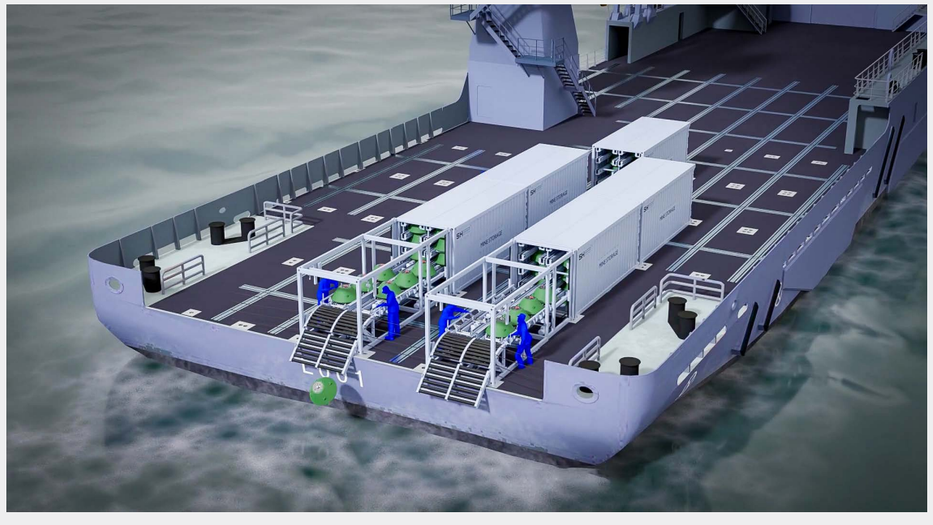
A modular platform can be switched from combat to patrol by removing combat-related modules and inserting modules for extra boats and autonomous vehicles optimised for surveillance, while the space freed up by module removal can be used to carry HADR stores and equipment should the need arise. This flexibility represents significantly greater value for money when compared to a fleet made up of diverse platforms. The smaller the fleet, the greater the value for money delivered by modularity.

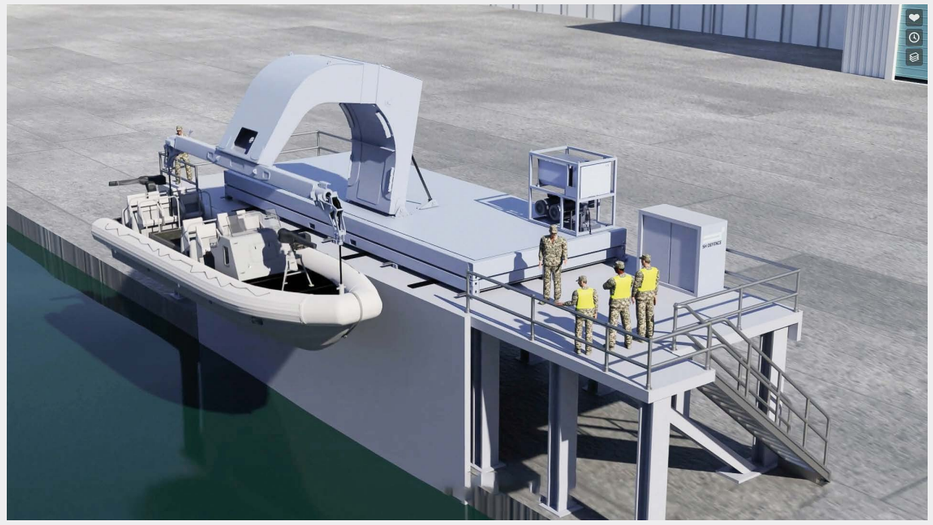
Cost Escalation.
Modularity offers a way in which high-quality, high-cost mission systems can be acquired and fielded in sufficient quantity. Instead of acquiring sufficient numbers of multi-mission combatants permanently fitted with high-quality, high-cost mission systems or having to compromise on the quality of permanently fitted systems in order to afford them, modularity allows navies to acquire only the number of mission systems needed for concurrent operations in that mission.

For example, a navy's concurrent mission requirements may require six combat-capable ships, but perhaps only two of those ships are ever likely to be required to carry out concurrent ASW missions. Only two (or perhaps three) modular ASW missions need to be acquired, as opposed to the six a traditional combat fleet would have. The ASW modules can be rotated between ships as required. ASW systems and trained people are not carried by ships not performing ASW missions or training, leaving module space for other capabilities, such as anti-ship missile decoys, close-in weapon systems, or extra boats for special forces support or MIO. Assuming platforms are standardised, an effective modular fleet can be acquired at a significantly lower cost than a fleet comprised of traditionally designed combatants.

Work Force Management.
All navies are searching for ways to improve workforce efficiency and remove dissatisfiers that lead to attrition. Two of the most significant are high operating tempos and barriers to attaining and maintaining proficiency in primary competencies.

A multi-function frigate carries with it everywhere the systems and the people it needs for every mission to which it might be assigned. As indicated above, this





means that people trained to maintain and operate mission systems not required by the mission at hand are underemployed, leading to skill decay and consequent dissatisfaction. They are also separated from friends and family without job satisfaction, which might partially compensate for that.

A modular ship needs only to carry the systems and people that it is likely to need for the missions it is actually assigned and those for which it needs to maintain a high degree of readiness. This allows new workforce concepts to be considered. Instead of being permanently assigned to a ship, mission system operators and maintainers could be assigned to a module, deploying at sea with the module when it is required for operations and training and maintaining and training with the module at their home naval base when it is not. Their operating tempo is reduced, and their ability to maintain proficiency can enhanced by using high-functioning simulation injected into their module system, which does not incur the wear and tear that results from permanent installation in environmentally hostile shipboard environments.

Naval people have traditionally identified strongly with the ship to which they are assigned. Such identification is critical to morale, and a module-based manning system would have to recreate it. This could be done by establishing a unified, shore-based home for module teams under traditional naval leadership structures.

The operating tempo for those people not assigned to modules would need to be addressed in parallel with module-based manning. Some navies have had success with dual crewing or with "three watch" systems in which ships are crewed with sufficient numbers to allow a third to be ashore for respite and training at any one time. These models could be applied to platform crews so that their operating tempo remained within acceptable limits.

A workforce model such as that outlined above would probably not reduce the workforce demand signal. However, onboard automation for propulsion, damage control, and other platform numbers is steadily reducing the numbers required for ships to operate safely. This reduction, coupled with a module-based workforce concept, could deliver significant improvements in workforce efficiency and retention.

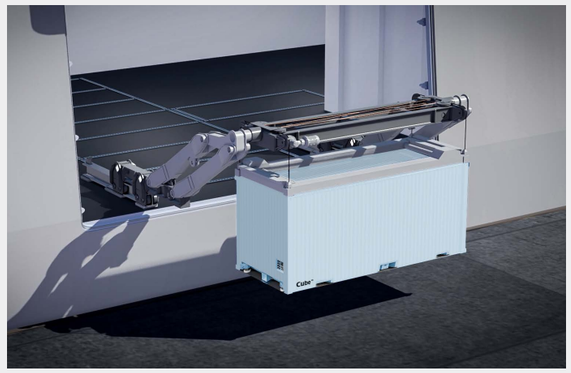
Minimising System Diversity.
Modularity allows the adoption of standard platform types to operate effectively over a wide range of missions, allowing the number of ship types in a given fleet to be reduced. Platform systems can be more readily standardised, reducing supply chain diversity and training pipeline complexity. Operators and maintainers can be more readily moved between ships and become immediately effective. This has safety implications for many shipboard functions, such as navigation and bridge watchkeeping, as the likelihood of errors caused by lack of system familiarity is much reduced.

*Article by **Andy Watts** in collaboration with SH Defence*

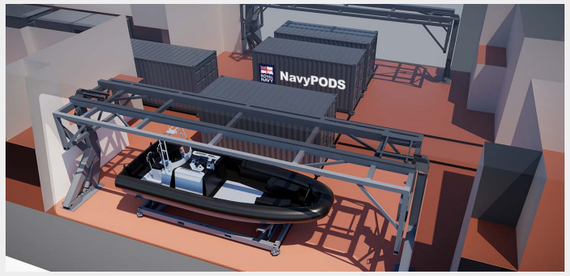
The Cube System™ - Module Handling

The Cube System uses various aids to handle and fasten payloads (and Davits) to ensure the ability to replace them when needed. Interchangeability is the focal point of the entire Cube System.

