

Developments with Autonomous Ships

Possible Case Studies from a VTS Perspective (24 January 2022)

SUMMARY

Country	Commenced / Commencing Operations		Trial / Test Bed	
Belgium / Netherlands	Fugro Orca	USV (remote operated) survey	Deseo	inland container vessel
	-	-	Factofour	inland container vessel
China	ZhiFei	110m Container ship		
Denmark	-	-	Nellie Bly	10m Tug
Finland	-	-	Suomenlinna II	Passenger ferry
	-	-	Falco	Car Ferry
	-	-	Callboats	Passenger ferry
France	-	-	VN Rebel	
Japan	-	-	Sunflower Shiretoko	Car ferry
	-	-	Soleil	Coastal car ferry
	-	-	Suzaku	Domestic container vessel
Korea	-	-	Haugum No. 1	Mid-sized merchant ship
	-	-	Aragon XNUMX	Coast survey ship (3 tons)
	-	-	??	LNG carrier and smaller passenger crafts
Norway	Yara Birkeland	80m Container ship	ASKO	Container shuttle
	Bastø Fosen VI	Passenger ferry	-	-
Singapore	-	-	Intellitug Smart Maritime Autonomous Vessel Project MINERVA	Tug
Spain	USV Vendaval	Patrol Ship	-	-
Sweden	-	-	Candela	7 m leisure craft
USA	Mayflower	15m Trimaran	-	-
UK/USA		21-72 m -Ocean survey ships	-	-

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PART 1 – COMMENCED / COMMENCING OPERATIONS					
Country	Vessel	Comments	VTS Involvement	Reference/s	Rapporteur
Norway	Yara Birkeland Container ship 80m Length <ul style="list-style-type: none"> • 120 TEU • Autonomous • Controlled remotely • Crew (initial phase) 	<ul style="list-style-type: none"> • Will enter commercial operations in 2022. • Initially the vessel will start a two-year trial period to become autonomous and certified as an autonomous, fully electric container vessel • To operate within 12 nautical miles from the coast, between 3 ports in southern Norway. • Brevik VTS - Vessel needs permission from the VTS center to “use the water”, e.g sail in to the area, leave port, anchor etc. The VTS centers are authorized to set terms to a permission, e.g when to depart or what route to follow, thus organizing the traffic. 	Brevik VTS	https://edition.cnn.com/2021/08/25/world/yara-birkeland-norway-crewless-container-ship-spc-intl/index.html	Trond Ski
	Bastø Fosen VI Passenger ferry <ul style="list-style-type: none"> • Autonomous • Crew 	<ul style="list-style-type: none"> • Regular passenger ferry service from Feb 2020 • Have autonom berthing capabilities • Horten VTS - Vessel needs permission from the VTS center to “use the water”, e.g sail in to the area, leave port, anchor etc. The VTS centers are authorized to set terms to a permission, e.g when to depart or what route to follow, thus organizing the traffic. 	Horten VTS	https://www.kongsberg.com/maritime/about-us/news-and-media/news-archive/2020/first-adaptive-transit-on-bastofosen-vi/	
China	ZhiFei Container ship 110m Length 300TEU <ul style="list-style-type: none"> • Autonomous • Remote control • Crew 	<ul style="list-style-type: none"> • The Zhifei has been successfully built and launched, It is expected to carry out intelligent navigation function test in October 2021. • The ship has three driving modes: manual driving, remote control and autonomous navigation. It can realize the functions of route independent planning, intelligent collision avoidance, automatic berthing and disembarking and remote control driving. 		http://www.gov.cn/xinwen/2021-09/14/content_5637219.htm	
USA	Mayflower 15 m length	<ul style="list-style-type: none"> • Ocean science, data collection vessel • Trans-Atlantic sailing planned to commemorate 400 years since original Mayflower 	None locally,	https://www.ibm.com/au	Michael Trent

