



The Evolution of the Chinese Submarine Force

Submarine History Seminar

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Naval Submarine League Webinar

22 October 2024

This presentation is a slightly expanded version of the one I gave during the Naval Submarine League's Submarine History Seminar webinar on 22 October 2024. This year's history seminar focused on the development of Chinese submarine force and consisted of the following panelists.

Moderator – David A. Rosenberg, PhD – Military historian and NSL History Seminar Chairperson

Panelist – CAPT Christopher P. Carlson, USN (Ret) – former Defense Intelligence Agency Senior Intelligence Officer and former nuclear submarine officer

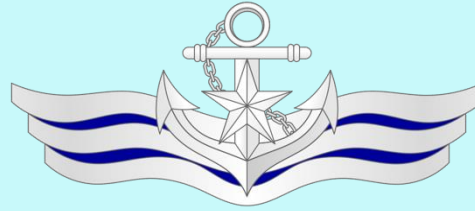
Panelist – Andrew S. Erickson, PhD – Professor of Strategy in the Naval War College's China Maritime Studies Institute

Panelist – Jonathan D. T. Ward, PhD – President of Atlas Organization and senior fellow at Hudson Institute

Panelist – CAPT Daniel Packer, USN (Ret) – COMSUBFOR Director for AUKUS and former nuclear submarine officer

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Overview

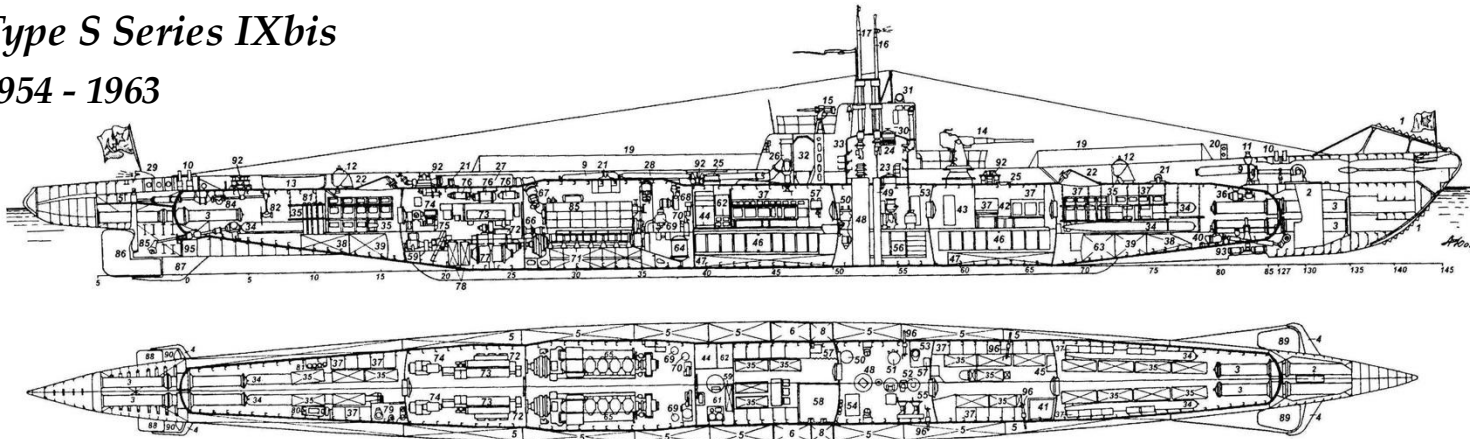


- ◆ China was a late player into the submarine game.
 - First submarines acquired in 1954-55.
- ◆ Indigenous development was initially very slow.
 - PLAN not a high priority for defense spending.
 - Emphasis was on coastal defense.
- ◆ Roughly three phases of development.
- ◆ Crawl Phase
 - 1954 – 1994: Anti-surface warfare oriented based on Near Coast Defense strategy.
- ◆ Walk Phase
 - 1995 – 2012: Anti-surface warfare oriented based on Near Seas Active Defense strategy.
- ◆ Run Phase
 - 2013+: Emphasis shifting to a multi-mission capability, to include anti-submarine and strike, based on Far Seas Operations strategy.
- ◆ While China was slow off the blocks in submarine development, the country is working up to a full sprint.