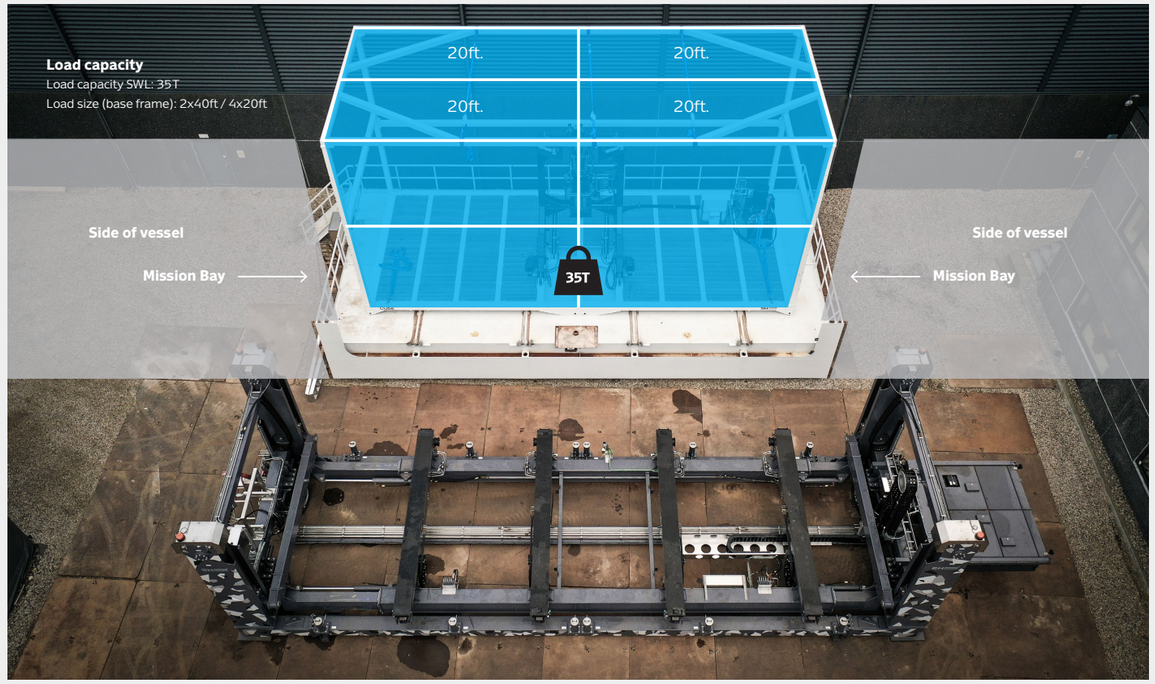
The Cube plug-and-play mission modules enter the mission bay, are then skidded into and around the mission bay, and further out on the open deck to replace existing modules or for storage. Alternatively, mission modules are placed on dedicated positions on the ship, such as lower or upper mission decks or flight decks secured with hydraulic twist locks integrated into the deck structure.

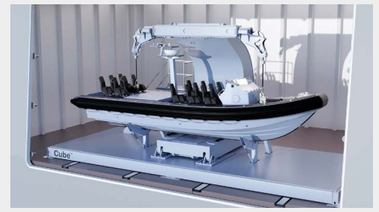


Cargo transfer Davit. This Cargo transfer Davit solution, for Auxiliary ships and part of The Cube System, enables loading and offloading 20ft containers or boxes from ship to ship and shore to ship. The configuration shown is hydraulically operated and has an outreach of 2.500mm and SWL of 20T.



Cube Boat Davit in Mission bay and hangar with Sea State Skidding System





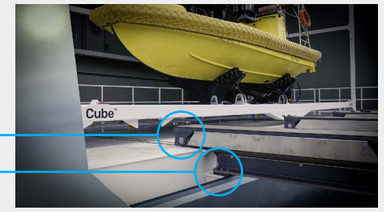
The Cube Side Loader is essential when payloads comparable to eight 20ft or four 40ft containers side by side and on top of each other must enter the mission bay from the quayside. The Cube Side Loader has a load capacity SWL of approx. 35T.

Specifications

Arm reach Nominal 2.700 mm max 3.000 (from loader to ship)
Self-driving rail nominal 6.900 mm into the ship (may be extended)
Load capacity SWL 35T
Load size (base frame) 2x40ft
Lifting height 1.100 – 6.000 mm (from ground)
Driving speed loaded 1 km/h
Driving speed empty 5 km/h

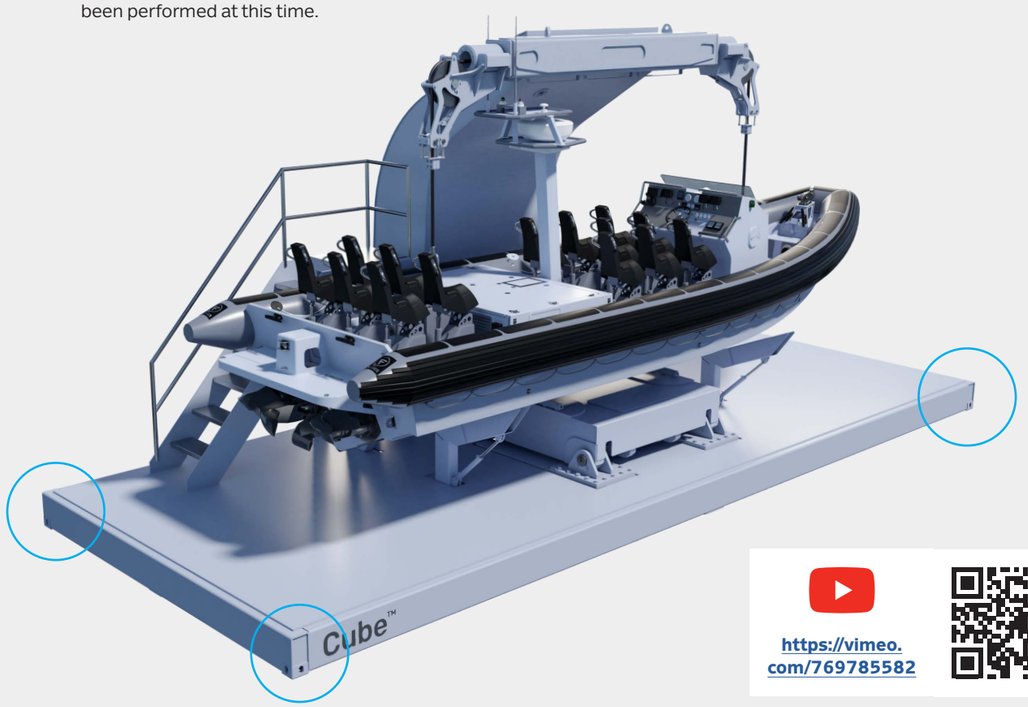
https://vimeo.com/769788281

The Mission Bay goes smart, fast.



The Cube Twist Lock System for securing payloads consists of remotely operated hydraulic twist locks (with a remote lock indicator) integrated into the deck structure, arranged in groups of 4 each matching a 20ft container. The total number of twist locks for a mission bay is up to 4 x 4 = 16.

Shock qualification of shipboard equipment.
Depending on requirements, ship construction and classification society, SH Defence believes that the Twistlock System can be authorized accordingly. However, these tests have not been performed at this time.



https://vimeo.com/769785582

The Cube System introuction

The Cube mission module is an interchangeable and reinforced frame securing itself with hydraulic twist locks.

Twist locks
Modules are fixed and secured with remotely operated hydraulic Twist locks.

With the **Sea State skidding system** (on the following pages) it is possible to move Cube™ compatible modules around on the open deck and into the hangar.

Fast swap of equipment between vessels
Cube™ Mission modules can quickly be exchanged in any harbour with The Cube™ Side or Stern Loader.

Live demonstration at Naval Base Korsor

Example of a Cube boat module consisting of a RHIB from UK company **MST** and a Davit system from Norwegian **VestDavit**. The module is placed on a reinforced 2x40ft Cube Base frame with hydraulic twist locks for attachment in the mission bay. The module is approved for man-riding.

The Cube System™ - For free use

The Cube™ System is open source and for free use by any ship designer, shipyard, software integrator or equipment supplier.

