NON-SSN ANTI-SUBMARINE WARFARE CAPABILITIES OF THE ROK AND JAPAN

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Anti-submarine warfare (ASW) is a form of naval warfare that uses platforms and systems such as surface ships, submarines, aircraft, and underwater surveillance networks to search for, to detect, track, and, when required, engage hostile submarines.

In this chapter, ASW refers to a series of operations intended to deny an adversary the effective use of its submarines. These operations may include surveillance and cueing, search, detection, classification, tracking, and target motion analysis, prosecution, engagement, and post-engagement. Not every ASW platform or supporting asset contributes directly to every stage. This chapter analyses the capabilities of the Republic of Korea (ROK) Navy and the Japan Maritime Self-Defence Force (JMSDF) across those functions, together with the future direction of their ASW capability development.

ASW capability is not a separate category of military; rather, it is the capability to conduct ASW and achieve the intended operational effect. The US Army defines military capability as the "Army's ability to achieve desired effects with ready units, organizations, and systems to meet the requirements of the National Military Strategy."[1] Australia defines it as "the ability to achieve a desired effect in a specific operating environment," consisting of three interdependent factors: combat readiness, sustainable capability, and force structure.[2]

In the meantime, "non-SSN ASW capabilities" is not an established term in naval discussions. It does not refer to ASW directed specifically against conventional or non-nuclear-powered submarines. Rather, the terminology refers to ASW capabilities provided by platforms and systems other than nuclear-powered attack submarines (SSNs). The propulsion type of both the ASW platforms and the target remain operationally relevant. This paper examines "non-SSN ASW capabilities" as part of a broader study of global trends in SSN development. Since neither the ROK Navy nor the JMSDF currently operates SSNs, the paper focuses on the surface ships, conventional submarines, aircraft, fixed and deployable sensors, intelligence assets, and supporting organisations through which the two navies conduct ASW.

Sonar is the principal underwater sensor used in ASW, and its performance in detection, classification, localisation, and tracking is therefore an important component of ASW capability.

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[1] US Department of the Army, *Army Regulation 525-30: Army Strategic and Operational Readiness* (Department of the Army, 2019).

[2] Alan Hinge, *Australian Defence Preparedness: Principles, Problems and Prospects: Introducing Repertoire of Missions (ROMINS), a Practical Path to Australian Defence Preparedness* (Australian Defence Studies Centre, 2000), 15.

However, acoustic performance is strongly affected by factors including water depth, temperature and salinity profiles, seabed conditions, ambient and self-noise, platform speed, target signature, sensor configuration, and signal processing. Publicly stated technical specifications consequently provide only a limited basis for estimating performance under operational conditions. Similar caution is required when assessing radar, electro-optical, infrared, magnetic, and other supporting sensors. [3] This paper therefore assesses publicly observable organisations, platforms, sensors, supporting assets, procurement trends, and institutional arrangements, which indicate the scale, composition, and direction of ASW development rather than operational effectiveness.

The following sections provide parallel assessments of the ASW capabilities of the ROK Navy and the JMSDF. Each section first examines the organisations and policies through which the respective navy conducts ASW before considering its airborne, surface-ship, and submarine platforms, together with other supporting assets. The section on the ROK Navy also explains the general characteristics of each category of ASW platform. To avoid repetition, the section on the JMSDF applies the same broad framework without repeating these explanations. The subsequent section then examines the future direction of ASW capability development in the ROK and Japan. The tables below summarise the key findings of the paper and provide a roadmap for the analysis that follows.

PLATFORM	IN SERVICE	NUMBER	KEY SENSORS	ASW ARMAMENT
P-3C / P-3CK Orion	1995–	16 (8 P-3C, 8 P-3CK)	AN/APS-137 radar; MAD; EO/IR; c. 40 sonobuoys (P-3CK)	Mk 46 and K745 torpedoes; Harpoon; depth charges
P-8A Poseidon	2024–	6	c. 120 sonobuoys; digital acoustic processing; no MAD	Mk 54 torpedo (HAAWC-capable); Harpoon
Super Lynx Mk.99 / Mk.99A	1991–	25 (12 Mk.99, 13 Mk.99A)	Seaspray 3 radar; AN/AQS-18 dipping sonar; FLIR	K745 torpedo
AW-159 Wildcat	2016–	8	AESA radar; low-frequency dipping sonar; sonobuoys; EO/IR	K745 torpedo

TABLE 1. ROK NAVY AIRBORNE ASW PLATFORMS

[3] *See e.g.*, Naval Doctrine Command, "Littoral Anti-Submarine Warfare Concept," May 1, 1998, https://man.fas.org/dod-101/sys/ship/docs/aswcncpt.htm.

CLASS	TYPE	HULL-MOUNTED SONAR	TOWED / VARIABLE-DEPTH SONAR	ASW HELO
Ulsan	Frigate	Signaal PHS-32	—	No
Pohang	Corvette	Signaal PHS-32 (later batches)	—	No
Gwanggaeto the Great (DDH-I)	Destroyer	ATLAS DSQS-21BZ	SQR-220K TASS	Yes
Chungmugong Yi Sun-sin (DDH-II)	Destroyer	ATLAS DSQS-21BZ	SQR-220K TASS	Yes
Sejong the Great (DDH-III)	Aegis destroyer	ATLAS DSQS-21BZ	SQR-220K TASS	Yes
Daegu (FFG-II)	Frigate	SQS-240K	—	Yes
Jeongjo the Great (DDG-II)	Aegis destroyer	Low-frequency hull-mounted sonar	Low-frequency active VDS; MFTA	Yes

TABLE 2. ROK NAVY SURFACE COMBATANT ASW SYSTEMS

CLASS	INTRODUCED	NUMBER	HULL LENGTH	SONAR ARRAYS	COMBART SYSTEM
Jang Bogo-I	Early 1990s	9	Not stated	Cylindrical bow sonar	ATLAS (Germany)
Jang Bogo-II	2000s	9	65.3 m	Bow sonar; FAS; TAS	ATLAS (Germany)
Jang Bogo-III Batch-I	Programme from 2016	3	83.5 m	Bow sonar; FAS; TAS	Indigenous
Jang Bogo-III Batch-II	Under construction	3 (1 advanced, 2 building)	89.4m	Bow sonar; FAS; TAS	Indigenous

TABLE 3. ROK NAVY SUBMARINE CLASSES AND SONAR

PLATFORM	IN SERVICE	NUMBER	KEY SENSORS	ASW ARMAMENT
Kawasaki P-1	2013–	c. 35 (Mar 2025); target c. 61	AESA radar; EO/IR; indigenous acoustic processing; MAD; large sonobuoy load	Lightweight torpedoes; anti-submarine bombs;
P-3C and variants	1981–	101 procured; 32 held (Mar 2024)	Standard ASW suite; ELINT (EP-3); IMINT (OP-3C); test and EW training (UP-3)	Lightweight torpedoes; anti-submarine bombs;
SH-60J	1991–	103 procured; 7 held (Mar 2024)	Dipping sonar; sonobuoys	Lightweight torpedoes
SH-60K	2005–	82 held (Jan 2025); 83 planned	Dipping sonar; sonobuoys	Lightweight torpedoes
SH-60L	Development completed Dec 2023	2 held (Jan 2025); c. 77 planned	Multistatic sonar system; improved FLIR; AIS; high-speed data link	Lightweight torpedoes

TABLE 4. JMDSF AIRBORNE ASW PLATFORMS

CLASS	TYPE	SONAR SYSTEM	ASW ARMAMENT	ASW HELO
Murasame	General-purpose destroyer	OQS-5 hull-mounted; OQR-2 tactical TASS	VLA vertical-launch ASROC; triple torpedo tubes	Yes
Asahi	General-purpose destroyer	OQQ-24 integrated sonar; bistatic capability	Type 07 vertical-launch ASW rocket	Yes
Mogami (FFM)	Multirole frigate	OQQ-25 (VDS and TASS integrated); OQQ-11 mine-detection sonar	Type 07 ASW rocket; Type 12 torpedo	Yes
Kongō	Aegis destroyer	OQS-102 hull-mounted	VLA vertical-launch ASROC; Type 12 torpedo	No hangar

CLASS	TYPE	SONAR SYSTEM	ASW ARMAMENT	ASW HELO
Maya	Aegis destroyer	AN/SQS-53C hull-mounted; AN/SQR-20 MFTA; AN/SQQ-89A(V)15J	Type 07 vertical-launch ASW rocket	Yes (hangar fitted)

TABLE 5. JMSDF SURFACE COMBATANT ASW SYSTEMS

CLASS	IN SERVICE	SONAR SYSTEM	BOW ARRAY	FLANK ARRAY (FAS)	PROPULSION / NOTABLE FEATURES
Oyashio	1998–	ZQQ-6	Cylindrical	Piezoelectric; first full-scale FAS integration	Lead-acid battery; TAS fitted
Sōryū	2009–	ZQQ-7	Cylindrical	Piezoelectric; large aperture via element count	AIP (10 boats) or lithium-ion battery (2 boats); c. 2 m longer and 400+ t heavier than Oyashio
Taigei	2022–	ZQQ-8	Horseshoe-shaped conformal array	Fibre-optic array	Lithium-ion battery; bistatic localisation; first boat converted to test submarine

TABLE 6. JMSDF SUBMARINE CLASSES AND SONAR

Current ASW capabilities of the ROK Navy

General overview of the ROK Navy ASW

The ROK Navy operates a multi-layered command structure that supports ASW. Under the ROK Fleet Command in Busan, three numbered fleets are responsible for their respective maritime areas: the First Fleet for the eastern waters the Second Fleet for the western waters, and the Third Fleet for the southern waters of the Korean Peninsula. The Task Fleet Command in Jeju provides mobile forces for wider area options, while The Naval Air Command in Pohang operates naval aviation assets, and the Submarine Force Command in Jinhae oversees the submarine force.[4]

The numbered fleets conduct maritime surveillance and ASW operations within their respective areas of responsibility. Maritime patrol aircraft and shipborne helicopters provide airborne surveillance, search, and prosecution capacity, while the Task Fleet Command supports mobile operations beyond the immediate areas of the numbered fleets. Submarines provide a further

[4] Republic of Korea Navy, “Organisation” [조직], accessed September 14, 2026, https://www.navy.mil.kr/mbshome/mbs/navy/subview.do?id=navy_010200000000.

underwater surveillance and engagement capability under the Submarine Force Command. Publicly available organisational information does not, however, reveal the detailed command relationships, tasking arrangements, or degree of real-time coordination among these forces. ASW should therefore be understood as one mission conducted through this broader naval command structure rather than as a separate organisational function.

The ROK Navy's ASW posture has traditionally focused on North Korea's diesel-electric submarine force, particularly its coastal and midget submarines. From much of the post-war period, this force consisted largely of older conventional designs with limited submerged endurance when compared with newer submarines intended for longer submerged operations. In coastal and infiltration scenarios, the ROK Navy consequently placed considerable emphasis on detecting exposed masts and snorkelling submarines through surface-search radar and visual observation.[5] This was an important part of the surveillance posture, but it did not constitute the entirety of ROK ASW, which also involved sonar-equipped ships, maritime patrol aircraft, helicopters, submarines, and fixed or deployable sensors.