Birth of the PLAN Submarine Force

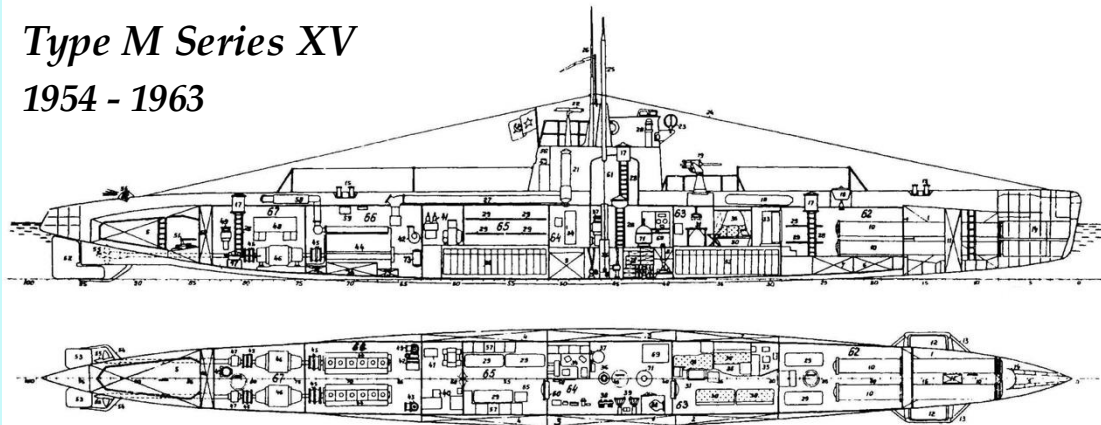
Type S Series IXbis

1954 - 1963



Type M Series XV

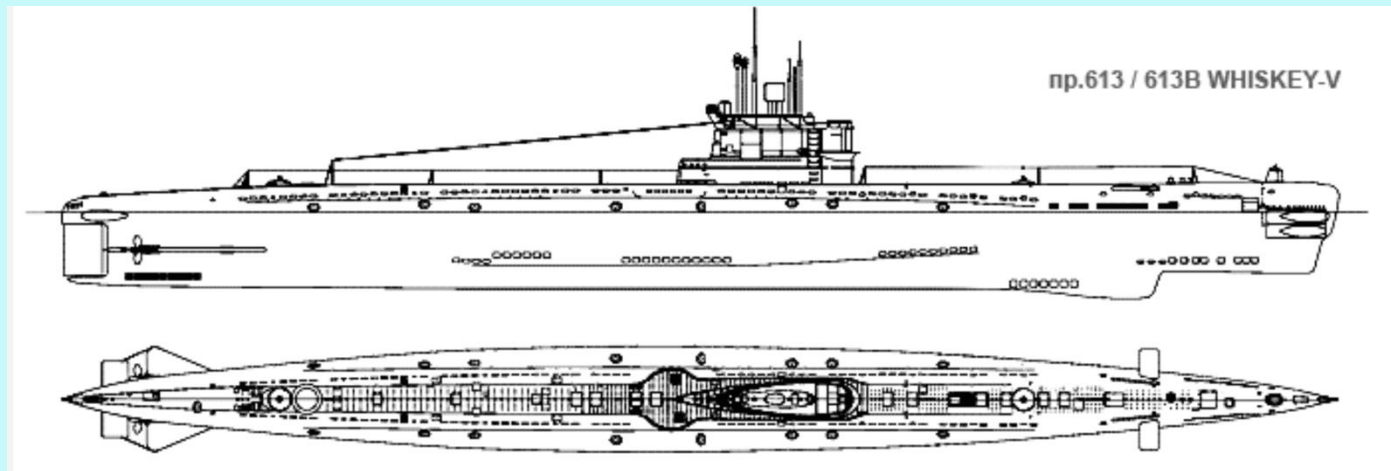
1954 - 1963



- ◆ Four Type S Series IXbis and four Type M Series XV transferred between 1954-55.
- ◆ World War II Soviet submarine designs, entered service from 1947-50.
- ◆ Type S Series IXbis: 1,077 tons (subm)
- ◆ Type M Series XV: 350 tons (subm)