VARD a Fincantieri company

Cube™ System on next generation OPV from **VARD Marine**

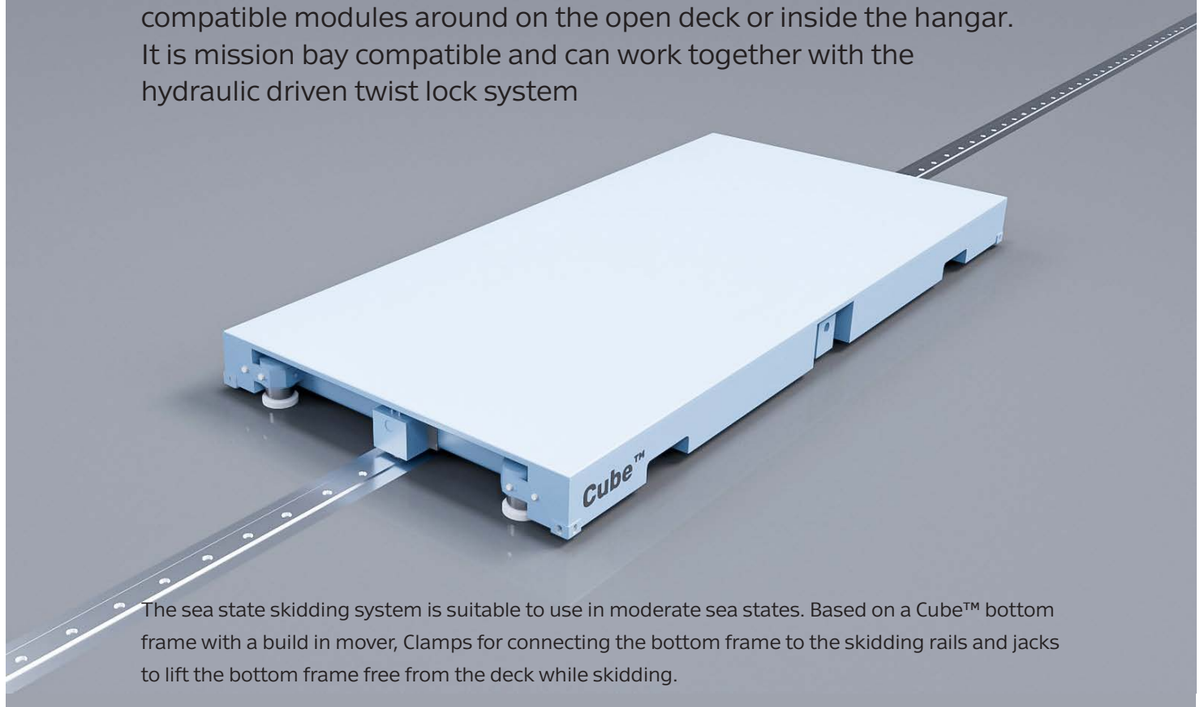
Flight deck/ Stern mission area | **Mission Bay** | **Mission well** | **Bow area**

Selected ship designers

FASSMER DEFENCE · BAE SYSTEMS · FINCANTIERI · babcock · Navantia · OMT · DAMEN NAVAL · BMT · NAVAL GROUP · SAAB · N·V·L · Baltic Workboats shipyard · SANDOCK AUSTRAL SHIPYARDS · KONGSBERG · AUSTAL · VARD a Fincantieri company · GERMAN NAVAL YARDS · HYUNDAI HEAVY INDUSTRIES · seaspan · DAVIE · OSK-ShipTech A/S

The Sea State skidding system

The Sea State skidding system makes it possible to move Cube™ compatible modules around on the open deck or inside the hangar. It is mission bay compatible and can work together with the hydraulic driven twist lock system

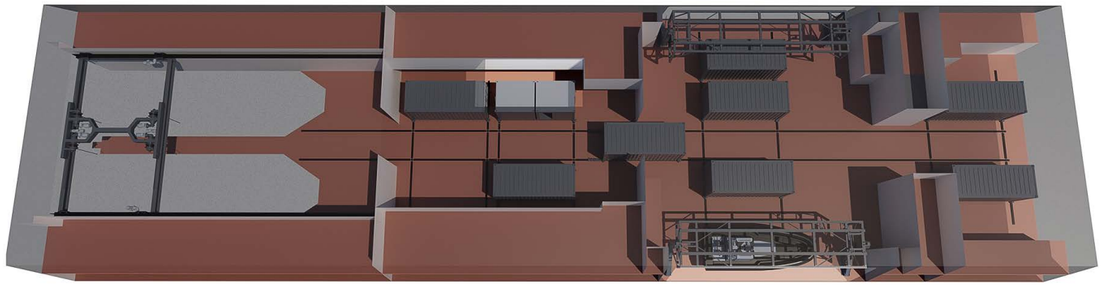


The sea state skidding system is suitable to use in moderate sea states. Based on a Cube™ bottom frame with a build in mover, Clamps for connecting the bottom frame to the skidding rails and jacks to lift the bottom frame free from the deck while skidding.

The system is mission bay compatible and can work together with the hydraulic driven twist lock system developed for the Cube™. The operational maximum accelerations are horizontal 0,5g and vertical 0,8g. Maximum roll angle 22,5 deg.

The Mover unit consists of a moving cylinder for longitudinal movement and one for transverse movement. In addition, there are 3 pc. Hydraulic operated lock pins. All cylinders are with end position feedback to a PLC. Operator do not need to position or reposition any items for the operation. The operator attaches a small portable control unit to the bottom frame and selects the direction of movement. Hold to run on all functions.

Sea state skidding system can be supplied in several building blocks allowing the user to choose the solution that fits the operational requirements best (See Appendix 2).



Mission bay and hangar with Sea State Skidding System

Option 1. The basic version is a Cube™ Ready bottom frame prepared for sea state skidding. All necessary brackets for the installation of building blocks making up a full sea state skidding compliant cube is included.

Option 2. Skidding Jacks – a set of 4 skidding jacks, used to hoist the bottom frame free from deck, directional valve, a loose skidding dog and pipes and valves. This set is suitable for the conversion of a 20` Cube™ frame into a frame that can be skidded in harbour conditions. No HPU, No clamps and No internal mover is included. Option 2 can be added to the basic version (option1).

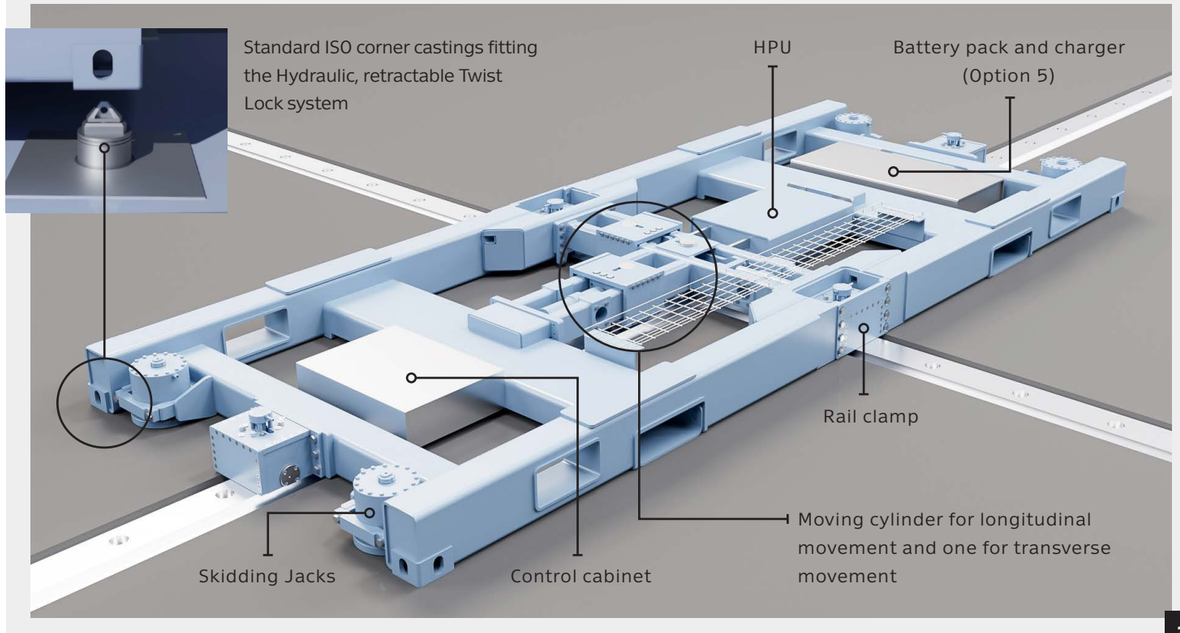
Option 3. Full version without HPU – This set is the basic frame incl. the 4 hydraulic jacks. 4 clamps to secure the bottom frame to the skidding rails. The built in hydraulic mover, installed in the bottom frame. A PLC to automatic control movement and sequence in the desired direction. Handheld control unit with cable and push buttons to select desired direction of movement. – Bottom frame needs electric and hydraulic power from external source.

Option 4. Same as 3 but includes an internal HPU – Bottom frames needs only electric power from external source.