Older diesel-electric submarines must periodically snorkel to recharge their batteries, although the frequency depends on their speed, battery condition, mission profile, and operating environment. These periods of exposure can create an opportunity for radar, electro-optical, and visual detection. As North Korea's submarine capabilities and operating patterns have evolved, the ROK Navy has introduced newer sonar systems and expanded the role of acoustic search and tracking. The following sections examine the publicly observable development of these platforms and sensors without assuming that the introduction of new equipment necessarily demonstrates a corresponding level of operational proficiency.

Airborne ASW platforms

Among the threats facing a submarine, ASW aircraft are one of the most effective.[6] A submerged submarine relies mainly on sonar for detection, but sonar generally cannot give adequate warning of approaching aircraft. ASW aircraft can deploy numerous sonobuoys over a wide area in a short period, and can rapidly approach, track, and attack submarine. Submarines therefore try to avoid ASW aircraft whenever possible. This section reviews the ROK Navy's fixed-wing and rotary-wing ASW aircraft.

The ROK Navy decided to acquire new fixed-wing maritime patrol aircraft in the late 1980s and has operated the Lockheed Martin P-3 Orion series since 1995. The P-3 is a four-engine turboprop aircraft developed from the L-188 Electra airliner; the P-3 first flew in 1959. The ROK Navy

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[5] Yonghwan Choi, "Trends in North Korea's Naval Buildup: Assessment and Challenges" [북한의 해군력 강화 동향 : 평가와 과제], *Issue Brief* 689, (2025), https://www.inss.re.kr/upload/bbs/BBSA05/202505/F20250516151505011.pdf.

[6] Korea Institute for Miliary Affairs, "Implications of the ROK Navy's Acquisition of Six P-8 Poseidons" [한국 해군의 P-8 포세이돈 6 대 도입과 함의], April 10, 2024, https://www.kima.re.kr/3.html?Table=ins_kima_newsletter&mode=view&uid=1704&s=11.

established a fleet of 16 aircraft: eight newly produced P-3Cs and eight P-3CKs upgraded from second-hand P-3Bs.[7]

The P-3 has a maximum speed of approximately 750 km/h. Its turboprop configuration is well suited to the relatively low-speed, long-endurance flight profiles commonly associated with the maritime patrol. Published figures indicate an endurance of approximately 12–16 hours and has a maximum range of about 8,900 km, although actual mission endurance depends on payload, altitude, weather, transit distance, and time spent on station Its sensor suite includes the AN/APS-137 radar and a magnetic anomaly detector (MAD). The MAD, installed in the tail boom, detects small disturbances of the Earth's magnetic field caused by a submarine at close range.[8]

The P-3CK modernisation reportedly improved electro-optical detection performance by a factor of five and increased sonobuoy capacity to about 40. The aircraft can carry Mk 46-series lightweight torpedoes, domestically produced K745 Blue Shark lightweight torpedoes, Harpoon anti-ship missiles, depth charges, and naval mines. According to the cited report, ROK Navy P-3 aircraft have achieved operational results including tracking a foreign submarine for more than 70 hours.[9] However, the P-3 design originates in the 1960s, and nearly three decades of ROK Navy service have led to increasing airframe deterioration. A fatal crash in 2025 raised further concerns about the safety of the aging fleet.[10]

The ROK Navy decided in 2013 to acquire a new-generation maritime patrol aircraft to replace the aging P-3 fleet. In 2018, it selected the Boeing P-8A Poseidon through a Foreign Military Sales (FMS) agreement with the US government. The P-8A is a twin-engine turbofan aircraft derived from the Boeing 737-800ERX. Deliveries began in June 2024, and all six aircraft subsequently entered ROK Navy service.[11]

The P-8A has a maximum speed of about 907 km/h, considerably faster than the P-3. This allows it to reach its operation area more rapidly and patrol a wider area within the same period. A notable improvement is its capacity for about 120 sonobuoys, more than three times that of the P-3CK. The P-8A does not carry a MAD. Its design instead emphasises wide-area acoustic detection,

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[7] Nakgyu Yang, "Maritime Weapons 13: The P-3 Orion" [최첨단 해상무기 13, P-3 오라이언], *Asia Economy*, September 26, 2022, https://view.asiae.co.kr/article/2013110821474054485.

[8] The Dong-A Ilbo, "What Is the P-3, the 'Submarine Killer' That Crashed 30 Years After Its Introduction?" [도입 30 년 만에 추락한 '잠수함 킬러' P-3 는 어떤 기종?], *The Dong-A Ilbo*, May 29, 2025, https://www.donga.com/news/Society/article/all/20250529/131710945/1.

[9] Yonhap, "ROK Navy Patrol Aircraft Chased a Russian Submarine in the East Sea Last Month" [해군 초계기, 지난달 동해서 러시아 잠수함 추격전], *Yonhap*, April 25, 2017, https://www.yna.co.kr/view/AKR20170425021700014.

[10] Jihwan Kim, "Cause of Patrol Aircraft Crash Unclear... Navy Cites Aircraft Age and Lack of Training" [초계기 추락 사고 원인 불분명… 해군 "기종 노후·훈련 미실시 영향"], *ChosunBiz*, November 13, 2025, https://biz.chosun.com/policy/politics/2025/11/13/URIQL7ICOBBEDLJ2QY3ISPMFJM/.

[11] Hojoon Kim, "ROK Navy Receives All Six Poseidon Maritime Patrol Aircraft, First Public Unveiling" [최강 해상초계기 포세이돈 6 대 모두 인수…언론에 첫 공개], *Yonhap*, July 4, 2024, https://www.yna.co.kr/view/AKR20240704050400504.

networked operations, digital signal processing, on the judgment that these provide greater operational utility than close-range magnetic detection in its intended mission profile. Its principal ASW weapon is the Mk 54 lightweight torpedo. It can also employ Harpoon anti-ship missiles and may integrate additional stand-off weapons depending on configuration and future programmes. The High Altitude Anti-Submarine Warfare Weapon Capability (HAAWC) system allows the aircraft to release a torpedo from high altitude at stand-off range. Unlike the P-3, which had to descend to low altitude for torpedo delivery, a HAAWC-equipped P-8A can remain at a safer altitude. This can improve survivability in an environment containing air-defence threats.[12]

The introduction of the P-8A is more than the replacement of an aging aircraft. It may change the way the ROK Navy conducts ASW. The larger sonobuoy capacity and improved digital signal processing can increase the reliability of detection and tracking against quieter targets, including North Korea's newer submarines. HAAWC-based high-altitude torpedo delivery may also improve survivability as air-defence capabilities relevant to the Korean Peninsula continue to develop.

However, the small number of P-8As may limit the effect of this improvement. A fleet of only six aircraft may find it difficult to provide continuous coverage of the areas assigned to the three numbered fleets while also supporting operations in distant waters. The aging P-3 fleet will therefore need to fill this gap during the transitional period over the next several years.

In addition, concerns have emerged about a possible reduction of Boeing's P-8 production after 2025 and the resulting uncertainty over further procurement. The ROK Navy and the South Korean defence industry have therefore considered developing an indigenous maritime patrol aircraft.[13] At the individual-platform level, the P-8A is a clear improvement in detection and precision-engagement capability. To improve the ROK Navy's ASW force as a whole, however, South Korea will need to secure additional maritime patrol aircraft, safely retire the P-3 fleet, and consider the long-term development of an indigenous ASW patrol aircraft.

For rotary-wing aircraft, the ROK Navy introduced the British-developed Westland Lynx in 1991 and began full-scale operation in 1993. It acquired 25 aircraft through two procurement programmes.[14] The ROK Navy initially operated the Lynx with its aging destroyer force and later expanded the host platforms to the *Gwanggaeto the Great*-class and *Chungmugong Yi Sun-sin*-class destroyers, as well as the *Sejong the Great*-class Aegis destroyers.

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[12] Sejin Oh, "P-8 Poseidon" [P-8 포세이돈], Bemil, June 13, 2017, https://bemil.chosun.com/site/data/html_dir/2017/06/13/2017061302311.html.

[13] Seongah Sim and Nakgyu Yang, "KAI Takes on the Indigenous Development of the 'Submarine Killer' Maritime Patrol Aircraft" [KAI, '잠수함 킬러' 해상초계기 국산화 도전], *Asia Business Daily*, October 21, 2025, https://view.asiae.co.kr/article/2025102109315713004.

[14] YTN, "Lynx Helicopter Sent 'Mayday' Before Crash… What Caused the Accident?" [링스헬기, 추락 전 '메이데이'…사고 원인은?], *YTN*, September 28, 2016, http://www.ytn.co.kr/_ln/0103_201609281756030169.

The Lynx mission spectrum, however, extends beyond ASW. Its principal missions include anti-surface attack and anti-submarine operations. Given the limited size of the ROK Navy's aviation force, the Lynx has also conducted personnel transport, maritime patrol, and search-and-rescue (SAR) missions. It has therefore functioned not as a single-purpose ASW platform but as a shipborne multirole asset.[15]

This became more evident with its successor, the AW-159 Wildcat. The ROK Navy placed eight AW-159s into service from 2016 and subsequently pursued additional maritime helicopters. The AW-159 carries a more advanced sensor suite than the Lynx, including an active electronically scanned array (AESA) radar, a low-frequency dipping sonar, sonobuoys, and an electro-optical/infrared system. It can also employ Spike anti-ship guided missiles and K745 Blue Shark lightweight torpedoes. The aircraft therefore has substantial engagement capability in both ASW and anti-surface warfare.[16]

Official descriptions list ASW, anti-surface warfare, and search and rescue in parallel as the aircraft's principal missions, which indicates that the ROK Navy intended the AW-159 as a multirole platform from the beginning. Its endurance also varies with mission configuration. The aircraft can reportedly remain airborne for more than three hours with only the dipping sonar, more than two hours when it also carries a torpedo, and more than two and a half hours when configured with anti-ship guided missiles. These differences support the view that the ROK Navy changes the aircraft's equipment and weapons according to the mission, rather than operating it solely for ASW.

In sum, Lynx and AW-159 have supported the ROK Navy's broader range of maritime operations through their mobility and rapid response. Both types therefore have a strong character as general-purpose shipborne assets, although ASW remains one of their principal missions.

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[15] Sanghyeon Oh, "The Submarine-Hunting Helicopter Lynx" [잠수함 잡는 헬기 링스], *Herald Economy*, August 4, 2024, https://news.nate.com/view/20240804n04535.

[16] Goun Heo, "ROK Navy to Acquire Replacement for Ageing 'Lynx' Maritime Helicopters via Foreign Purchase" [노후화된 해상작전헬기 '링스' 대체전력, 국외구매로 도입한다], *News1*, December 29, 2023, https://www.news1.kr/diplomacy/defense-diplomacy/5275125.

Surface-Ship ASW platforms

The ROK Navy's principal surface combatants conduct ASW with various sonar systems and weapons. However, their ASW equipment indicates that the ROK Navy did not give high priority to surface-ship ASW until relatively recently. Its force development prioritised anti-surface and anti-air warfare, with particular emphasis on fleet air defence. This reflected the nature of the direct threats facing the fleet for many years, which came primarily from North Korean missile-armed fast attack craft and coastal anti-ship missiles, rather than submarines. The ROK Navy's surface combatants therefore developed as multirole platforms emphasising air defence and ship-to-ship and ship-to-surface strike.[17]

The traditional method of detecting North Korean submarines also influenced the development and use of the surface fleet's sonar systems. Unlike Japan, South Korea has no narrow passage or chokepoint that North Korean submarines must sail before reaching South Korean waters. It was therefore difficult to dedicate sonar platforms to specific locations and maintain continuous surveillance.