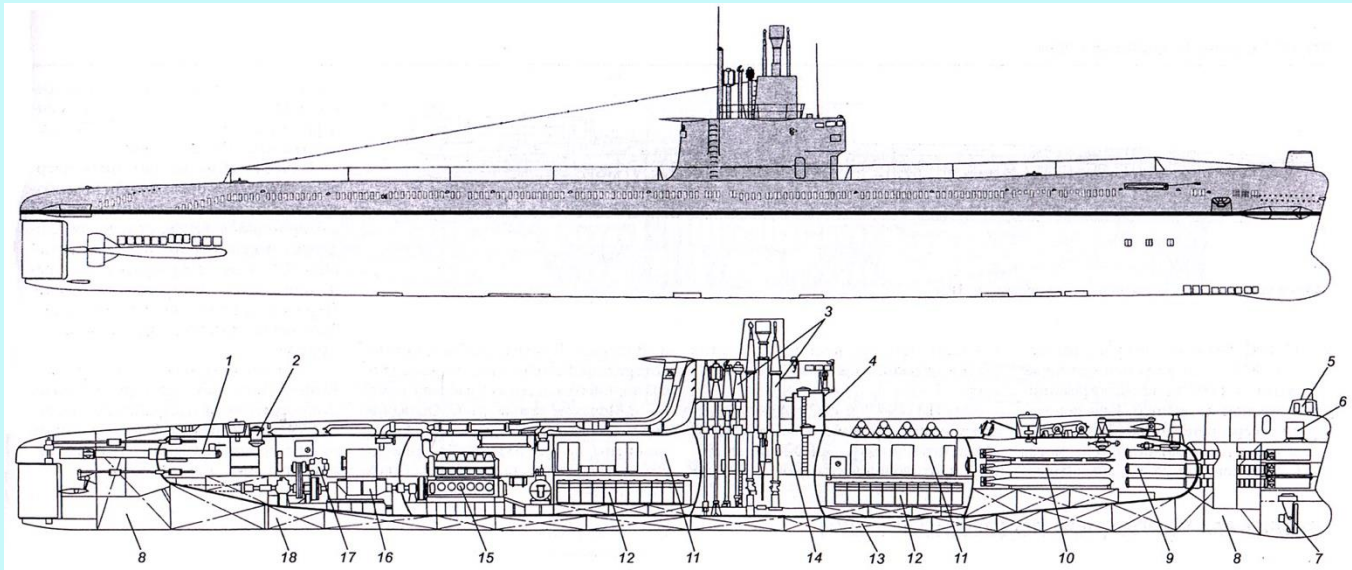
Submarines - Crawl

Type 6603/03 SS

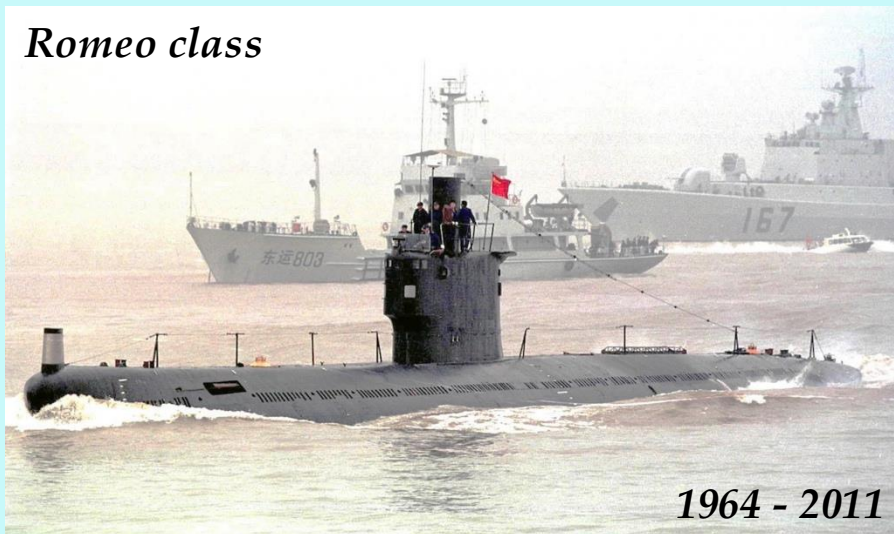


- ◆ License produced Soviet Project 613 Whiskey IV/V class.
- ◆ Number built: 21
- ◆ Submerged displacement: 1,350 tons.
- ◆ Based on German World War II Type XXI.