Option 5. Same as 4 but includes a battery pack and a charger. The Cube™ can now be skidded without external power sources for a limited distance. – Details TBD

Note: The described solutions are valid for a 20`ISO container size Cube™. Larger Cubes needs 2 build in movers for level 3,4 and 5 and potential extra clamps depending of the Cube™ size.

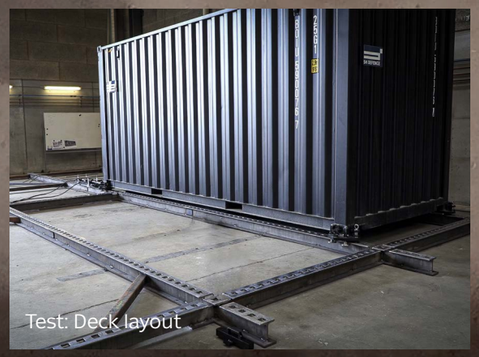
The Cube™ ready bottom frame incl. Mover, valves, jacks, clamps etc. is 320 mm high. With a build in HPU with a nominal power of 9 kW at 440V 60 Hz, the expected moving speed will be 1-1,5 m/min with containers weighing app. 30 Ton. The expected moving speed will be 2-2,5 m/min with containers weighing 15 Ton or less. Higher moving speeds can be achieved with the use of external HPU.



The Harbour skidding system

The Harbour skidding system makes it possible to move Cube™ compatible modules around on the open deck or inside the hangar.

- Re-arrange 10', 20' or 40' modules.
- SWL per unit: Max. 30 MT
- Energy supply: Two Hydraulic skidding dogs
- Manually operated by two people

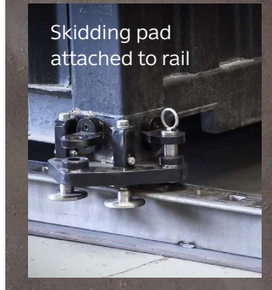


Test: Deck layout

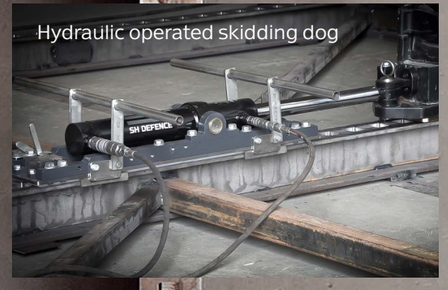
Harbour skidding system

System consisting of 4 skidding pads that are placed under the corners of a standard ISO shipping container. The deck structure must be prepared with two skidding rails attached to the deck or embedded in the deck structure.

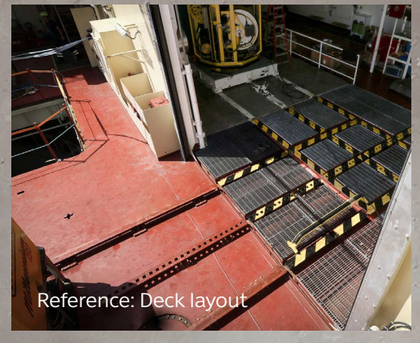
The container is moved by 2 hydraulic operated skidding dogs that attaches to the skidding pads at the corners. Operation of the dogs is hydraulic and manual. The dogs needs to be repositioned by lifting them from one rail set to the next in the event where longitudinal skidding is changed to transverse or opposite. The system is suitable for low sea state and can accept horizontal acceleration of <0,1g or 3 deg. Roll.



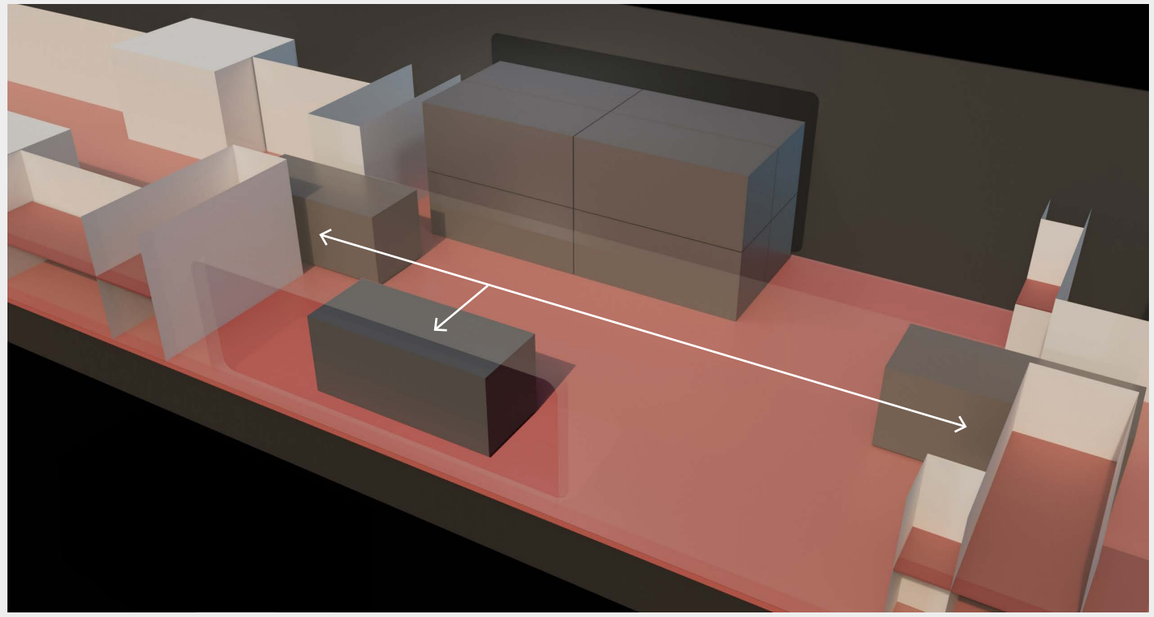
Skidding pad attached to rail

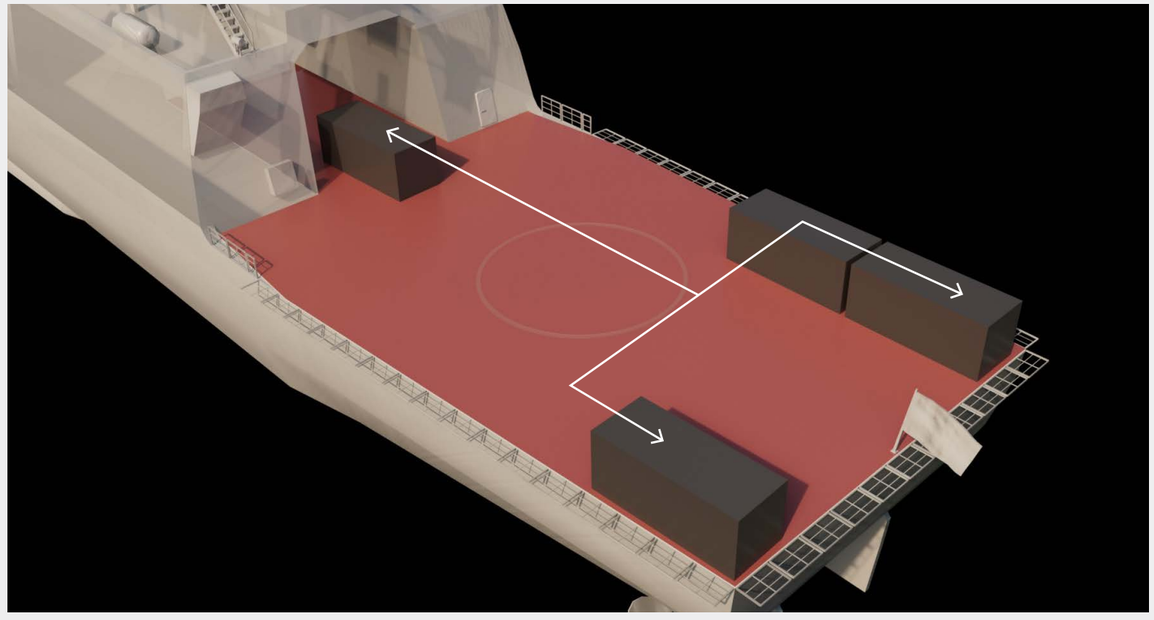


Hydraulic operated skidding dog

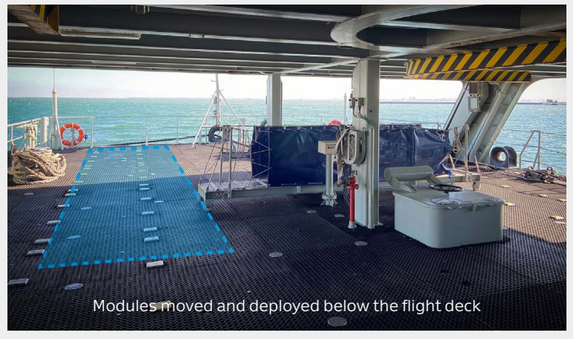


Reference: Deck layout





The Harbour skidding system makes it possible to move Cube™ compatible modules around on the open deck or inside the hangar.