Instead, the ROK Navy estimated when North Korean submarines would need to snorkel after submerging near the Northern Limit Line (NLL) and then monitored the expected locations using radar and visual observation. The ROK Navy also assessed that North Korea operated many of its submarines mainly for special forces infiltration, rather than for attacks against surface combatants. These assumptions may have contributed to the relatively slow development of shipborne ASW equipment.[18]

The sinking of ROKS *Cheonan* in 2010, however, marked a turning point in the ROK Navy's perception of and preparedness for ASW. A patrol corvette with limited ASW capability sank after a North Korean torpedo attack.[19] The ROK Navy subsequently reinforced the underwater defence systems of its existing vessels and strengthened the sonar systems and ASW weapons on newly constructed ships.

Before 2010, the aging *Ulsan*-class frigates and *Pohang*-class patrol combat corvettes formed an important part of the ROK Navy's coastal surface force. The Navy designed these vessels mainly

[17] Dongkeun Lee, "Sea Power in the Indo-Pacific" (PhD diss., The Australian National University, 2026), 267-283. See also, YTN, "'Anti-Submarine Capability' Greatly Improved: 4th Anniversary of Cheonan Sinking" [천안함 폭침 4 주기…'대잠능력' 대폭 향상], *YTN*, March 26, 2014, https://www.ytn.co.kr/_ln/0101_201403260500500287.

[18] Hyeonsoo Kim, "Reinforcing Countermeasures Against NK Asymmetric Forces: 1 Year After Cheonan" [천안함 피격 1 주년: 對潛헬기 확충 등 北 비대칭전력 대응책 보강 시급], *Kukmin Ilbo*, March 24, 2011, https://www.kmib.co.kr/article/view.asp?arcid=0004781938. See also, Jeongwoo Soon, "Navy "Focuses on Bolstering ASW" After the Sinking of ROKS Cheonan" [해군, 천안함 피격 이후… "대잠능력 보강에 중점"], *New Daily*, March 23, 2015, https://www.newdaily.co.kr/site/data/html/2015/03/23/2015032300097.html.

[19] SBS, "Joint Investigation Concludes North Korean Torpedo Attack" [천안함 조사결과 발표], *SBS*, May 20, 2010, https://news.sbs.co.kr/news/endPage.do?news_id=N1000749168.

for coastal patrols and anti-surface warfare.[20] They therefore carried relatively small hull-mounted sonar, light torpedo, and depth charges. The more advanced *Gwanggaeto the Great*-class DDH-I, *Chungmugong Yi Sun-sin*-class DDH-II, and *Sejong the Great*-class DDH-III destroyers carried more capable sonar systems, including the ATLAS DSQS-21BZ hull-mounted sonar and the SQR-220K towed-array sonar (TASS), and could also operate shipborne ASW helicopters.

Nevertheless, the development of their sonar paradoxically indicates the low priority the ROK Navy assigned to surface-ship ASW. Neither the DSQS-21BZ nor the SQR-220K was an inherently defective system. The issue was the limited improvement across successive ship classes. The ROK Navy used the same sonar systems from the first DDH-I, launched in 1996, to the final DDH-III, launched in 2011. Over the same progression, it achieved substantial improvements in air defence and in anti-ship and land-attack weapons, which were hardly comparable with the changes to sonar. The ROK Navy made no improvement in sonar capability, even though the larger hulls and greater electrical power of the later destroyers could support more advanced systems.

After the sinking of ROKS *Cheonan*, however, the ROK Navy made considerable progress in the tactical employment of its existing ASW equipment. Also, ships designed and built after 2010 show clear efforts to improve ASW equipment in addition to tactical measures. For example, the *Daegu*-class FFG-II, whose basic design began in 2011, introduced the new SQS-240K hull-mounted sonar.[21] The *Jeongjo the Great*-class DDG-II, whose basic-design review began in 2018, introduced an integrated sonar suite combining a low-frequency hull-mounted sonar, a low-frequency active variable-depth sonar (VDS), and a multifunction towed-array sonar (MFTA).[22] The principal differences between these newer and earlier systems are their ability to conduct low-frequency active search and their integration of hull-mounted and towed sonar sensors.

Submarine-based ASW platforms

ASW begins with sonar detection, which can be divided into active and passive methods. In active detection, the platform transmits an acoustic signal, commonly called a sonar ping, and then analyses the echo reflected from the target. This allows the platform to estimate the target's range and bearing with relative accuracy and enables a more proactive search. In passive detection, by contrast, the platform does not transmit a signal but receives and analyses sounds from external sources. Passive sonar can detect certain acoustic signals at considerable distances without revealing the detecting platform. However, it normally provides less precise range information than active sonar. Its effectiveness can also be affected by acoustic propagation, signal distortion,

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[20] Ingyun Shin, "Warships Armed with 'Top-Class' ASW Capability, Ten Years After the Sinking of ROKS Cheonan" [천안함 피폭 10 년 와신상담, 대잠 '끝판 클래스'로 무장한 전투함], *The Dong-a Ilbo*, March 28, 2020, https://www.donga.com/news/Politics/article/all/20200328/100393014/1.

[21] Heejoon Park, "The 'ROKS Cheonan' Reborn: A New Frigate with Powerful ASW Capability" [새 호위함 '천안함'의 강력한 대잠전 능력], *The Fact*, November 10, 2021, https://news.tf.co.kr/read/ptoday/1898667.htm.

[22] Cheoljae Lee, "'Shooting Down' a Ballistic Missile within Ten Minutes: Aboard the ROKS Jeongjo the Great" ['발사' 10 분 만에 탄도탄 격추…바다 누비는 정조대왕함 타보니], *JoongAng Ilbo*, February 2, 2025, https://www.joongang.co.kr/article/25311007.

background noise, and the movement and self-noise of the detecting platform. Passive detection is still more difficult when the opposing submarine maintains a very low acoustic signature.[23]

Submarines rely mainly on passive sonar during most stages of their operations, because active transmission may disclose their presence and approximate location. Submarines consequently restrict active sonar to specific tactical circumstances, like situations immediately preceding an engagement. This is an important disadvantage compared with ASW aircraft and surface ships, which can select or combine active and passive detection with fewer restrictions. Submarine-only ASW is therefore limited. Modern ASW requires the coordinated use of aircraft, surface ships, submarines, fixed acoustic arrays, and other sensors. For this reason, this report limits its analysis of submarine-based ASW capabilities mainly to a relative comparison among the submarines concerned.

The ROK Navy's submarine force consists of three principal classes: 9 *Jang Bogo-I*-class submarines introduced from the early 1990s, 9 *Jang Bogo-II*-class submarines introduced from the 2000s, and 3 *Jang Bogo-III* Batch-I submarines introduced under a programme that began in 2016. The first *Jang Bogo-III* Batch-II submarine has also reached a stage of construction, while the second and third boats remain under construction.[24] The capabilities of the three classes now in service have developed gradually. This section focuses mainly on their sonar capabilities. No country publicly discloses the detailed performance of its submarine sonar systems. The following analysis therefore provides only a general assessment based on public-domain information.

A major difference between the *Jang Bogo-I* and *Jang Bogo-II* classes concerns their capacity for low-frequency detection. The *Jang Bogo-I*-class relies mainly on a cylindrical bow sonar, which limits its ability to exploit low-frequency acoustic signals. The *Jang Bogo-II*-class supplements its bow array with a flank-array sonar (FAS) and a towed-array sonar (TAS). These arrays provide a broader acoustic aperture and can improve the submarine's ability to detect lower-frequency signals, which may be regarded as an important improvement in the ROK Navy's submarine-based ASW capability.[25]

Low-frequency detection has two major implications. First, it enables detection at longer ranges, because lower-frequency sound travels over longer distances with less transmission loss.[26] Second, it enables the identification of machinery noise from a target submarine. High-frequency detection

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[23] ROK Defense Acquisition Program Administration, "Weapon Story: The Underwater Watchman, Sonar System" [무기 이야기: 바다 속 감시자 소나체계], ROK DAPA Official Blog, October 31, 2017, https://blog.naver.com/dapapr/221129476815.

[24] ROK Defense Acquisition Program Administration, "The Complete Story of the ROK Submarines: From the Dolgorae-Class to the Jangbogo-Class" [돌고래급 잠수함부터 장보고급 잠수함까지! 한국형잠수함의 모든 것], ROK DAPA Official Blog, July 18, 2024, https://blog.naver.com/dapapr/223516155700.

[25] ROK Defense Acquisition Program Administration, "Jangbogo-II Submarines: The Cornerstone of Future Undersea Power" [미래 수중전력의 초석, 장보고-II 잠수함], *KONAS*, May 14, 2007, https://www.konas.net/article/article.asp?idx=11350.

[26] Discovery of Sound in the Sea, "Sound Absorption," University of Rhode Island, accessed July 21, 2026, https://dosits.org/science/movement/why-does-sound-get-weaker-as-it-travels/sound-absorption/.

is mainly suitable for the propeller noise of surface ships, but has limitations against the propeller noise of submarines, which are much quieter. If low-frequency detection can identify the noise from a submarine's auxiliary machinery, it can contribute to detecting the submarine. Therefore, with the *Jang Bogo-II*-class equipped with FAS and TAS, the ROK Navy's submarines may be assessed as having acquired an ASW capability for the first time.

The difference between the *Jang Bogo-II* and *Jang Bogo-III*-classes is distinct from the hardware improvement described above. The important factor is not whether they have FAS and TAS, but the difference in the performance of these systems. Up to the *Jang Bogo-II*-class, all equipment, including the sonar systems, was integrated with the German ATLAS combat system. In the *Jang Bogo*-III class, South Korea carried out the domestic development of combat systems.[27] This fact alone does not determine which system performs better. However, given the advances in computing between the respective development periods, it is reasonable to assume that analytical and computational capabilities improved even if the same type of equipment were used.

There are also clear differences in hardware. sonar systems for low-frequency detection generally take the form of linear arrays, whose length and arrangement have a decisive influence on the detectable frequency range and detection distance. In particular, increasing the array length of a low-frequency linear-array sensor improves its directivity index (DI) and angular resolution under the same design and environmental conditions. It may therefore improve long-range, low-frequency detection within the designed operating-frequency band. The *Jang Bogo-II* has a hull length of 65.3 metres, while the *Jang Bogo-III* has a hull length of 83.5 metres. On this basis alone, an improvement in FAS performance can reasonably be expected.[28]

In this manner, the ROK Navy has continued to develop its submarine force. However, as noted above for surface combatants, the overall improvement of platform performance does not necessarily focus on ASW. In submarines, improvements in submerged endurance and in anti-ship and land-attack capabilities proceed together with improvements in sonar performance. It remains necessary to observe what further changes will appear.

Other ASW assets

ASW generally brings to mind joint and coordinated operations among aircraft, surface ships, and submarines to detect, classify, track, and attack hostile submarines. However, several other assets form the foundation of ASW. This section examines three of them. The first is the Sound

[27] ROK Defense Acquisition Program Administration, "The 11-Year, Five-Month Journey: Jangbogo-III Batch-I Submarine Combat Management System" [11 년 5 개월의 여정, 장보고-III Batch-I 잠수함 전투체계], ROK DAPA Official Blog, November 11, 2021, https://blog.naver.com/dapapr/222564999421.