Type 033 SS



Romeo class



- ◆ First two Type 6633 built from kits supplied by the Soviet Union.
- ◆ Number built: 84
- ◆ Submerged displacement: 1,730 tons.
- ◆ Essentially an enlarged Type 03 with the same sensor suite and weapons.

Type 035 SS



- ◆ Enlarged and streamlined Type 033. Built in four groups.
 - Type 035: Two built with Type 033 electric motors, not successful.
 - Type 035A: Four built with more powerful motors.
 - Type 035G: Twelve built with new sonar system, including passive ranging array.
 - Type 035B: Four built due to delay in Type 039 program. Still in service.
- ◆ Submerged displacement: 2,110 tons.
- ◆ Last PLAN submarine class based on World War II design philosophy.

Type 09I SSN



- ◆ First two hulls suffered numerous mechanical problems.
 - Submerged displacement: 5,100 tons.
- ◆ Remaining three hulls are ≈ 8 meters longer.
 - Submerged displacement: 5,600 tons.
- ◆ Loud.
 - Comparable to a Soviet Type I nuclear submarine.
- ◆ Slow (24/25 knots).
- ◆ Until 1989 lacked torpedo armament.

Type 09II SSBN

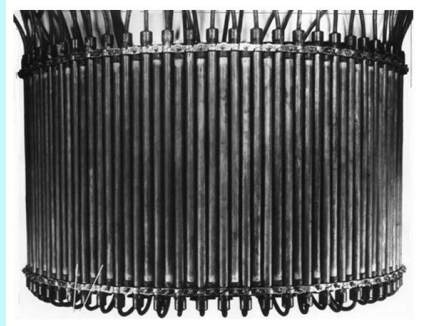


- ◆ Single unit, also suffered from mechanical difficulties.
- ◆ Submerged displacement: 8,325 tons.
- ◆ Loud.
 - Comparable to a Soviet Type I nuclear submarine.
- ◆ Slow (22 knots).
- ◆ Until 1989 lacked torpedo armament.
- ◆ Operational status of Type 09II and JL-1 was considered “questionable.”
 - JL-1 SLBM has a range of 1,770 km (955 nmi).

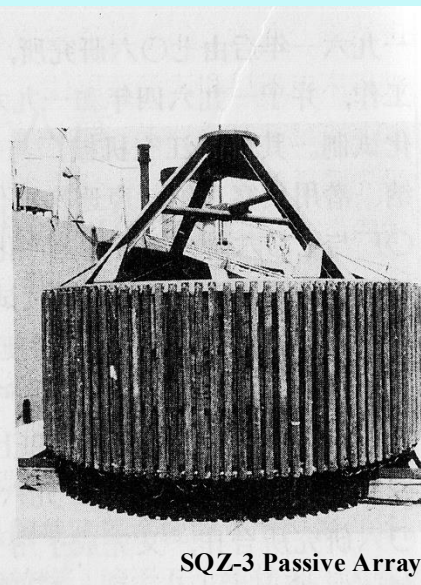
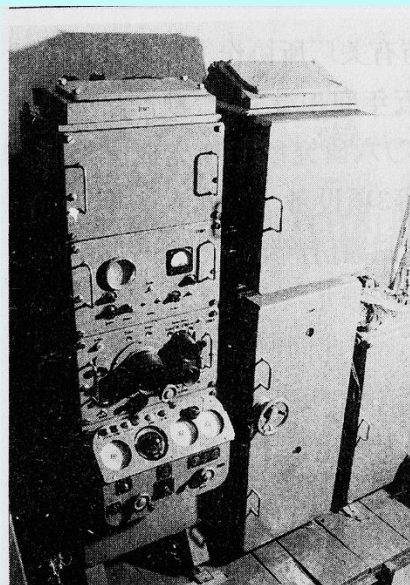
Submarine Sonars - Crawl



MG-10



MG-200



SQZ-3 Passive Array



SQZ-1/D Operator Console

- ◆ Sonars based on Soviet designs.
 - MG-10 Feniks and MG-200 Arktika
 - Broadband MF passive and HF active.
- ◆ MG-10 is the Soviet equivalent of the BQR-2.
 - SQZ-3 passive array is an enlarged version.
- ◆ SQZ-1/D and 3 are integrated active/passive sonar.
 - Active and passive functions controlled from the same console.