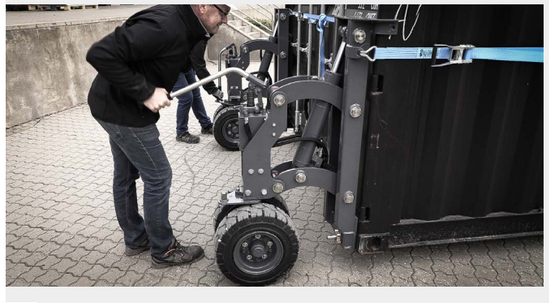
Modules moved and deployed below the flight deck

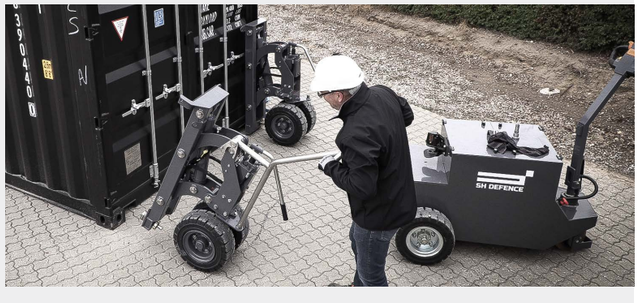
Modules moved and deployed on top of flight deck

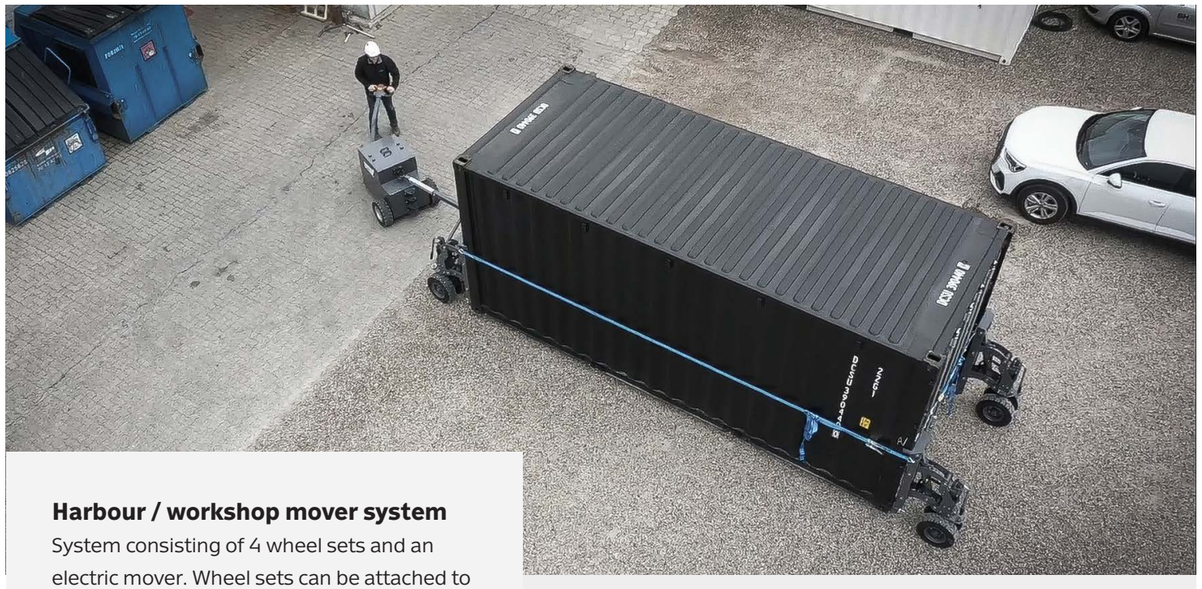
The Module mover

Module mover with battery-driven tractor designed for the handling of Cube™ Modules inside a ship, at the workshop or harbour.

Secure and compact storage during sea voyage
The system is provided with a docking station (10ft container fottprint) for secure storage of all system components.







Harbour / workshop mover system
System consisting of 4 wheel sets and an electric mover. Wheel sets can be attached to a standard ISO shipping container at the lower corners. Max gross of the container is 10 Ton.

The Max capability of the shown configuration moves a container/Cube module with a max gross of 10T.The system is **not** suitable for use at sea.

Specifications

Bogie wheel weight:	4x195 kg
Lifting capacity:	10T
Lifting height (10 MT):	500mm
Tractor weight:	1.500 kg
Motor:	3kW
Battery:	24V DC Exide Tensor
Operation:	Manual
Docking station:	10' ISO footprint
System Weight in total:	3.8T

Modules can be moved around on a Multi-role platform

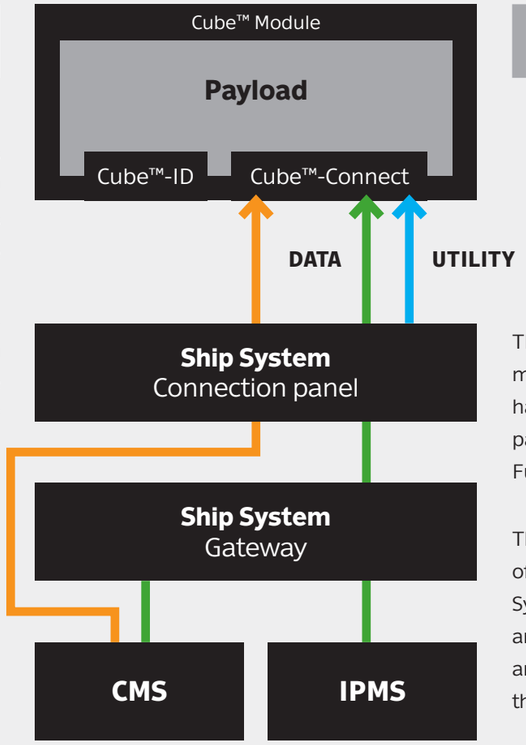
Ship integration of Cube™ Modules

As described on the previous pages, a Cube™ Module encapsulates and makes payloads from an equipment manufacturer modular and adaptable to Coast Guard, SAR and Navy platforms.

The payload is ready for integration, provided the ship is prepared with a physical space such as a mission bay with the possibilities for mechanical fixation.

Placed on the Cube™ Module (in accordance with ANEP-99), is a screen with information - An Electronic Datasheet configured for each payload called a **Cube™-ID**. Each Cube™ Module is furthermore equipped with a physical connector panel with outputs called **Cube™-Connect**.

Setup



The **Cube™-ID** contains information for each Cube™ Module and the payload it is carrying. It is mandatory for the integration on the platform: What payload has been loaded, Weight and CoG, and which connections are needed for the equipment to operate?