[28] Assuming identical array type, element spacing, operating frequency, processing performance, and acoustic conditions, the increase in array aperture from 65m to 83m yields an approximate directivity-index increment of $\Delta DI \approx 10\log(83/65)=1.06$dB. Under a simplified spherical-spreading model, this corresponds to a theoretical detection-range ratio of $R2/R1 \approx 10^{1.06/20}=1.13$. This is an illustrative calculation only; actual submarine sonar performance depends on the effective aperture, array geometry, self-noise, target source level, oceanographic conditions, and signal processing.

Surveillance System (SOSUS), that uses fixed arrays of passive sonar sensors installed underwater or on the seabed to detect and track underwater targets at long ranges. A representative example is the US SOSUS installed across the Greenland–Iceland–United Kingdom (GIUK) Gap and the Norwegian Sea during the Cold War, which strengthened NATO's early-detection capability.[29]

The second is satellite reconnaissance. With current technology, reconnaissance satellites cannot detect a submerged submarine. The important point, however, is that satellites can observe an adversary's submarine bases and determine whether and when a particular submarine has departed. This information can support the reinforcement of an ASW surveillance network. The frequency with which a country can monitor hostile submarine bases, or whether it can conduct near-real-time surveillance, is therefore an important factor in gaining an advantage during the initial stage of ASW.

The third is the operation of ocean surveillance ships. Two categories of information are necessary for detecting the acoustic emissions of hostile submarines: higher-frequency noise radiated from their propellers, and the distinctive lower-frequency noise produced by internal machinery and hull vibration. Without such information, known as an acoustic signature, individual platforms have no reliable means of identifying the source of a received acoustic signal. Before conducting full-scale ASW, it is therefore necessary to collect the acoustic signatures of hostile submarines and establish a database. Ocean surveillance ships perform this function. In a broader sense, this category may also include multipurpose vessels capable of laying or towing sonar cables. Information on these capabilities is generally subject to an even higher level of secrecy than information on aircraft, surface combatants, or submarines. The following discussion examines these three elements within the limits of publicly available information.

At first, there is almost no public information on South Korea's fixed-array sonar systems. Until the 2000s, North Korea made several attempts to infiltrate special operations forces using submarines and submersibles. In several cases, the ROK Armed Forces discovered the operations, and armed engagements followed. It was therefore reasonable to assess that South Korea developed fixed sonar systems to monitor submarines attempting to infiltrate its coastal waters.

The next element is South Korea's military reconnaissance satellite capability. Through its medium- and large-sized military reconnaissance satellite programme, South Korea operates five satellites: one EO/IR satellite and four synthetic aperture RADAR (SAR) satellites.[30] The important consideration is the interval at which the satellites can observe a specific location, namely their revisit time. The completed five-satellite constellation appears able to observe a specific location in North Korea 12 times per day, or once every two hours. As a follow-on programme, South Korea is expected to launch 12 additional satellites. If this proceeds as planned,

[29] Franz-Stefan Gady, "US Navy Upgrading Undersea Sub-Detecting Sensor Network," *The Diplomat*, November 3, 2016, https://thediplomat.com/2016/11/us-navy-upgrading-undersea-sub-detecting-sensor-network/.

[30] Deokhoon Kim, "Military to Operationalise All Five Reconnaissance Satellites by End-April, 'Two Months Ahead of Schedule'" [군, 정찰위성 5 기 이달 말 전력화…'계획보다 2 달 앞당겨'], *KBS*, April 28, 2026, https://news.kbs.co.kr/news/pc/view/view.do?ncd=8548186.

South Korea may secure a revisit time of less than 30 minutes by the 2030s.[31] The current revisit time is insufficient for the ROK military's comprehensive Kill Chain concept,[32] which means that the present satellites may have difficulty providing timely warning against solid-fuel ballistic-missile launches. A submarine, however, requires at least one hour of preparation before departing from port. Therefore, despite a certain margin of error, the present system appears to provide an appropriate level for monitoring the movements of the submarines at their bases.

The final element is the ocean surveillance ship. Since 1993, the ROK Navy has operated three such vessels: ROKS *Sincheonji* (AGS-11), ROKS *Sinsegi* (AGS-12), and ROKS *Singiwon* (AGS-13). These vessels collect underwater acoustic intelligence, signals and communications intelligence, and information on the maritime environment, including water temperature, salinity, sound velocity, and seabed topography.[33] They thereby provide an intelligence foundation for ASW and other naval operations.

Ocean surveillance ships are particularly important because they can operate TASS more intensively. Surface combatants can also operate TASS, but the operating conditions of a TASS are highly sensitive to a ship's manoeuvres. Surface combatants must conduct various missions other than ASW, and these manoeuvres often interfere with the optimal operation of TASS. Ocean surveillance ships specialise in intelligence collection and can be assessed as achieving particularly high sonar operating efficiency. These vessels are already undergone considerable aging. The ROK Navy is therefore pursuing a plan to acquire two additional large next-generation ocean surveillance ships.[34]

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[31] Hyeokcheol Kwon, "South Korea's Fourth Military Reconnaissance Satellite Enters Orbit and Establishes Communication" [한국 4 번째 군사정찰위성, 우주궤도 진입 후 교신 성공], *The Hankyoreh*, April 21, 2025, https://www.hani.co.kr/arti/politics/defense/1193664.html.

[32] The Kill Chain is the first pillar of the ROK military's three-axis defence system, alongside the Korea Air and Missile Defense (KAMD) and Korea Massive Punishment and Retaliation (KMPR) components. It denotes a sequence of detection, identification, decision, and strike intended to locate and neutralise an adversary's missile launch assets before launch and is therefore highly sensitive to sensor revisit intervals. Please see, Seungim Jeong, "The Military Will Again Use the Terms 'Kill Chain' and 'Three-Axis System,' Abolished under the Moon Jae-in Administration" [軍, 문재인 정부 때 사라진 '킬체인' '3 축체계' 용어 다시 쓴다], *Hankook Ilbo*, May 19, 2022, https://www.hankookilbo.com/news/article/A2022051914570001319.

[33] Hyeonho Lee, "[Exclusive] Navy to Build Two 'Maritime Intelligence Ships' at a Cost of KRW 1.94 Trillion to Strengthen Intelligence Collection on North Korea" [[단독] 해군, 1 조 9400 억 투입 '해양정보함' 2 척 건조…대북 정보수집 강화 [이현호의 밀리터리!톡]], *Seoul Economic Daily*, October 20, 2025, https://news.nate.com/view/20251020n01928.

[34] Lee, "[Exclusive] Navy to Build Two 'Maritime Intelligence Ships' at a Cost of KRW 1.94 Trillion to Strengthen Intelligence Collection on North Korea" [[단독] 해군, 1 조 9400 억 투입 '해양정보함' 2 척 건조…대북 정보수집 강화 [이현호의 밀리터리!톡]].

Current ASW capabilities of the JMSDF

General overview of JMSDF ASW

The JMSDF's ASW structure entered a new phase after the large-scale organisational reform in March 2026. The JMSDF abolished the Fleet Escort Force (護衛艦, *goei-kantai*) and the Mine Warfare Force, which had traditionally formed the core of its force structure, and established the Fleet Surface Force (水上艦隊, *suijou-kantai*) by integrating them directly under the Self-Defence Fleet.[35]

Under the Fleet Surface Force, the JMSDF consolidated the former four Escort Flotillas into three Surface Warfare Groups. Helicopter-carrying destroyers (DDHs), including *Izumo*, *Kaga*, and *Hyuga*, serve as the flagships of these groups. It also established an Amphibious and Mine Warfare Group, combining mine warfare, transport, and amphibious functions, and a Patrol and Defense Group responsible for warning and surveillance, in which *Mogami*-class frigates (FFMs) are concentrated.[36] In addition, the JMSDF established an Information Warfare/Operations Command by integrating previously dispersed intelligence, communications, and oceanographic units.

This reform does not seek to increase the total number of ships; rather, it aims to specialise units by function and improve the efficiency of command and information warfare. It is therefore not a measure specifically designed for ASW. Nevertheless, the reform consolidated a DDH-centred group structure capable of operating ASW helicopters, concentrated continuous surveillance of straits and coastal waters under the Patrol and Defence Group and reorganised the central information network that integrates acoustic and environmental data. In these respects, the reform could be assessed as having further organised the JMSDF's overall ASW posture.

Compared with the ROK Navy, JMSDF ASW differs fundamentally in its developmental environment and historical legacy. The first difference concerns the scale of the operational area. Unlike South Korea, which has traditionally operated in relatively narrow coastal and adjacent waters, the JMSDF has had to defend extensive waters across the Western Pacific, the East China Sea, and the Sea of Okhotsk, together with long sea lines of communication (SLOCs). The second difference is the existence of chokepoints. Unlike South Korea, which lacks a clearly defined ASW

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[35] Kosuke Takahashi, "JMSDF Launches the 'Fleet Surface Force,' Abolishing the Escort Fleet: Largest Reorganisation Since Its Founding" [海自「水上艦隊」発足　護衛艦隊を廃止、創設以来最大規模の組織改編　第 1～3 の水上戦群の編成が判明], *Yahoo! News Japan*, March 23, 2026, https://news.yahoo.co.jp/expert/articles/3f6ed3bb54ba101e1178135fba1c416dd05074d0.

[36] Kosuke Takahashi, "The Full Picture of the JMSDF's New 'Fleet Surface Force' (Latest Organisation Chart)" [海自新編「水上艦隊」の全容判明（最新組織図）], *Yahoo! News Japan*, March 24, 2026, https://news.yahoo.co.jp/expert/articles/4ec9c1e647b59d7564c3d137ef07db71016ca875. See also, Mainichi Shimbun, "The 'Escort Fleet' Has Vanished: What Changes with the New 'Fleet Surface Force'?" [「護衛艦隊」が消えた！　海自"創設以来の大改編"の狙いは？　「水上艦隊」新編で何が変わるのか], *Mainichi Shimbun*, March 24, 2026, https://ecnavi.jp/mainichi_news/article/042f09fad091eea47ab764dc16e90ac8/.

chokepoint, Japan has the Soya, Tsugaru, Osumi and Tsushima Straits between its islands. These geographical conditions enable Japan to conduct strait-control-oriented ASW.[37]

These characteristics originated in the historical circumstances of the Cold War.[38] Under the division of responsibilities between the United States and Japan, the JMSDF served as a barrier against the advance of Soviet Pacific Fleet submarines into the Pacific, and in this role developed a strong specialisation in ASW. As a result, Japan developed ocean-going, acoustics-centred ASW over several decades at the levels of doctrine, organisation, equipment, and training.

Airborne ASW platforms

The JMSDF's airborne ASW force substantially exceeds that of the ROK Navy in scale. This section reviews its fixed-wing maritime patrol aircraft (P-1 and P-3C) and rotary-wing ASW helicopters (the SH-60 series).