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Country	Vessel	Comments	VTS Involvement	Reference/s	Rapporteur
	<ul style="list-style-type: none"> Autonomous Unmanned Solar powered 	<ul style="list-style-type: none"> 2020 trip Plymouth (UK) to Plymouth, Massachusetts (USA) delayed due to COVID-19 First trip commenced 15 June 2021 but abandoned due to mechanical issues Repairs made, local trials in progress Summer-Fall 2021 Cooperative effort planned with Port of Rotterdam planned during Fall 2021 trials Second trip planned for Spring 2022 	Planned effort with Rotterdam during trials	en/cloud/automation/mayflower-autonomous-ship	
US/UK	ARMADA FLEET Ocean survey vessels 21 to 78 m in length <ul style="list-style-type: none"> Autonomous Unmanned Hybrid power 	Ocean Infinity made waves in 2018 with the launch of 6 Autonomous Underwater Vehicles (AUV) from a single vessel to vastly expand ocean survey coverage. In 2021, they are launching the ARMADA FLEET, a fleet of hybrid powered, high endurance Unmanned Surface Vessels (USV) to be deployed globally and controlled remotely from centres in Southampton (UK), Austin, Texas (USA) and Singapore.	Building 3 Remote Control Centre for global control of survey vessels	Ocean Infinity Armada Fleet Building Armada	Michael Trent
Spain	USV Vendaval Patrol ship 11 m length <ul style="list-style-type: none"> Remote operated Power driven vessel 	<ul style="list-style-type: none"> Operating since 2020. Can be operated with and without crew on board. Safety surveillance. Security surveillance. Environmental monitoring. Only operate within port limits. 	Port of Ceuta	http://www.puertodeceuta.com/puerto/sistema-de-vigilancia-y-control-medioambiental-svcm-en-las-aguas-proximas-a-las-darsenas-y-muelles-del-puerto-de-ceuta/	Carlos F. Salinas
France	VN Rebel	The VN Rebel vessel was remotely operated by satellite links from the head office of the SeaOwl group, 16 rue Rivay, 92300 levallois-perret. The ship has been remotely operated since its departure from the quay to the point located to the south-east of the Saint Mandrier prequ'île outside the Toulon harbour and approaches. The conditions for	No, outside VTS supervision. In contact with	https://seaowlgroup.com/seaowl-un-navire-tele-opere-par-satellite-pour-	

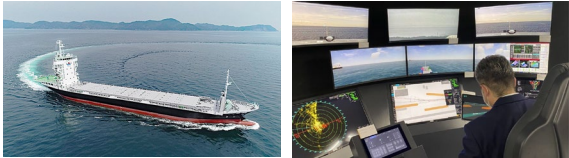
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Country	Vessel	Comments	VTS Involvement	Reference/s	Rapporteur
		<p>supervising this experiment were authorized by the Maritime Prefecture of the Mediterranean.</p> <p>Trial Completed</p>	the military base	les-operations-subsea-en-afrique/	
	<p>surface craft and authorization regime prerequisite for more powerful gear (autonomous vessels).</p>	<p>The decree relating to the methods of experimentation with the navigation of autonomous or remotely controlled maritime floating devices for maritime navigation was published in the OJ of May 31, 2020: https://www.legifrance.gouv.fr/affichTexte.do;jsessionid=49684741F9CA006C753DCD6D1602E101.tplgfr22s_2?cidTexte=JORFTEXT000041938890&dateTexte=&oldAction=rechJO&categorieLien=id&idJO=JORFCONT000041938591</p> <p>As a reminder, this decree was issued in application of X of article 135 of the LOM.</p> <p>It establishes a dual regime allowing the conduct of experiments with these autonomous or remotely controlled floating devices: a prior declaration regime for small devices (maritime drones), which meet the criteria established by the decree, and an authorization regime prerequisite for more powerful gear (autonomous vessels).</p> <p>Declarations and requests for authorizations are made to the maritime prefectures. In addition, it obliges the operators to communicate the results of the tests to the DAM so that the administration can use them within the framework of the preparation of the report intended for the Parliament and of the ordinance relating to autonomous ships which must make it possible to adapt the law applicable to the development of these devices. The publication of this decree unfortunately took place the day after International Drones Day (no sense of communication at DILA) but it concludes nearly 6 months of work largely carried out by Farah and whom I would particularly like to thank.</p>			
Belgium / Netherlands	Fugro Orca	USV (remote operated) survey vessel from Port of Rotterdam towards Offshore area at the Northsea			Harmen van Dorsser