Submarine Torpedoes - Crawl



- ◆ Yu-1 steam powered, anti-ship torpedo – copy of Soviet 53-39.
 - IOC: 1971, Length: 7.8 m, Speed: 50/39 knots, Range: 1.9/4.9 nmi, unguided.
 - Yu-1A passive homer – not successful.
 - Yu-1B active/passive homing, IOC: 1986.
- ◆ Yu-4A electric, passive, anti-ship torpedo – copy of Soviet SAET-50
 - IOC: 1984, Length: 7.8 m, Speed: 36 knots, Range: 8.1 nmi.
 - Yu-4B active/passive homing, IOC: 1990.
- ◆ Yu-3 electric, passive, anti-submarine torpedo – based on Soviet SET-53.
 - IOC: 1989, Length: 6.6 m, Speed: 35 knots, Range: 7.0 nmi.
 - Yu-3A active/passive homing, IOC: 1992.

Submarine ASCMs - Crawl

YJ-8



Type 33G class



- ◆ Type 33G fitted with six YJ-8 missiles.
- ◆ Must surface to fire.
- ◆ YJ-8 [CSS-N-4 Sardine]
 - Range: 22.7 nmi
 - Mach 0.9
 - Sea skimmer
 - IOC: 1987
- ◆ Successful test platform, but not a serious combat unit. Vulnerable while preparing to fire missiles.

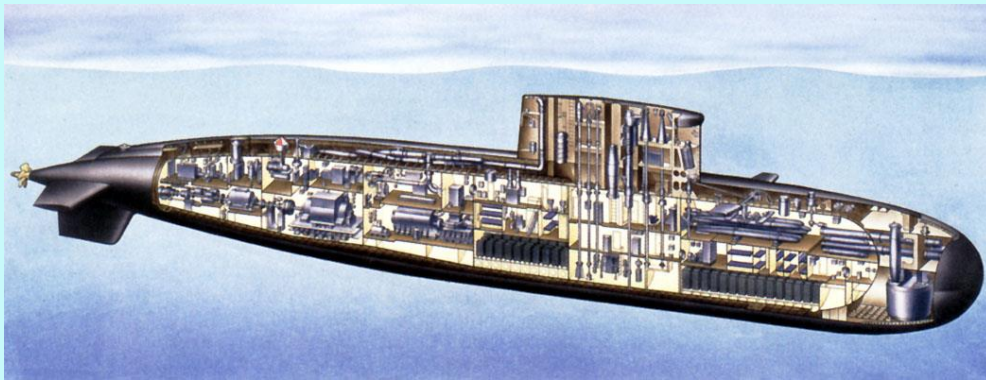
Submarines - Walk

Type 039/039G/039G1 SS



- ◆ Second generation conventional submarine design. Built in three groups.
 - Type 039: One built, serious problems with the design. Not considered acceptable.
 - Type 039G: Three built with full sail and quieter.
 - Type 039G1: Eleven built fitted with anechoic coating.
 - Capable of firing wire-guided torpedoes and ASCMs.
- ◆ Submerged displacement: 2,250 tons.
- ◆ Has features reminiscent of the French Agosta SS class.