The core of the JMSDF's fixed-wing force is the Kawasaki P-1, developed domestically to replace the aging P-3C. The P-1 is a four-engine turbofan maritime patrol aircraft. It first flew in 2007, and system development was completed in 2013, when operational deployment began.[39] Unlike the US P-8, which is based on a commercial airliner, the P-1 was designed specifically for maritime patrol from the beginning. About 35 aircraft were reportedly deployed as of the end of March 2025. The Japanese Ministry of Defense originally planned to acquire about 65 aircraft. However, following the revision of Japan's three national security documents in December 2022, it reduced the final target to about 61 aircraft.[40]

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[37] Yasuharu Kimura, "The Threat of Chinese Naval Vessels Repeatedly Entering the Tokara Strait: What Countermeasures Can Japan Take Without Relying on the United States?" [中国軍艦の相次ぐトカラ海峡進入、米国を頼れぬ日本の対抗策は], Jitsugyo no Nihon Research Institute, October 7, 2024, https://forum.j-n.co.jp/narrative/7512/. See also, House of Councillors, National Diet of Japan, "Written Inquiry Concerning the Warning and Surveillance System for the Three Straits and Waters Surrounding Japan" [三海峡及び日本周辺水域の警戒監視システムに関する質問主意書], February 21, 1983, https://www.sangiin.go.jp/japanese/joho1/kousei/syuisyo/098/syuh/s098009.htm.

[38] Mizuho Kajiwara, "The Superiority of US Submarine Detection Technologies in the Cold War" [冷戦期の米国における潜水艦探知技術の優位性] (PhD diss., Keio University, 2023), https://cir.nii.ac.jp/crid/1910583860640723456.

[39] Board of Audit of Japan, "The Status of Operations of the Domestically Developed Fixed-Wing Patrol Aircraft (P-1)" [国内開発された固定翼哨戒機（P-1）の運用等の状況について], June 2025, https://www.jbaudit.go.jp/report/new/kobetsu06/pdf/070627_zenbun.pdf. (the first XP-1 prototype flew in September 2007; the Minister of Defense granted unit-use approval in March 2013, when two P-1s were deployed to Atsugi Air Base and operational use began); see also Kawasaki Heavy Industries, "Maritime Patrol Aircraft P-1 and Cargo Aircraft C-2" [固定翼哨戒機「P-1」および輸送機「C-2」], *Kawasaki Technical Review* 179, (2018), https://www.khi.co.jp/rd/magazine/pdf/179/n17913.pdf.

[40] Board of Audit of Japan, "The Status of Operations of the Domestically Developed Fixed-Wing Patrol Aircraft (P-1)."

The P-1 carries an AESA radar, EO/IR detection equipment, and an indigenously developed acoustic processing system, and operates a large number of sonobuoys.[41] The P-1 retains a MAD, installed in a boom extending from the rear of the fuselage. Its armament includes lightweight torpedoes, anti-submarine bombs, Type 91 air-to-ship missiles, and Harpoon anti-ship missiles.[42]

However, the Board of Audit found that a considerable number of deployed P-1 aircraft faced restrictions on mission performance due to engine corrosion, electronic-equipment defects, and delays in procuring replacement parts. These findings indicate that Japan still faces challenges in ensuring the stable operation of its domestically developed aircraft.[43]

Meanwhile, the JMSDF continues to operate a considerable number of P-3Cs, introduced in large numbers from the Cold War period. The JMSDF once possessed over 100 P-3 series aircraft, one of the largest P-3 fleets in the world. Although the P-3 series has been replaced by the P-1, the JMSDF has maintained the overall scale of its maritime patrol force. Notably, the JMSDF has separately operated several variants in addition to the standard ASW patrol model: the EP-3 for electronic intelligence collection, the OP-3C for imagery intelligence collection, and the UP-3 series for multipurpose and test missions.[44] This shows that Japan did not merely possess a large number of ASW patrol aircraft but also expanded advanced capabilities using variants based on the same platform. This is one of the clearest contrasts with South Korea's airborne ASW capabilities.

Regarding rotary-wing aircraft, the JMSDF operates the SH-60-series helicopters, which Japan independently modified from the US Sikorsky S-70 family. Beginning with the SH-60J introduced in 1991, the JMSDF has operated several dozen SH-60Ks, which Mitsubishi Heavy Industries extensively redesigned and began deploying in 2005. Japan completed development of the further improved SH-60L in 2023 and is introducing it successively.[45]

These helicopters operate dipping sonar, sonobuoys, and lightweight torpedoes, and the JMSDF deploys them aboard a wide range of vessels, from Aegis destroyers to DDHs. The latest SH-60L

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[41] The Japanese Ministry of Defence does not disclose the P-1's sonobuoy capacity. Open sources indicate a load larger than that of the P-3C, consistent with the aircraft's larger internal volume and its emphasis on wide-area acoustic search.

[42] Sea Eagles of the Pacific, "JMSDF KAWASAKI P-1" [哨戒機　P-1], accessed September 16, 2026, http://torakyojin88.web.fc2.com/p1.html.

[43] "Many of the MSDF's P-1 Patrol Aircraft Unusable for Missions: Board of Audit" [海自の P1 哨戒機多くが任務に使えない状態 会計検査院], *NHK*, June 27, 2025, https://news.web.nhk/newsweb/na/na-k10014846291000.

[44] Wing, "MSDF and US Navy Conduct Joint Training South of Shikoku" [海自と米海軍、四国南方で共同訓練], *Wing*, February 20, 2026, https://www.jwing.net/news/105307.

[45] Fly Team, "Mitsubishi 'SH-60L Patrol Helicopter' Development Completed! To Be Formally Deployed to the MSDF's Atsugi Air Base as the SH-60K Successor" [三菱「SH-60L 哨戒ヘリコプター」開発完了！海自・厚木航空基地に正式配備へ、SH-60K 後継機], December 25, 2023, https://flyteam.jp/news/article/140246.

has improved low-frequency acoustic-processing capability and a high-speed data link. It was designed for multistate ASW operations, in which multiple helicopters and surface ships share acoustic information and receive echoes from the same transmitted signal.[46]

The JMSDF's airborne ASW force could be assessed as among the world's most advanced in both quantitative scale and qualitative completeness. The domestically developed P-1 and the remaining P-3C-series aircraft continuously patrol extensive maritime areas. Numerous SH-60-series helicopters undertake the ASW defence of the fleet, while specialised intelligence-collection variants operate separately. This structure stands in clear contrast to the ROK Navy, which relies on a small number of aircraft. However, the JMSDF also faces problems concerning the operational availability of the domestically developed P-1. A future challenge will be how the JMSDF's airborne force, based on the numerical strength and indigenous technology accumulated since the Cold War, responds to the latest threats while maintaining an adequate operational availability rate.

Surface-Ship ASW platforms

As examined above, the ROK Navy's surface combatants traditionally prioritised anti-surface and anti-air warfare. By contrast, the JMSDF's surface fleet has developed with a central emphasis on ASW since its establishment.[47] During the Cold War, Japan formed the so-called "eight ships and eight helicopters" structure under the division of security responsibilities between the United States and Japan.[48] Its purpose was to establish an ASW barrier against the advance of Soviet Pacific Fleet submarines into the Pacific. Under this structure, one Escort Flotilla consisted of eight destroyers and eight ASW helicopters, centred on a helicopter-carrying destroyer, so that the fleet itself functioned as a single ASW search-and-attack network.

The developmental trajectory of individual surface-ship ASW platforms is shown clearly in the general-purpose destroyer (DD) series introduced after the Cold War. For example, the *Murasame*-class, first commissioned in 1996, combined an OQS-5 hull-mounted sonar with an OQR-2 tactical TASS.[49] It also operated anti-submarine rockets, triple lightweight torpedo launchers, and an SH-

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[46] Takayuki Ayabe, "The JMSDF's Latest Patrol Helicopter 'SH-60L': What It Can Do" [海上自衛隊の最新哨戒ヘリコプター「SH-60L」は], Motor Fan, August 11, 2024, https://motor-fan.jp/article/253925/.

[47] Robert Farley, "Understanding Civil-Military Relations and Anti-Submarine Warfare," *The Diplomat*, August 16, 2019, https://thediplomat.com/2019/08/understanding-civil-military-relations-and-anti-submarine-warfare/.

[48] The "eight ships and eight helicopters" (8 艦 8 機, *hachi-kan hachi-ki*) concept refers to an escort flotilla of eight destroyers with eight embarked ASW helicopters, organised around a helicopter-carrying destroyer to sustain continuous airborne ASW coverage. Hideki Kaihoshi, "JMSDF Escort Ships of the Hatsuyuki Class: Core General-Purpose Escorts Built under the 'Eight-Eight Fleet' Concept" [海上自衛隊：護衛艦「はつゆき」型、『八八艦隊構想』により建造された基幹・主力汎用護衛艦], Motor Fan, January 8, 2022, https://motor-fan.jp/mf/article/34447/.

[49] OQS-5 is a hull-mounted sonar developed in Japan, providing combined active and passive search in the low-frequency band. Its array is housed in a bulbous bow dome and acoustically isolated from the hull to reduce self-noise. OQR-2 is a tactical towed array sonar (TASS), streamed astern to exploit low-frequency passive detection at

60 ASW helicopter. The *Asahi*-class, which entered service in 2018, about two decades and several generations later, again placed particular emphasis on ASW. Its sonar system evolved into the OQQ-24 integrated sonar system, whose central feature is a bistatic capability enabling the ship to receive echoes from signals transmitted by a friendly ship or helicopter.[50] It can also accommodate two helicopters, which demonstrates its emphasis on ASW.

The development of ASW equipment progressed further with the *Mogami*-class new-generation multirole frigate (FFM) which carries both the OQQ-25 sonar for ASW and the separate OQQ-11 sonar for mine detection and was therefore designed to conduct both ASW and mine warfare on a single platform. The OQQ-25 integrates a VDS and a TASS.[51] The ship is also designed to integrate the Type 07 anti-submarine rocket, Type 12 lightweight torpedo, latest SH-60L helicopter, and unmanned systems. This may be regarded as an example in which the directions of reform examined above – the establishment of the Amphibious and Mine Warfare Group and functional specialisation – were also implemented at the level of ship design.

ASW evolution can also be seen in Aegis destroyers (DDGs), which traditionally prioritised air-defence missions. The *Kongō*-class (1993–), the JMSDF's first Aegis destroyer class, carried the OQS-102 hull-mounted sonar, anti-submarine rockets, and lightweight torpedoes. However, it has no hangar for the regular operation of an ASW helicopter.[52] By contrast, the latest *Maya*-class (2020–) combines the AN/SQS-53C hull-mounted sonar and the AN/SQR-20 MFTA under the AN/SQQ-89A(V)15J ASW combat system, which it shares with the US Navy. The installation of a hangar for an ASW helicopter also strengthened the class's airborne ASW capability.[53]

The ASW capabilities of JMSDF surface ships have maintained a consistent direction of development, extending from the generational evolution of hull-mounted sonar and TASS to

ranges beyond those available to the hull array; later units carry the improved OQR-2C. Both sensors are integrated through the OYQ-103 anti-submarine warfare information processing system, so that the *Murasame* class conducts close-in active search and longer-range passive surveillance as a single integrated function rather than through independent sensors. Detailed performance parameters are not disclosed by the Japanese Ministry of Defense.

[50] Hideki Kaihoshi, "The Latest General-Purpose Destroyer, Emphasising ASW and with a Revised Propulsion System" [対潜水艦戦闘を重視、推進方式も見直した最新鋭の汎用護衛艦], Motor-Fan, January 29, 2022, https://motor-fan.jp/article/40110/.