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PART 2 – TRIALS / TEST BEDS					
Country	Vessel	Comments	VTS involvement?	Reference/s	Rapporteur
Belgium / Netherlands	Deseo	The inland container vessel DESEO is sailing between Zeebrugge and Antwerp. The vessel is remotely operated from Anwerp, by SEAFAR. This is the second phase of the test. The first part was from Zeebrugge to Vlissingen. The tests are under full VTS Coverage.			Vivian Baetens
	Factofour	The inland container vessel FACTOFOUR is sailing between Hansweert (NL) and Antwerp (BE). The vessel is equipped for autonomous sailing, but at this stage they are only gathering data for the Black-Box. The tests are under full VTS Coverage.			(Joint nautical Authority)
Korea	Haumgum No. 1 Aragon XNUMX.	<ul style="list-style-type: none"> ○ Planned for end of 2021 ○ 	??	https://www.maritime-executive.com/article/hyundai-plans-first-ocean-going-autonomous-ship-voyage-by-year-s-end	Jinsu Jeon
Japan	Suzaku Domestic container vessel	Autonomous technology trial using a domestic container vessel “Suzaku”, 749 g.t. from Tokyo-bay to Nagoya-bay with crew onboard will be conducted in February 2022. The remote support/control center was established in Chiba-city in September 2021. 	Y Both Tokyo-bay and Nagaya-bay are VTS coverage area but crew onboard	https://www.jms-inc.jp/news/detail/31/en	Hideki Noguchi
	Soleil Coastal car ferry	Fully autonomous ship navigation system and autonomous berthing and unberthing system conducted a demonstration test on 17 Jan. 2022 at Northern Kyushu aria.	Y Test area is under VTS coverage	https://www.mhi.com/news/220117.html	Hideki Noguchi

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Country	Vessel	Comments	VTS involvement?	Reference/s	Rapporteur
			Test was conducted with crew onboard		
	Sunflower Shiretoko coastal car ferry	Auto-berthing and unberthing system of the Sunflower Shiretoko at the port.	N	https://www.porttechnology.org/news/mitsui-osk-lines-trial-shows-autonomous-vessel-promise/	
Finland	Suomenlinna II Passenger ferry	Remote control trial of passenger ferry in a pre-selected area of Helsinki harbor in 2018. Operated by ABB Trial Completed	N	https://new.abb.com/marine/marine-references/suomenlinna-ii	Matti Aaltonen
	Falco Car Ferry	Remote control of car ferry in archipelago of Turku, Finland Trial Completed	N	https://www.rolls-royce.com/media/press-releases/2018/03-12-2018-rr-and-finferries-demonstrate-worlds-first-fully-autonomous-ferry.aspx	
	Callboats Passenger Ferry	Electric catamaran passenger ferry (12 pax) operated during summertime 2020 and 2021 between near-by islands and mainland Helsinki. Captain is onboard but ferry's operations are automated and it can be remote-controlled. Ferry is battery driven and takes part of the energy through solar cells. Operator is Aava Lines Oy and as shareholders are Forum Virium Helsinki, Mente Marine Oy, City of Helsinki and Helen Oy. The purpose is to start operations autonomously after national acceptance.	N	merisatama@callboats.com	