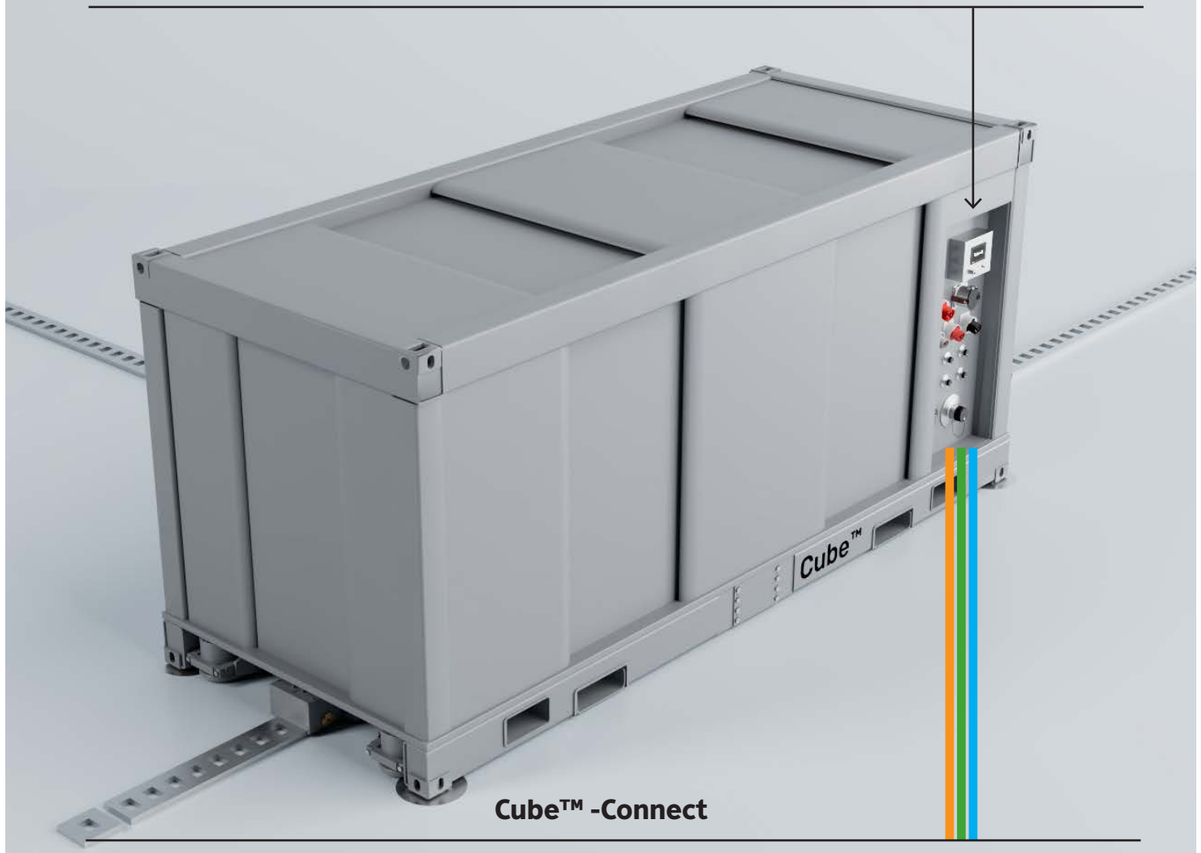
The **Cube™ Connect.** The module and the ship shall have a matching connector panel divided into Utility and Functional areas.

The **Cube™ ID** is independent of types and brands of Ship Systems such as IPMS, CMS and MMS and acts ONLY as an information provider - See the list on the next page.

The Cube™-Connect panel is configured according to the requirements of the equipment manufacturer. Data *to and from* the equipment inside the Cube™ Module, not least weapon-related connections, are hardwired directly to the Cube™-Connect panel for a cyber-secure and uninterrupted connection to Ship Systems through the Cube™-Connect (▬).

Cube™ -ID

Cube-ID data	ANEP-99 data	Cube-Connect data	Cube-Connect data	OEM data
Cube ID no.:	CCTV	***Functional:***	***Utility:***	OEM type:
Cube s/n:	WH Lights on/off	Input/Control	Power	OEM s/n:
Cube Mission:	RED Lights on/off	Data X1, X2, X(n)	P1	OEM version:
Cube Size:	GR Lights on/off	Output	P2	OEM software:
Weight:		Data Y1, Y2, Y(n)	P3	OEM software version
CoG:		Position	Cooling:	
DangerZone:		GPS, Gyro, Log	Water in	
		Weapon Control	Water out	
		Inhibit, Launch/Fire	Salt water in	
		Auxilliary	Salt water out	
		A1, A2, A(n)	Fresh Water In	
		Communication	Dirty Water Out	
		VCS, Antenna	Ext. Hydraulic In	
		Maintenance	Ext. Hydraulic Out	
		OEM, Cube-ID		



Cube™ -Connect

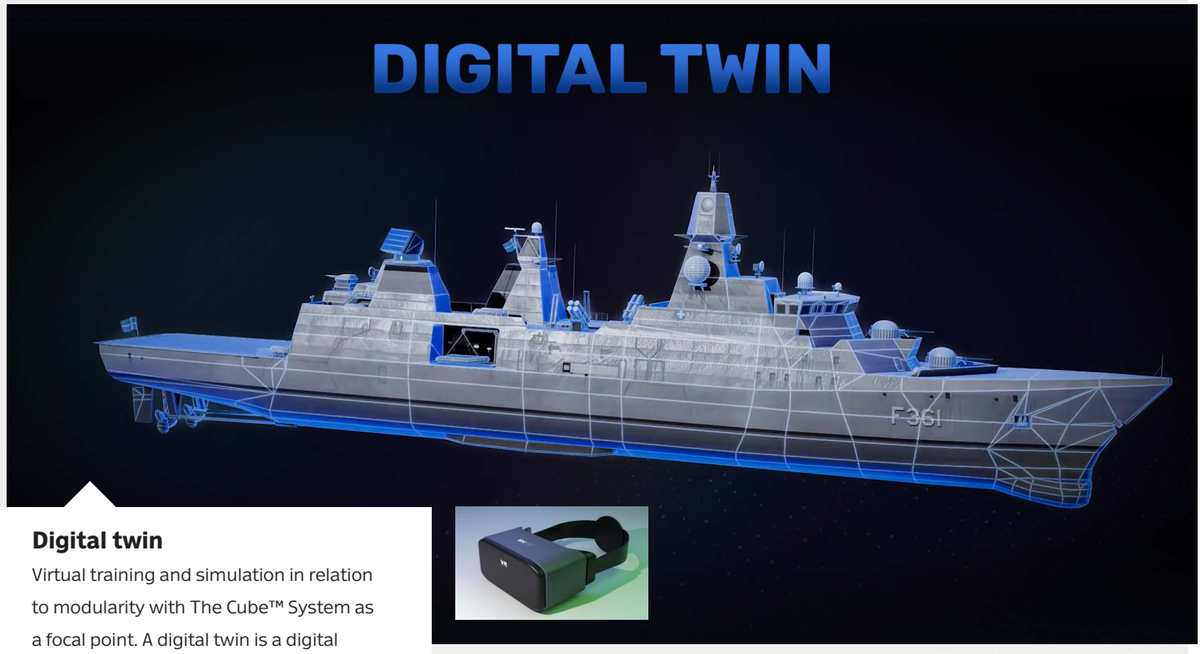
CUBE-CONNECT FUNCTIONAL

INPUT/CONTROL	OUTPUT	WEAPON CONTROL	AUX	MAINTENANCE	COMMUNICATION
Data X1	Data Y1	Weapon Inhibit	A1	Cube-ID	VCS
Data X2	Data Y2	Launch/Fire	A2	OEM	Antenna
Data X3	Data Y3	Weapon AUX	A3	POSITION GPS/GYRO/LOG	

CUBE-CONNECT UTILITY

POWER	COOLING WATER	WATER	SALT WATER
P1	Water IN	Fresh Water IN	Salt Water IN
P2	Water OUT	Dirty Water OUT	Salt Water OUT
P3			

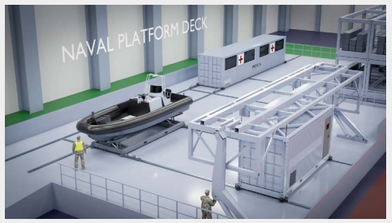
Train. Test. Upgrade



Digital twin

Virtual training and simulation in relation to modularity with The Cube™ System as a focal point. A digital twin is a digital representation of a physical object, process, service or environment that behaves and looks like its counterpart in the real-world.

Illustration top and right: Babcock



Testing facilities, ILS, Repair, Upgrade and Acceptance

Test and training facility will allow end users to experiment, test and train on existing and future Cube™ compatible modular equipment and systems in a realistic, scalable and controlled environment.

Training

Modular Capabilities need a shore base training establishment for specialist training, maintaining a suitable level of skill when not embarked is essential.

Storage

Logistics and infrastructure will be critical to the effective management, movement, maintenance, storage, protection and deployment of containerised capabilities.

Training & Maintenance

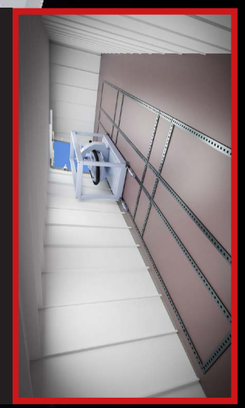
ILS Repair, Upgrade and Acceptance Testing

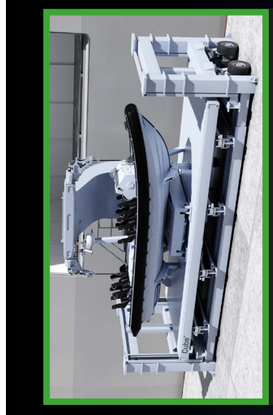
Virtual Reality Training/ Simulation and Digital Twin

The Cube™ System

Onshore infrastructure, module movers and storage facilities

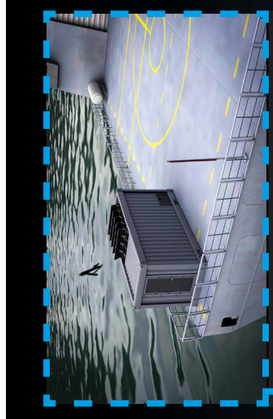
Onboard infrastructure, skidding system, automatic twistlocks and elevators





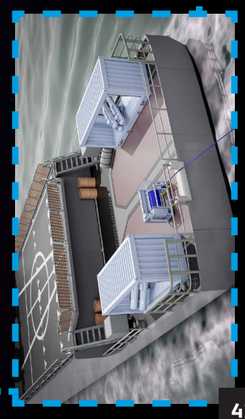
Cube™ Loading system

Mission Bays / Doors



300+ different payloads

Cube™ Store for Enhanced Capabilities



Custom-made equipment solutions by SH Defence

Mission Bay doors

SH Defence is your specialist of high quality and reliable doors for Mission Bays Doors in steel, aluminium, bulletproof- or lightweight composite (light weight armour plating based on sophisticated fibre composites) protecting structure, cargo and equipment.