[51] Hideki Kaihoshi, "A Unicorn? 'New-Generation' Stealth Frigates of the Mogami Class Enter Service One After Another" [一角獣？ "新世代" ステルス艦「もがみ」型護衛艦が続々登場], Motor Fan, October 22, 2022, https://motor-fan.jp/article/91199/. See also, Japan Maritime Self-Defense Force, "Escort Ship 'Mogami' Class (FFM)" [護衛艦「もがみ」型 FFM], accessed September 15, 2026, https://www.mod.go.jp/msdf/equipment/ships/ffm/mogami/.

[52] Japan Maritime Self-Defense Force, "Escort Ship 'Kongō' Class (DDG)" [護衛艦「こんごう」型 DDG], accessed 22 July 2026, https://www.mod.go.jp/msdf/equipment/ships/ddg/kongou/.

[53] JMU, "Escort Ship 'Maya'" [護衛艦「まや」], JMU Technical Review 8, https://www.jmuc.co.jp/rd/technical-review/assets/VOL8_b2_Maya.pdf. See also, Kouji Inoue, "System Integration: The AN/SQQ-89 ASW System Also Carried by MSDF Escort Ships" [システムの統合化 海自の護衛艦も搭載する AN/SQQ-89 対潜システム], Mynavi, June 1, 2024, https://news.mynavi.jp/techplus/article/military_it-560/.

multistatic-based detection. It could be assessed as the result of the JMSDF's tradition of incorporating ASW into the fundamental principles of fleet organisation, consistently reflected in its ship designs.

Submarine-Based ASW platforms

Unlike the ROK Navy's submarine force, which has assumed multirole missions such as anti-ship and land-attack operations and support for special operations, JMSDF submarines have developed with ASW as a core mission since the Cold War. They have performed the so-called hunter-killer role of intercepting and tracking Soviet and Chinese submarines along their routes of movement.[54] This is directly related to the geographical conditions and the division of security responsibilities between the United States and Japan examined above. JMSDF submarines assume the mission of quietly lying in wait at the chokepoints of the straits, where they detect and track hostile submarines attempting to pass through.

This hunter-killer mission requires several particular capabilities. The first is an extremely high level of acoustic quietness. As examined above, the manoeuvre of the detecting platform itself affects passive detection. The quieter the detecting submarine, the farther away it can detect the weak noise emitted by an adversary. Acoustic quietness therefore leads directly to an advantage in detection. For this reason, JMSDF submarines have developed toward minimising noise while remaining submerged at low speed for long periods. They have adopted raft-mounted machinery with vibration isolation, anechoic tiles, and, from the *Sōryū*-class onward, air-independent propulsion (AIP) or lithium-ion-battery propulsion, which allows longer submerged operational time.[55]

The second requirement is sensitive passive sonar and a large-aperture array.[56] A hunter-killer submarine must detect a quiet adversary by passive methods and therefore requires large FAS and TAS capable of collecting and resolving weak, low-frequency signals across a wide aperture.

The third requirement is an enhanced target motion analysis (TMA) capability. Passive detection generally provides bearing information but involves a substantial margin of error in estimating range. A submarine must overcome this by accumulating and calculating changes in bearing over time and in relation to its own movement, thereby estimating the target's course, speed, and range. All submarines require this capability, but the hunter-killer mission places particular emphasis on it. Ultimately, this mission requires a combination of three capabilities: remaining hidden quietly,

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[54] U.S. Front Line, "Japan and U.S. Monitor Chinese Submarines, Covering the Pacific from Okinawa Bases" [中国潜水艦を日米で監視 沖縄拠点に太平洋カバー], September 9, 2015, https://usfl.com/news/79903.

[55] Xioshan, "Japan's First Lithium-Ion-Battery-Powered Submarine 'Ōryū' Delivered to the MSDF" [日本首艘搭载锂离子电池的海自新潜艇交付], March 6, 2020, https://www.nengyuanjie.net/article/34715.html.

[56] "Large-aperture array": the aperture is the physical size of a sonar array. A larger aperture allows the array to receive lower-frequency signals and yields finer bearing resolution, so a wide array is favored for low-frequency, long-range detection – a design orientation termed "large-aperture."

listening from a long distance, and calculating the target's position accurately with minimum manoeuvre. The development of JMSDF submarines has concentrated on these capabilities.

This orientation can be identified particularly in the sonar systems of the three classes now in service: the *Oyashio*, *Sōryū*, and *Taigei*-classes. All three carry ZQQ-series sonar systems developed by Oki Electric Industry. These are integrated systems combining a cylindrical or conformal bow sonar, FAS along the sides of the hull, and a TAS at the stern, aiming to provide all-round detection coverage.[57] However, there are clear differences in the level of maturity achieved by each generation.

First, the *Oyashio*-class (1998–) carries the ZQQ-6 sonar system. The significance of this class lies in its full-scale integration of FAS for the first time, in addition to bow sonar and TAS.[58] As with the South Korean submarines examined above, it established a division of frequency coverage in which the bow sonar mainly handles high-frequency signals and the FAS handles low-frequency signals. This enabled the class to address two tasks at once: long-range detection and the identification of low-frequency noise from quiet targets.

The subsequent *Sōryū*-class (2009–) carries the ZQQ-7 sonar system. Together with a cylindrical bow sonar, it has FAS and TAS, the class meeting the requirement for a large-aperture array through the number of array elements, reflecting the principle that a larger array improves long-range low-frequency detection and bearing resolution.[59] Compared with the *Oyashio*-class, the *Sōryū*-class is about two metres longer and has a submerged displacement greater by more than 400 tonnes. These increases appear to have physically contributed to the improvement of sonar performance.

The ZQQ-8 sonar system of the latest *Taigei*-class (2022–) shows a notable qualitative advance. First, the previous cylindrical bow sonar was replaced by a horseshoe-shaped conformal-array sonar, understood to have secured a wider aperture along the shape of the hull.[60] In addition, the FAS applies more sensitive fibre-optic array technology in place of conventional piezoelectric elements, improving detection sensitivity. Particularly notable is its reported bistatic localisation capability, which allows the submarine to receive and integrate echoes from active sonar pings

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[57] The first letter of a JMSDF sonar designation indicates the platform on which it is carried: "O" denotes a surface vessel and "Z" denotes a submarine. Accordingly, whereas the OQQ series examined above is an integrated sonar system for surface ships, the ZQQ series applies the same type of multifunction integrated sonar to submarines.
[58] Sea Eagles of the Pacific, "Submarine 'Oyashio' Class (SS-590)" [潜水艦「おやしお」型], accessed July 22, 2026, http://torakyojin88.web.fc2.com/ss590.html. See also, Japan Maritime Self-Defense Force, "Submarine 'Oyashio' Class (SS)" [潜水艦「おやしお」型 SS], accessed July 22, 2026, https://www.mod.go.jp/msdf/equipment/ships/ss/oyashio/.
[59] Japan Maritime Self-Defense Force, "Submarine Sonar ZQQ-6 and Submarine Sonar System ZQQ-7" [潜水艦ソーナーZQQ－6、潜水艦ソーナー・システム ZQQ－7], Fleet Supply Depot Notice no. 04-45, November 29, 2022, https://www.mod.go.jp/msdf/bukei/yd/nyuusatsu/K-04-0100-0045.pdf.
[60] Kosuke Takahashi, "Japan Commissions Fifth Taigei-class Submarine," *Naval News*, March 10, 2026, https://www.navalnews.com/naval-news/2026/03/japan-commissions-fifth-taigei-class-submarine/.

transmitted by a surface ship and to estimate the target's position.[61] In other words, fleet-level cooperation can supplement the fundamental constraint that requires a submarine to maintain stealth and rely only on passive detection.

Meanwhile, the JMSDF has continued to improve its existing classes in addition to developing new ones. For the *Sōryū*-class, later-built submarines received improvements to detection and survivability related equipment, including combat systems and torpedo countermeasure systems.[62] Furthermore, the first *Taigei*-class submarine was converted into a test submarine and now serves as a test platform for next-generation submarine sonar.[63] This demonstrates how highly the JMSDF values underwater detection capability as a core asset.

Other ASW assets

As with South Korea's fixed-array sonar systems, the specific locations and technical specifications of Japan's fixed-array sonar systems constitute classified military information and cannot be confirmed from publicly available sources. Nevertheless, their general characteristics could be estimated from available research and news reports. In South Korea, such systems appear to be localised networks limited to major ports and areas near the maritime boundary. Japan, by contrast, is estimated to have established a wide-area seabed acoustic surveillance network covering its inland seas and surrounding straits. This network reportedly connects multiple underwater hydrophone arrays to coastal stations, and continuously detects, classifies, and tracks submarines and surface ships passing through the straits and surrounding waters.[64]

More importantly, the US Navy and the JMSDF reportedly operate a considerable part of this network jointly. As the activities of the People's Liberation Army Navy (PLAN) submarines became more assertive in the early 2000s, the two navies began to establish a fixed-array network to monitor the movement of Chinese submarines in the East China Sea. As a result, the so-called Fish Hook undersea defence line, with Okinawa, Guam, and Taiwan as its principal nodes, is

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[61] Tetsuya Kakitani, "The New Submarine 'Taigei': How Does It Differ from Previous Submarines? An Expert Explains" [新型潜水艦『たいげい』、これまでの潜水艦と何が違う？専門家が解説], *Mamor*, December 18, 2023, https://mamor-web.jp/_ct/17656521.

[62] Japan Ministry of Defense, FY2020 Policy Evaluation (Prior Programme Evaluation): "Research on Components of a Flow-Noise-Reduction Underwater Torpedo Tube" [令和２年度政策評価書（事前の事業評価）「流体雑音低減型水中発射管構成要素の研究」], September 2020, https://www.mod.go.jp/j/policy/hyouka/seisaku/2020/pdf/jizen_04_honbun.pdf.

[63] Traffic News, "'A Unique Role': The New 'Iron Whale' Unit, the 11th Submarine Squadron, Is Established" [「唯一無二の役割」新たな鉄鯨部隊「第 11 潜水隊」発足！], *Traffic News*, March 8, 2024, https://trafficnews.jp/post/131483.

[64] Kyodo News, "Japan and US Operate a Chinese-Submarine Surveillance Network from Okinawa, Covering the Pacific" [日米で中国潜水艦監視網 沖縄拠点、太平洋カバー], *Kyodo News*, September 9, 2015, https://www.youtube.com/watch?v=hbYy9p1bbO0.

estimated to have taken shape around 2005. It is estimated to consist of two hydrophone networks, extending from Okinawa to southern Kyushu and from Okinawa to Taiwan.[65]

Japan initiated its reconnaissance satellite project through the Information Gathering Satellite (IGS) programme in response to North Korea's nuclear tests and ballistic missile launches. The IGS system consists of optical satellites that obtain high-resolution images during daytime and clear weather, SAR satellites capable of observation at night and in adverse weather, and data-relay satellites that support them. Notably, the Cabinet Satellite Intelligence Center (CSICE), under the Cabinet Intelligence and Research Office, administers this programme rather than the Ministry of Defense.[66]

The principal missions of this system are to monitor military-related facilities in neighbouring countries, and to support responses to large-scale disasters. Under the current system, Japan can image any location on the Earth at least once per day. The Japanese government aims to establish a ten-satellite system, excluding reserve satellites, consisting of four optical satellites, four RADAR satellites, and two data-relay satellites, in order to shorten the revisit interval and image a specific target several times per day. Separately from the IGS programme, Japan is also developing a constellation that will place about 50 small satellites in low Earth orbit to acquire targeting information for its counterstrike capabilities.[67] The original purposes of these systems are to detect indications of missile launches and monitor military facilities. However, their ability to identify the locations of vessels through optical and SAR imagery may, in principle, also support maritime surveillance, including the monitoring of submarine movements into and out of port.