Project 877EKM Kilo



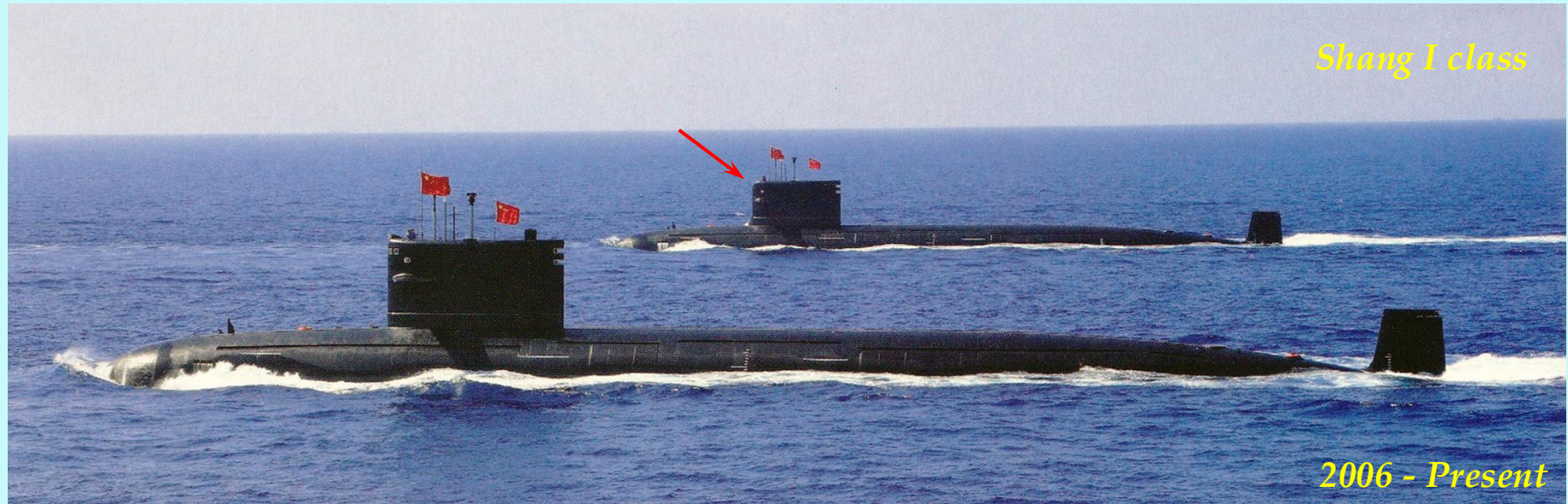
- ◆ Two incomplete submarines purchased from Russia in early 1994.
- ◆ Submerged displacement: 3,075 tons.
- ◆ Introduced China to modern Russian submarine technology.

Project 636/636M Kilo



- ◆ First two were incomplete Russian Project 636 purchased in 1997.
- ◆ The second group of eight were Project 636M submarines purchased in 2004.
 - Fitted to fire the SS-N-27b Sizzler ASCM.
- ◆ Submerged displacement: 3,175 tons.
- ◆ Sensors and torpedo fire control the same as Project 877.
- ◆ Quietest submarines in the PLAN.

Type 09III SSN

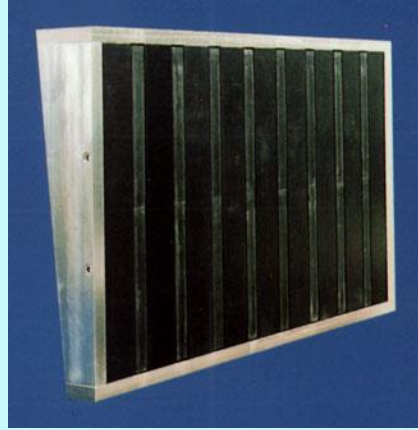


- ◆ First two Type 09III were likely disappointing.
- ◆ Submerged displacement: 5,300 tons.
- ◆ Faster than Type 09I (≈ 28 knots), but not achieving likely 30-knot design speed.
- ◆ Loud – a surprise.
 - Comparable to Project 671 Victor I.
- ◆ One of the Type 09III hulls had minor modifications to the sail to reduce drag.
 - Possible submerged speed increase to 29 knots.