Modern naval vessels must be capable of carrying out different missions and roles in both peacetime and wartime. Our Mission Bay Doors are customized to fit any naval vessels no matter the purpose or requirements.

Shockproofed
Steel. Aluminium. Bulletproof or Lightweight Composite

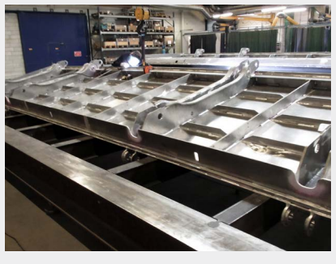
Stern door with Boat cradle

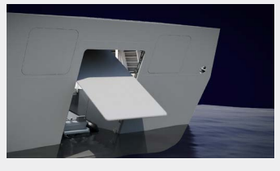
Stern door - SH Defence hydraulic mission bay doors are customized to fit any requirements. The door and all mechanical parts are made of seawater resistant material. The door itself is made in either steel, aluminium, bulletproof- or lightweight composite (lightweight armour plating based on sophisticated fibre composites), protecting personnel and equipment.

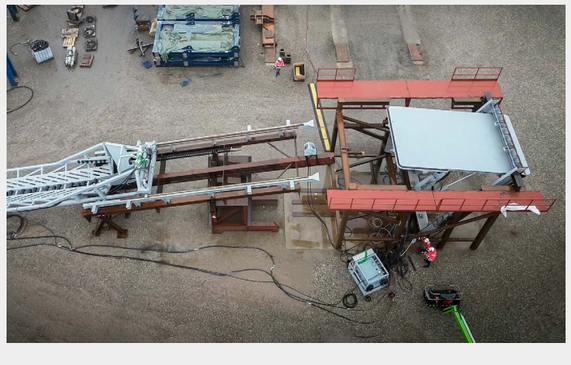
Boat cradle - Flexible boat cradle system to accommodate RHIBs and special operation boats. The flexible cradle and launch and recovery system can handle a wide range of boats with different hull forms. Slipway also tailor-made for drones and USV.

The system is perfect for frigates, corvettes and OPV´s with various missions and allows for one or two boats to be stowed behind each other. The LARS system is reliable, safe and fast to operate up to Sea state 6.

SH Defence delivers welds in aluminium, black steel, carbon steel, stainless steel 304 + 316, duplex steel and CuNiFe including WPQR (In-house certified IVS). We deliver NDT testing services on components and all types of materials (also onsite).







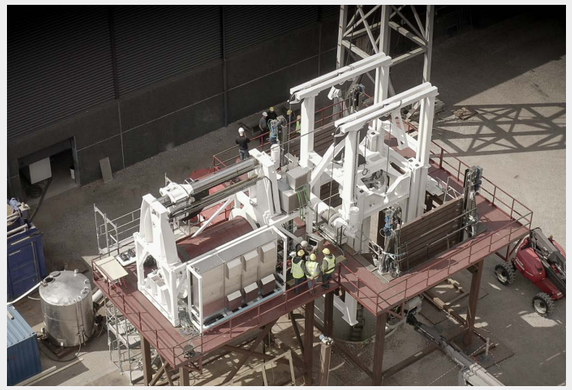
ALL construction, assembly and testing is done in-house

Launch and Recovery Systems

Launch and Recovery System (LARS) for Remotely Operated Vehicles (ROVs) and UAVs, including underwater surveillance, mine clearance, or underwater inspections.

SH Defence´s LARS is designed to deploy and retrieve equipment safely from the surface to the underwater environment and vice versa. It ensures smooth and controlled operations, especially in challenging maritime conditions.

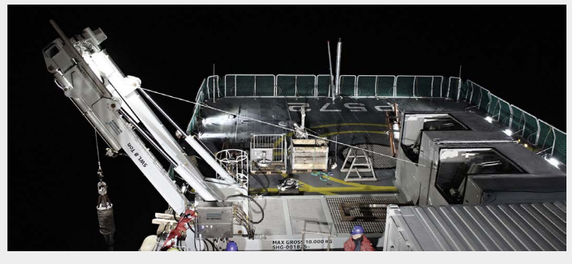
Our often complex solutions and systems are built from the ground up and usually consist of hangar doors, A-frames, winches and software combined into reliable and easy-to-operate systems – Equipment working under the most demanding requirements and conditions.

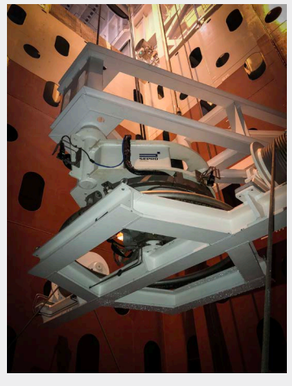


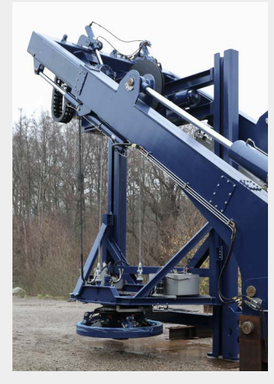
Moonpool and Submarine Rescue Systems

Surface support ships or vessels equipped with the necessary infrastructure, including moonpools, to deploy and recover the heavy specialized equipment launched through a moonpool with hatches on the bottom of the hull.

There is different equipment for such rescue operations. Still, most often, a Submarine Rescue Vehicle (SRV) and a Depressurization and Transfer Chamber (DTC) must go down through the Moonpool to reach the distressed submarine.





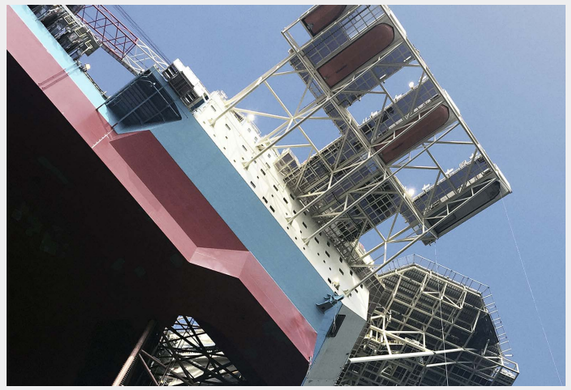


Custom-made equipment solutions by SH Defence

Overhanging cranes

Designing an overhanging crane solution for a mission bay is challenging as weight and size quickly become critical parameters. Overhanging crane solutions need to be versatile and are essential for a wide range of maritime operations, such as:

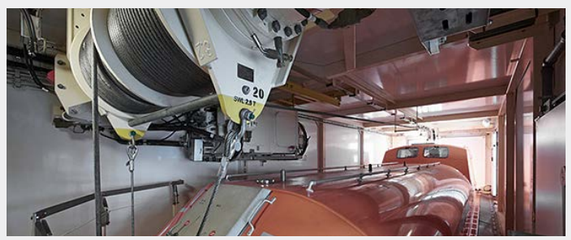
Cargo handling, deploying and retrieving UUVs, AUVs, ROVs, small boats, RHIBs, patrol boats, and other watercraft. Deploy and retrieve mine-sweeping equipment, sonar systems or equipment for diving operations to construct and maintain subsea infrastructure or to handle and position specialized equipment, such as sonar arrays, towed bodies, or underwater sensors, used for various surveillance and reconnaissance tasks.