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		<p>One Sea is a high-profile ecosystem with a primary aim to lead the way towards an operating autonomous maritime ecosystem by 2025. The collaboration gathers together leading marine experts and is a strategic combination of top research, state-of-the-art information technology and business.</p> <p>The work began in 2016, and the aim is to create an environment suitable for autonomous ships by 2025.</p>		https://www.oneseaeco.system.net/	Olli Soininen
Norway, Singapore et al	No particular ships	Tests of MASS in ports and port areas	??	MASS Ports	??
Norway	ASKO Container shuttle	<ul style="list-style-type: none"> Autonomous container shuttle designed to carry 16 containers over the Oslo fiord (Moss-Horten). Like Yara it's to be operated by MASSTERLY, ad Wilhelmsen/Kongsberg collaboration Conducting simulator sessions with VTS personell to train communication from ship control room to VTS. 	Horten VTS	ASKO project	Trond Ski
	Intellitug	<ul style="list-style-type: none"> Collaboration between technology provider, Wartsila, marine services provider PSA Marine, classification society Lloyd's Register, the Technology Centre for Offshore and Marine Singapore (TCOMS) and MPA 27m harbour tug Designed to provide supervised autonomous control for harbour tugs Smart navigation system and collision detection and collision avoidance capabilities verified in a defined trial area 	No	https://www.wartsila.com/intellitug?utm_source=press-release&utm_medium=org&utm_term=marine&utm_content=intellitug-project&utm_campaign=wartsila-and-psa-marine-successfully-complete-initial-sea-trials-of-smart-intellitug-ship	Chong Jia Chyuan

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	Smart Maritime Autonomous Vessel	<ul style="list-style-type: none"> • Collaboration between technology provider ST Engineering Marine, tug service provider, POSH, classification society ABS, telecommunication provider M1 and MPA • 30.5m harbour tug • Designed to have autonomous capabilities alongside a shore command centre with remote control capabilities • Autonomous navigation capabilities, collision detection and collision avoidance capabilities, and remote control capabilities verified in a defined trial area 	No	https://onward.stengg.com/2020/04/29/sea-trials-for-autonomous-tugs/	Chong Jia Chyuan
	Project MINERVA	<ul style="list-style-type: none"> • Collaboration between Keppel Offshore and Marine, ABB, ABS, TCOMS and MPA • 32m harbour tug • First phase of testing in the sanitised trial area which verified remote control capabilities • Next upcoming phase will test autonomous navigation and collision detection and collision avoidance capabilities in a defined trial area 	No	https://new.abb.com/news/detail/39090/abb-to-bring-autonomous-technology-to-the-port-of-singapore	Chong Jia Chyuan
Sweden	Candela - 7 m leisure craft and 25-30 pax ship Electric foil boat/ship	Innovative ships designer/producer planning to scale up 7 m leisure craft design to a 25-30 pax commuter ship in Stockholm, Oslo and San Francisco. Candela has been granted financing from the Swedish Government and the project is ongoing.	??	Candela Speedboats	??
	Electric & autonomous road ferries	<p>Electric driven (fossil free) road ferries for fully autonomous transit and designed to carry 60 cars.</p> <p>Route in the Stockholm archipelago (Ljusteröleden and Vaxholmsleden).</p> <p>Test project started.</p> <p>Delivery of first road ferry planned 2022/23.</p> <p>Run by Swedish Transport Administration</p>	??	https://www.trafikverket.se/farjerederiet/om-farjerederiet/nyheter---farjerederiet/Nyheter/2020/fyra-nya-elfarjor-till-stockholms-skargard/ (So far only in Swedish)	??

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Denmark	Nellie Bly 10m Tug	Sea Machines Robotics recently announced it will embark on a 1,000 nautical mile autonomous and remotely commanded journey around Denmark (September/October 2021) Transits will cover 3 VTS areas	??	https://thedigitalship.com/news/electronics-navigation/item/7500-sea-machines-prepares-vessel-for-1-000-mile-autonomous-voyage	Dorte Hansen
UK et al	MASS People MASS training and certification project	A MASS training and certification multilateral project led by UK maritime training company FUGRO aiming to develop standards for MASS operators and others and subsequently address the IMO with its findings.		https://www.fugro.com/media-centre/news/fulldetails/2021/02/18/fugro-launches-masspeople-international-working-group-for-remote-and-autonomous-training-standards	??