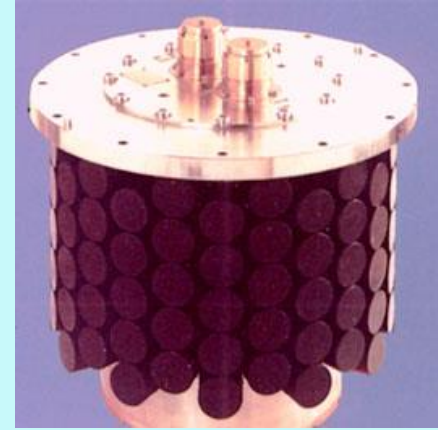
Submarine Sonars - Walk



DSUV-22 passive hull array



DUUX-5 passive ranging array



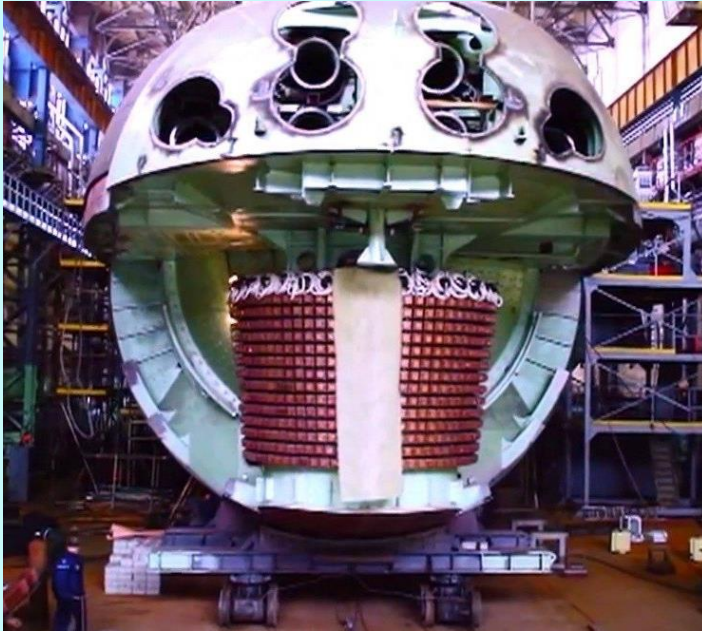
Cylindrical active array



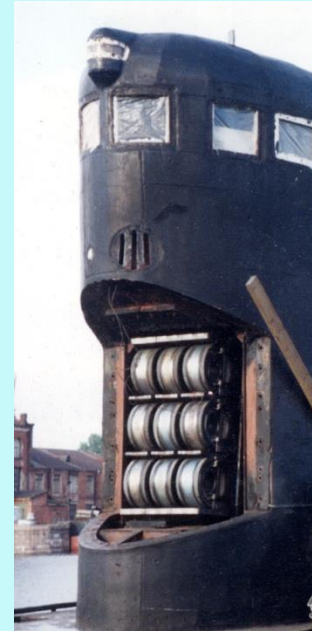
Eledone multifunction console

- ◆ SQZ-262 series submarine sonar suite.
 - Integrated, digital system with multifunction consoles..
 - Chinese developed display and control console
 - Arrays probably similar to French Eledone suite.
- ◆ Access to Pakistani Agosta class SS.
 - Examined earlier DSUV-2H and DUUX-2 systems.
- ◆ Two DUUX-5 systems exported to China in 1983.
 - Passive ranging only.
- ◆ Broadband MF passive and MF active hull arrays.
- ◆ Backfitted to early Type 035 and Type 033.

Submarine Sonars - Walk



MGK-400 passive hull array



MGK-400 active array



MGK-400 operator console

- ◆ MGK-400 Rubikon sonar.
 - Huge passive bow array 4.5 x 3 meters.
 - 1960's style passive and active displays.
 - Active sonar – low medium frequency.
- ◆ Less advanced than SQZ-262 system.

Submarine Torpedoes - Walk



Yu-6 torpedo



Yu-9 torpedo



TE-2-01 torpedo

- ◆ Received numerous torpedoes with the Project 877/636 Kilo sales.
 - TEST-71M/MK: Electric, ASW, wire-guided.
 - 53-65KE: Thermal, ASuW, wake-homing.
 - TE-2-01: Electric, dual purpose, wire-guided.
 - Dumbed down export USET-80KM.
- ◆ Updated Yu-3 torpedoes.
 - Yu-3B: Electric, dual purpose, wire-guided.
 - Yu-3BG: Wake homing feature added.
- ◆ Yu-6 thermal, dual purpose, wire-guided
 - Basically a copy of an early Mk48.
 - Range: 16.4 nmi, Speed: 50 knots.
 - Includes wake-homing feature.
 - Russian Otto fuel engine from Article 211TT1.
- ◆ Yu-9 electric, dual purpose, wire-guided.
 - Range: 9.7 nmi, Speed: 42 knots
 - Aluminum-Silver battery.
 - Includes wake-homing feature.
 - Exported as the ET-40.

Submarine ASCMs - Walk



YJ-82 launch canister model



YJ-82 missile



3M54E [SS-N-27b Sizzler]

- ◆ YJ-82 submerged launched variant of the YJ-8A (folding wings).
- ◆ Launch canister bears a very strong resemblance to sub-launched Harpoon.
- ◆ Lacks a booster, so range will be shorter.
- ◆ YJ-82 characteristics.
 - Range: 16.2 nmi (est)
 - Mach 0.9
 - Sea skimmer
 - IOC: $\approx$ 2004
- ◆ 3M54E Klub missile/SS-N-27B Sizzler
- ◆ Part of the Project 636M purchase.
- ◆ 3M54E characteristics.
 - Range: 119 nmi
 - Mach 0.9
 - Sea skimmer w/ Mach 3 sprint body
 - IOC: $\approx$ 2002
- ◆ Technological basis for YJ-18.