Finally, there are the JMSDF's ocean intelligence collection assets and specialised intelligence units. In this area, the difference between South Korea and Japan is considerable. South Korea previously operated two ocean surveillance ships and is now pursuing two next-generation ships because of the aging of its existing vessels. By contrast, the JMSDF operates multiple vessels of three different types, each with a different mission, supported by specialised units and shore-based data-processing systems.

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[65] Abhijit Singh, "India's 'Undersea Wall' in the Eastern Indian Ocean," Asia Maritime Transparency Initiative, June 15, 2016, https://amti.csis.org/indias-undersea-wall-eastern-indian-ocean/.

[66] On the administration of Japan's reconnaissance-satellite programme, see Cabinet Secretariat (Japan), "Cabinet Satellite Intelligence Center (CSICE)," Cabinet Secretariat (Japan), accessed September 15, 2026, https://www.cas.go.jp/jp/gaiyou/jimu/csice.html. See also, Deyana Goh, "Japan Launches Reconnaissance Satellite IGS-Radar 6," SpaceTech Asia, June 13, 2018, https://www.spacetechasia.com/japan-launches-reconnaissance-satellite-igs-radar-6/.; Administration by the Cabinet Satellite Intelligence Centre rather than the Ministry of Defense reflects the programme's origin as a civilian-controlled "information gathering" capability established after the 1998 North Korean missile launch. In practice it means that imagery tasking and dissemination are managed at Cabinet level, so the JMSDF is a consumer rather than the owner of these assets – a structural difference from the ROK military, which operates its reconnaissance satellites within the defence establishment.

[67] Sanghoon Lee, "Japan to Grasp Enemy Positions in Real Time with 50 Small Satellites" [日本、小型衛星 50 基で敵の位置をリアルタイムで把握], *The Dong-A Ilbo*, November 29, 2022, https://www.donga.com/jp/article/all/20221129/3791371/1.

The first type is the *Hibiki*-class auxiliary ocean surveillance ship (AOS). This class adopts a small-waterplane-area twin-hull (SWATH) design, which enables stable low-speed navigation even in adverse weather. It operates a low-frequency Surveillance Towed Array Sensor System (SURTASS) from the stern and collects the acoustic information, or acoustic signatures, emitted by submarines. The first ship, *Hibiki*, entered service in 1991; the fourth, *Bingo*, entered service in March 2026, bringing the class to four operational vessels.[68]

The second type is the oceanographic research ship (AGS). Instead of directly detecting acoustic information, these ships accumulate oceanographic data that determine the success or failure of ASW. Specifically, they precisely measure seabed topography and composition, ocean currents, geomagnetic conditions, and the acoustic propagation conditions directly related to sonar detection, including water temperature, salinity, and sound velocity, thereby producing the basic data necessary for acoustic detection. A distinctive feature of the JMSDF's oceanographic research ships is that successive single-ship classes, without sister ships, form a line of replacement. The JMSDF currently operates three: *Nichinan* (AGS-5105), commissioned in 1999; *Shōnan* (AGS-5106), commissioned in 2010; and their successor, the latest vessel *Akashi* (AGS-5107), commissioned in March 2026,[69] showing that the JMSDF continues to renew its forces in this area with modern vessels.

Third is the cable-laying ship (ARC) *Muroto*. Its principal mission is reportedly to lay and maintain underwater acoustic surveillance equipment and communications cables at bases, ports, and strategic maritime areas, although the details have not been disclosed.[70] Based on publicly available information, it is presumed to construct and maintain the physical infrastructure of the fixed-array sonar network examined above. *Muroto* entered service in 2013 and is homeported at Kure. Since 2015, it appears to have conducted cable-laying exercises in the waters around Guam with support from the US Navy.[71]

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[68] Kosuke Takahashi, "JMSDF's Newest Ocean Surveillance Ship 'Bingo' Launched; To Be Deployed to Kure Base, Hiroshima; Crew System Expanded to a Five-Crew, Four-Ship Rotation" [海自最新の音響測定艦「びんご」進水 広島・呉基地に配備予定 乗員体制を 4 隻による 5 クルー制へ], *Yahoo! News Japan*, February 17, 2025, https://news.yahoo.co.jp/expert/articles/7a0df6cd9763ef9261c32327dd5dab0e9d0c1e20.

[69] Traffic News, "First New Vessel in 16 Years! Self-Defense Ship 'Akashi' Commissioned; Unarmed at 28 Billion Yen Yet 'Extremely Important'; Where Will It Be Deployed?" [16 年ぶりの新型！ 自衛艦「あかし」就役 280 億円で武装ゼロでも"超重要"どこに配備？], *Traffic News*, March 10, 2026, https://trafficnews.jp/post/643115.

[70] Sea Eagles of the Pacific, "JMSDF ARC-483 MUROTO" [敷設艦「むろと」（２代目）], accessed September 16, 2026, http://torakyojin88.web.fc2.com/arc483.html.

"What Is the Mystery-Shrouded Mission of the JMSDF's Cable-Laying Ship 'Muroto'?" [海上自衛隊・敷設艦「むろと」の謎に包まれた任務とは？], Kaiyou Kokubou, 24 January 2023, https://kaiyoukokubou.jp/2023/01/25/fusetsukan-muroto/.

[71] Maritime Staff Office, "(Announcement) Guam Island Area Dispatch Training" [（おしらせ）グアム島方面派遣訓練], July 21, 2015, https://www.mod.go.jp/msdf/release/201507/20150721-02.pdf.

ROK and Japanese ASW capabilities beyond the 2030s

Key concepts in ASW development: Multistatic detection, AI, and UUVs

The future ASW environment facing South Korea and Japan is entering a phase in which both countries must respond to two simultaneous pressures: quieter threats and a wider battlespace. China's submarine force is becoming increasingly quiet through technological development, while North Korea seeks to advance into distant waters by constructing nuclear-powered submarines. As the submarines of potential adversaries improve, detection methods that rely on a single sensor or platform face growing limitations. At the same time, the maritime areas requiring surveillance are expanding, while population decline increasingly constrains the recruitment of military personnel. Against this background, South Korea and Japan are developing their ASW capabilities in broadly similar directions, although their specific priorities and pace differ.

This section examines these directions as follows. The first is the advancement of sonar systems, whose key elements are the ability to resolve signals in the low-frequency band and the practical application of multistatic detection, in which multiple platforms share a single acoustic source. The second is the development of information-analysis capabilities using artificial intelligence (AI). The third is the introduction of unmanned systems, including unmanned underwater vehicles (UUVs). The fourth is manned-unmanned teaming (MUM-T), which integrates unmanned and manned assets into a single combat system, together with the reorganisation of the command structures supporting such operations. The following sections examine how these directions are being implemented in concrete terms, identifying which programmes are being pursued, under which documents, and with what level of priority.

Major development in South Korea

South Korea's ASW development can be identified in its higher-level roadmap for defence science and technology and its medium-term financial plan. The 2025–2039 Defence Technology Planning Document, published by the Defence Acquisition Program Administration (DAPA) and the Korea Research Institute for Defence Technology Planning and Advancement in May 2025, presents a technology-acquisition roadmap for the next 15 years.[72] It categorises defence strategic technologies into ten fields and 30 technologies, and subdivides the existing 87 detailed technologies into 100 categories, establishing quantitative objectives for each.[73] The ten fields include AI, MUM-T, quantum technology, space, cyber and networks, and sensors and electromagnetic warfare. These fields correspond to the directions presented above: sonar systems as sensors, AI, unmanned systems and MUM-T, and emerging-domain technologies such as

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[72] Hanyeong Kim, "DAPA and KRIT Publish the '25–'39 Defense Technology Planning Document Containing a Mid-to Long-Term Technology-Acquisition Strategy" [방사청·국기연, 중·장기 기술확보 전략 담은 "25~'39 국방기술기획서' 발간], *News2day*, May 19, 2025, https://www.news2day.co.kr/article/20250519500143.

[73] ROK Defense Acquisition Program Administration "'25–'39 Defence Technology Planning Document (General Edition)" ['25-'39 국방기술기획서(일반본)], ROK Policy Briefing, May 19, 2025, https://www.korea.kr/archive/expDocView.do?docId=41380.

quantum, space, and network technologies. However, detailed specifications of multistatic and low-frequency sonar systems are masked for security reasons in DAPA's performance-management documents. It is therefore difficult to identify their quantitative objectives, and only the general direction of the relevant programmes can be confirmed.

Nevertheless, the sonar and unmanned-systems directions are being implemented through specific programmes. DAPA is already carrying out a scheduled upgrade programme that includes the sonar systems of the existing *Jang Bogo-II*-class submarines.[74] DAPA has also reorganised its programme-management structure for unmanned systems, creating dedicated programme teams for unmanned surface combatants and for unmanned aircraft.

These directions are taking form in recent development of individual weapon systems. A representative example is a UUV for ASW reconnaissance, developed by the Agency for Defence Development (ADD) together with domestic defence companies. This UUV is about 7 metres long, weighs 3.8 tonnes, and is designed to conduct missions for one month at a maximum depth of 300 metres. Development of its core technologies was completed in 2022, and operational deployment is planned for 2030.[75]

The vehicle carries an autonomous underwater navigation system, a compact sonar system, a hydrogen fuel-cell hybrid propulsion system, and a communications system linked to an unmanned surface vessel, and will conduct ASW reconnaissance missions. This programme is also connected to a plan to develop a combat UUV equipped with torpedoes and a large sonar system.[76]

Furthermore, ADD began research in 2023 into the core technologies and concept of operations for a multipurpose extra-large UUV, intended to respond to threats including North Korea's nuclear-armed torpedoes. This indicates a direction toward larger unmanned systems with longer submerged endurance.[77]

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[74] Hyeongil Lee, "DAPA Begins Performance Upgrade of the 1,800-ton Jang Bogo-II Submarines... Sonar Antennas to Be Replaced with Latest Models" [방사청, 장보고-II 1800t 급 잠수함 성능개량 돌입... 소나 안테나 최신형으로 교체], *The Korea Economic Daily*, November 20, 2025, https://www.hankyung.com/article/202511206096i.

[75] Newsis, "Agency for Defense Development Demonstrates Unmanned Underwater Vehicle for Reconnaissance of Enemy Submarines" [국방과학연구소, 적 잠수함 정찰용 무인 잠수정 시연], *Newsis*, July 1, 2022, https://www.newsis.com/view/NISX20220630_0001927134.

[76] Agency for Defense Development, "Anti-Submarine Warfare Unmanned Underwater Vehicle" [대잠전용무인잠수정], accessed July 18, 2026, https://www.add.re.kr/board?menuId=MENU02746&siteId=SITE00002. On the follow-on plan to develop reconnaissance- and combat-type extra-large UUVs (the MRXUUV programme), see Donggyu Kim, "Hanwha Systems to Undertake Development of Base Technologies for an Extra-Large Unmanned Underwater Vehicle" [한화시스템, 초대형급 무인 잠수정 기반 기술 개발 나선다], *Yonhap*, November 10, 2023, https://www.yna.co.kr/view/AKR20231110071700003.