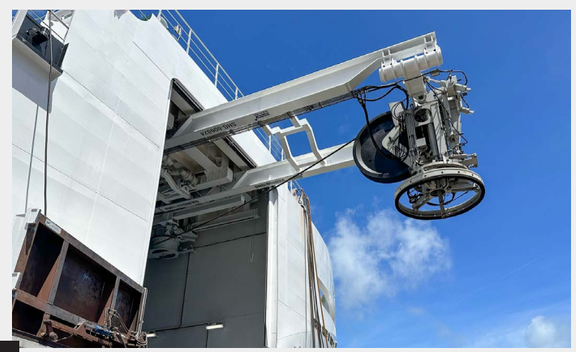


Davit systems

SH Group A/S, has a long and diverse track record of customised Davit systems for several Oil, Gas and Offshore Wind primes working in the northern hemisphere. Lifeboat, fast rescue boat and RHIB systems with a capacity of 1-122 people.

These systems are still in service after 10 years; some are NORSOK-approved, and others follow IMO regulations. The NORSOK R-002 Standard, developed by the Norwegian petroleum industry, is the industry's highest level ensuring adequate safety. SH Group still do 1-year, 5-year and 10-year service on most of the systems.





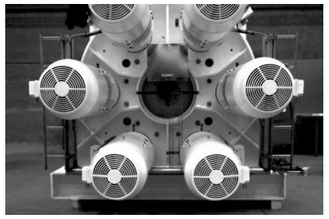
Winches for ROV´s, drones, surveillance, inspection and research or for heavy work equipment

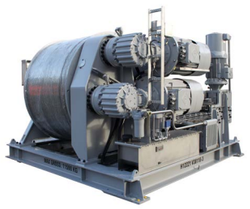
Rugged and reliable winches for extreme purposes
With the highest quality in mind – From the inside and out SH Defence delivers state of the art winches being **reliable, secure, and easy to operate** in any weather, even the harshest conditions at sea.

With more than 20 years of experience and an excellent track record, SH Defence supplies winches for all types of requirements.

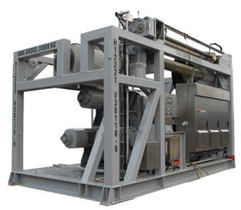
Winches for **ROV, AUV or research equipment** handling. Heavy work winches for handling of large modules, **tools, trenchers, or fast attack vessels** e.g.

Our winches are available in two main types. One is suitable for front spooling, and the other for right angle level wind spooling, allowing the winch to fit in a small hangar or a narrow space.

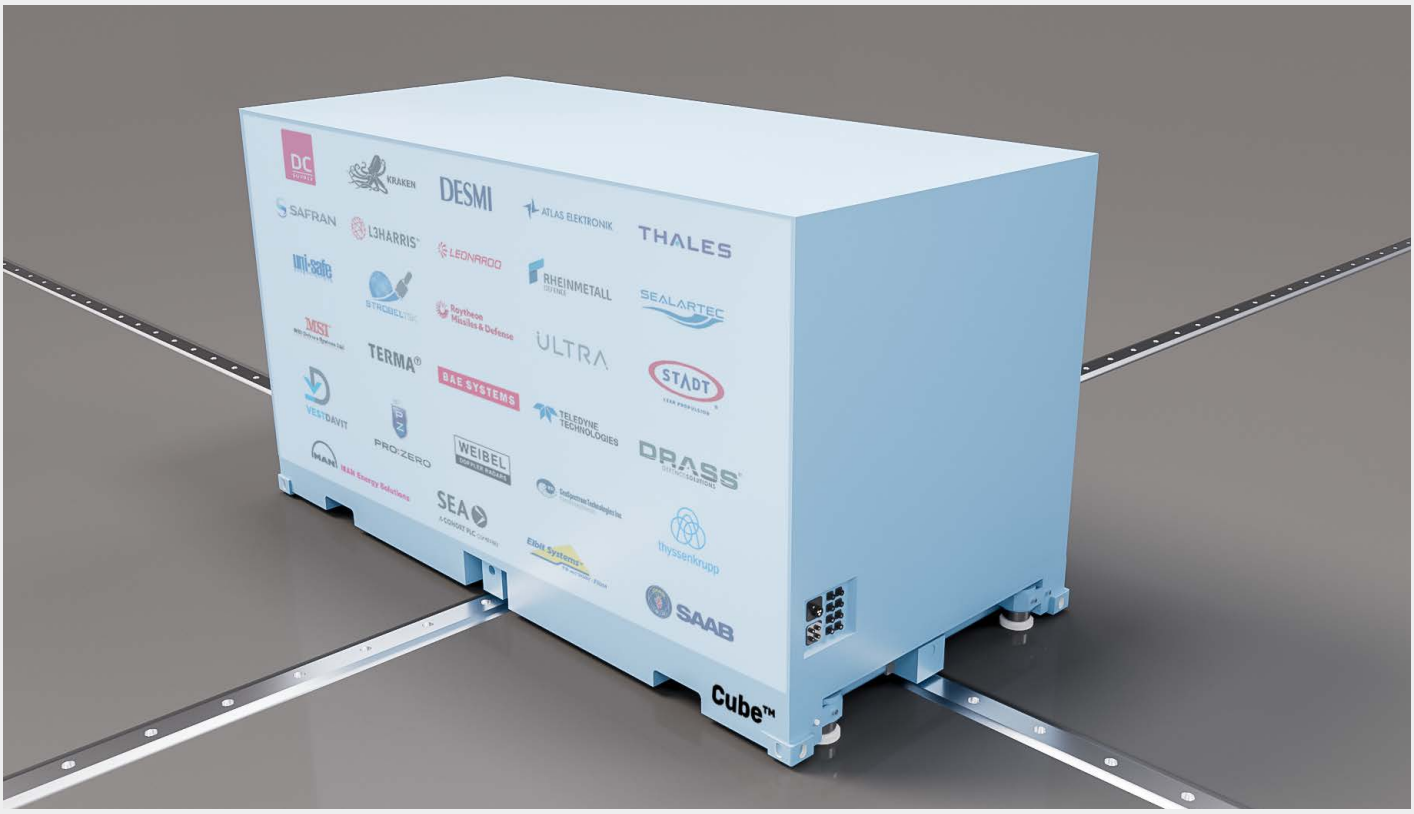




Name	**General Survey Winch**	**CTD Winch**	**Medium Wire Winch**
Wire diameter	ø10 mm	ø9,53 mm	ø10 mm
Wire length	7.000 meters	8.000 meters	7.000 meters
Pull on bottom	40 / 32 / top kN	40 / 32 / top kN	59 / 48 / top kN
Speed on bottom	100 / 122 / top m/min.	120 / 145 / top m/min.	120 / 147 / top m/min.
Main drives	2 x 37 kW @ 50 Hz	2 x 45 kW @ 50 Hz	2 x 75 kW @ 50 Hz
Level wind drive	1 x 7,5 kW @ 50 Hz	1 x 7,5 kW @ 50 Hz	1 x 15 kW @ 50 Hz
Frequency converters	2 x 45 + 1 x 7,5 kW @ 50 Hz	2 x 55 + 1 x 7,5 kW @ 50 Hz	2 x 90 + 1 x 15 kW @ 50 Hz
Weight winch	6.000 kg	5.300 kg	7.200 kg
Weight wire	2.520 kg	3.200 kg	3.360 kg
Weight of scientific equipment	800 kg	600 kg	1.000 kg



Large Wire Winch	**Deep Tow Winch**	**Water Sampling Winch**	**Mooring Survey Winch**
ø14 mm	ø17,4 mm	ø14 mm	ø14 mm
10.000 meters	8.000 meters	7.000 meters	6.000 meters
137 / 106 / top kN	98 / 67 / top kN	19,6 / top kN	22,5 / 14,5 / top kN
120 / 156 / top m/min.	90 / 131 / top m/min.	90 / top m/min.	165 / 250 / top m/min.
6 x 55 kW @ 50 Hz	3 x 55 kW @ 50 Hz	2 x 22 kW @ 50 Hz	2 x 37 kW @ 50 Hz
1 x 22 kW @ 50 Hz	1 x 15 kW @ 50 Hz	1 x 11 + 1 x 1 kW @ 50 Hz	1 x 2 kW @ 50 Hz
3 x 132 + 1 x 22 kW @ 50 Hz	3 x 75 + 1 x 15 kW @ 50 Hz	1 x 44 + 1 x 11 kW @ 50 Hz	1 x 75 kW @ 50 Hz
23.000 kg	19.100 kg	6.800 kg	5.500 kg
9.400 kg	8.480 kg	3.640 kg	910 kg
1.500 kg	760 kg	N/A	N/A



Member of

NavalTeamDenmark™

NTD

SH DEFENCE

Kuopiovej 20 · 5700 Svendborg · Denmark

www.shdefence.com

Version: 14/07/25