[77] Jiheon Kim, "Military Begins Research into Core Technologies for an 'Extra-Large Unmanned Underwater Vehicle'... Countering North Korea's 'Nuclear Torpedo'" [軍, '초대형 무인잠수정' 핵심기술 연구...北 '핵어뢰'에 대응], *Yonhap*, March 28, 2023, https://www.yna.co.kr/view/AKR20230327138600504.

Regarding sonar and MUM-T, the central element of development is the transition toward multistatic systems, in which the acoustic source or transmitter is physically separated from the receivers. The ROK Navy began full-scale research on multistatic systems after the sinking of ROKS *Cheonan*, and research has also continued on employing ASW helicopters as multistatic nodes. In particular, a South Korean company succeeded in developing an indigenous multistatic sonobuoy in 2025.[78]

In the surface fleet, the FFX programme has progressed from the *Incheon*-class (FFG-I) through the *Daegu*-class (FFG-II) to the *Chungnam*-class (FFG-III), with continuous improvements in sonar systems. The *Chungnam*-class employs an integrated sonar system combining hull-mounted sonar with TASS and VDS. The next-generation frigate sonar system developed by ADD incorporates automatic detection and tracking of multiple targets, real-time prediction of the underwater environment, and multisensor data-fusion technologies.[79]

However, detailed sonar specifications for the *Chungnam*-class and future frigates, as well as buoy-based underwater surveillance systems, remain either undisclosed or at the research stage, and are best understood as indicating the direction of future development.

Major developments in Japan

Japan's ASW development can also be identified from its higher-level security documents and rapidly increasing defence expenditure. In December 2022, Japan revised its three principal security documents: the National Security Strategy, the National Defence Strategy, and the Defence Build-up Program. Under the Defence Build-up Program, Japan decided to invest about JPY 43 trillion over the five years from 2023 to 2027, an increase of about 50 per cent over the previous five-year plan.[80] Accordingly, the annual defence budget increased from about JPY 8.7 trillion in FY2025 to JPY 9 trillion in FY2026, exceeding JPY 9 trillion for the first time. By including the FY2025 supplementary budget, Japan also brought forward the target year for defence expenditure equivalent to 2 per cent of GDP from FY2027 to FY2025.[81]

Within this trend, the Ministry of Defense has clearly indicated a moving toward strengthening undersea warfare capabilities in both financial and policy terms, including a substantial expansion

[78] Dongsik Lim, "SonarTech Succeeds in Localising a 'Multistatic Sonobuoy' for Submarine Detection" [소나테크, 잠수함 탐지용 '다중상태 소노부이' 국산화 성공], *ETNews*, November 17, 2025, https://www.etnews.com/20251117000107.

[79] Heebeom Park, "ADD Develops a Combat System and Sonar System for the Next-Generation Frigate" [ADD, 차기호위함용 전투·소나체계 개발], *ETNews*, December 2, 2012, https://www.etnews.com/201212020116.

[80] BBC, "Japanese Government Approves Major Expansion of Defence Spending, Citing the China Threat" [日本政府、防衛費の大幅拡大を閣議決定 中国の脅威を理由に], *BBC*, December 17, 2022, https://www.bbc.com/japanese/64009514.

[81] Nobuhiro Kubo, "FY2026 Defense Budget Decided, First Time Above JPY 9 Trillion; Thousands of Drones to Be Procured" [26 年度防衛予算案を決定、初の 9 兆円台 無人機を数千機調達], *Reuters*, December 26, 2025, https://jp.reuters.com/world/security/EB7Q4TFYL5MPJMDOSSXUGPL6YE-2025-12-26/.

of investment in maritime unmanned weapon systems over the next five years and the development of large UUVs for long-range reconnaissance and ASW.[82]

Japan's development of sonar is moving beyond the generational replacement of systems toward next-generation platforms, new materials, and signal-processing technologies. One representative direction is the evolution of submarine-mounted sonar. The first *Taigei*-class submarine was converted into a test submarine and now serves as a test platform for next-generation submarine sonar. As described above, the *Taigei*-class replaced conventional piezoelectric elements in its FAS with more sensitive fibre-optic array technology. Building on this, expanding and further advancing the fibre-optic hydrophone technology for subsequent submarines is a key element in strengthening the capability to detect weak low-frequency signals.[83]

In addition, the *Taigei*-class introduced a bistatic localisation capability in which the submarine receives and integrates echoes from active sonar pings transmitted by a surface ship. Accordingly, the direction of development is to extend multistatic cooperative detection to submarines, allowing them to share the fleet's acoustic sources while maintaining stealth.

This is also linked to the networking of fixed-wing and rotary-wing aircraft. The P-1 was designed to centrally integrate and analyse acoustic information collected by multiple sonobuoys through the HYQ-3 combat command and information-processing system, which applies knowledge-based technology, incorporating a direction toward data fusion beyond detection by individual sonobuoys.[84]

This networking-oriented direction is now extending into international cooperation as well. In June 2026, Kawasaki Heavy Industries signed an MOU with Airbus, under which the two companies agreed to jointly examine the feasibility of installing Kawasaki's detection technologies aboard the Airbus-led Eurodrone, a large unmanned aircraft measuring 17 metres in length with a 30 metre wingspan.[85] Kawasaki intends to apply to the unmanned aircraft the radar, sonar, and MAD technologies accumulated through the development of the P-3C and P-1. In particular, the concept seeks to reduce the personnel burden of wide-area surveillance and improve operational efficiency by operating this ASW unmanned aircraft in coordination with the P-1. This shows a shift toward

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[82] Newswitch, "Long-Range, Long-Endurance Underwater Unmanned Vehicles: The Ministry of Defense's Aim in Developing Them" [長距離・長時間運用型の水中無人機、防衛省が開発する狙い], *Newswitch*, November 2023, 20, https://newswitch.jp/p/39330.

[83] Il Choi, "The Significance of the Launch of Japan's New Submarine Taigei (大鯨)" [일본 신형잠수함 타이게이(大鯨)함 진수의 의미], Korea Institute for Maritime Strategy, accessed September 15, 2026, https://kims.or.kr/issubrief/kims-periscope/peri217/.

[84] Kawasaki Heavy Industries, "Maritime Patrol Aircraft P-1 and Cargo Aircraft C-2" [固定翼哨戒機「P-1」および輸送機「C-2」].

[85] Kawasaki Heavy Industries, "MOU Signed with Airbus D&S on Collaboration in the Field of Long-Endurance Unmanned Aerial Systems" [Airbus D&S 社と滞空型無人機分野における協業検討に関する MOU を締結], June 26, 2026, https://www.khi.co.jp/news/detail/20260626_1.html.

the automation and networking of information analysis, in which manned and unmanned platforms share the collection and processing of ASW acoustic information and integrate the resulting data.

Another notable point in unmanned systems is that unmanned underwater technologies accumulated through mine countermeasure operations are opening the possibility of application to ASW. The *Mogami*-class frigates have gained experience in MUM-T by serving as motherships for the OZZ-5 UUV and USVs, although this experience began in mine warfare. The Ministry of Defense also allocated about USD 160 million for research and development in 2024 and is pursuing a combat-support USV that uses submarine-navigation technology to detect threats and collect information. This suggests a trend in which the MCM foundation is expanding into submarine-detection missions.[86]

As noted above, this expanded investment in maritime unmanned systems also underpins the separately pursued large UUV for long-range reconnaissance and ASW. The autonomous-navigation, sonar-integration, and mothership-linkage technologies already proven through MCM UUVs are therefore expected to serve as the foundational technologies for unmanned systems dedicated to ASW.[87] However, the large ASW UUV and combat-support USV are best understood as remaining at the research, development, and testing stages.

Conclusion

South Korea and Japan have developed three-dimensional ASW postures in response to the expansion and increasing quietness of North Korean, Chinese, and Russian submarine forces. However, the geopolitical environments facing the two neighbouring countries differ considerably: the characteristics of the main enemy submarines they confront, their maritime geography including the presence or absence of straits, the size of their areas of responsibility, and the strategic missions assigned to their navies. It is therefore inappropriate to compare their ASW capabilities directly by the same standard, and they cannot be assessed simply by comparing the absolute numbers of ASW assets. As stated in the Introduction, this section has provided a trend-based assessment grounded in publicly available data; it has not fully addressed the actual performance of sonar under operational conditions or the level of proficiency in doctrine and training.

Nevertheless, an overall assessment may conclude that the JMSDF's ASW capabilities are superior to those of the ROK Navy. South Korea has rapidly improved its capabilities over the past decade, with the sinking of ROKS *Cheonan* in 2010 as a turning point. Japan, by contrast, has accumulated ASW capabilities steadily for half a century since assuming the mission of forming an ASW barrier

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[86] MONOist, "Unmanned and Autonomous Systems the JMSDF Is Developing: The State of UUV and USV Development" [海上自衛隊が取り組む無人化と自律化 UUV と USV の開発はどうなっているのか], June 5, 2025, https://monoist.itmedia.co.jp/mn/articles/2506/05/news017_3.html.

[87] Newswitch, "Long-Range, Long-Endurance Underwater Unmanned Vehicles: The Ministry of Defense's Aim in Developing Them" [長距離・長時間運用型の水中無人機、防衛省が開発する狙い].

against the Soviet Union during the Cold War, incorporating ASW into the basic principles of fleet organisation. This gap may be more evident in supporting areas than in frontline platforms such as maritime patrol aircraft, destroyers, and submarines: wide-area seabed acoustic surveillance networks; specialised intelligence collection assets; institutional structures that feed collected acoustic signatures and oceanographic data back into tactical doctrine; and proficiency in ASW tactics and equipment operation. The more instructive lesson for the ROK Navy therefore lies less in comparing individual equipment performance than in how the JMSDF has embedded ASW across its doctrine, organisation, and training.

Despite this gap, the future directions of the two countries are broadly similar, particularly the advancement of sonar systems capable of resolving low-frequency signals and allowing multiple platforms to share a single acoustic source, and efforts to employ UUVs and unmanned aircraft for ASW. South Korea is now beginning this transition on a full scale through higher-level roadmaps and individual programmes, including the development of ASW UUVs. Japan, by contrast, may be assessed as expanding it more actively through international joint development of ASW unmanned aircraft and large UUVs, on the basis of rapidly increasing defence expenditure and already established ASW assets.

A common challenge is whether the two countries can sustain the readiness needed to preserve their qualitative gains in ASW. South Korea's small P-8 fleet and uncertain indigenous maritime patrol aircraft programme, together with Japan's P-1 availability issues, illustrate these constraints. Long-term demographic decline and shrinking personnel pools further complicate efforts to maintain numerical balance against North Korea, China, and Russia. Both countries will therefore need not only to introduce unmanned systems capable of persistently monitoring wide maritime areas with fewer personnel, but also to integrate these systems effectively with existing crewed platforms, command structures, and ASW doctrine. Ultimately, the durability of their ASW advantage will depend less on the acquisition of increasingly sophisticated individual platforms than on their ability to sustain readiness, maintain sufficient operational coverage, and incorporate unmanned capabilities into routine fleet operations. The central challenge for both navies is therefore no longer simply how to improve their ability to detect and track submarines, but how to sustain that capability over time under increasingly demanding operational and demographic conditions.