Submarines - Run

Type 039A/B/C

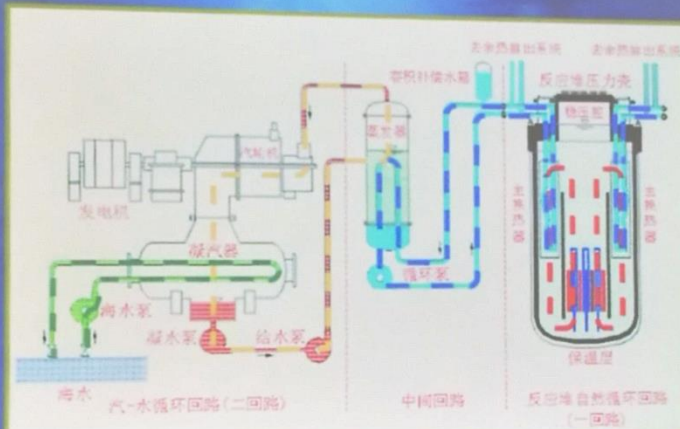


- ◆ Third generation of conventional submarines. Built in three groups.
 - Type 039A: 4 built
 - Type 039B: 16 built w/last 8 having rounded sail and fillet
 - Type 039C: 1-3 built so far, shaped sail and towed array.
- ◆ Submerged displacement: 3,600 tons.
- ◆ Equipped with Stirling engine AIP system.

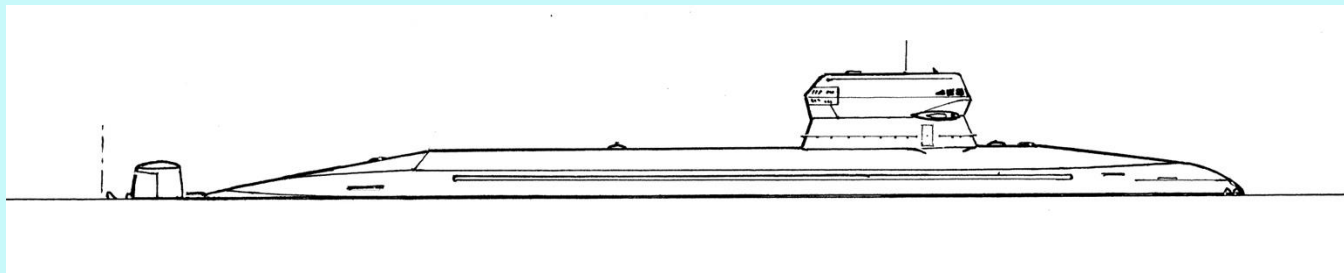
Type 041

Small nuclear AIP slide – Aug 2017 RADM Zhao (ret)

小核电装置原理图



Zhou class



- ◆ Type 041 Zhou class launched between 24 – 25 April 2024 at Wuchang Shipyard.
- ◆ Approx 7-meters longer than Type 039A/B/C, fitted with an X-stern configuration.
- ◆ Extra length possibly for a nuclear AIP system – low power, micro-reactor.
 - Alternative theory is a vertical launch system.
- ◆ Between 29 May and 12 June, the submarine apparently sank at its fitting out pier.

Type 09IIIA Version 1 & 2 SSNs



- ◆ Submerged displacement: 6,675 tons.
- ◆ More robust sail modifications to reduce drag – probably achieved 30 knots.
- ◆ Quieter than Shang I, but still noisy.
 - Comparable to Project 671RT Victor II.
- ◆ Fitted with a towed array deployment tube on the upper rudder.

Type 09IIIA Version 3 SSN



- ◆ Final Type 09IIIA design with two hulls built.
- ◆ Submerged displacement: 6,675 tons.
- ◆ Fitted with a towed array deployment tube on the upper rudder.
- ◆ Quiet.
 - Comparable to a Project 671RTM Victor III SSN.

Type 09IIIB SSN



- ◆ First hull rolled out in late April 2022 or mid-January 2023.
- ◆ Just slightly longer than other Type 09III submarines; additional 1.5 meters.
- ◆ Submerged displacement: 6,700 tons.
- ◆ Likely fitted with a pump jet propulsor.
- ◆ Likely quieter than Type 09IIIA.
 - Quiet - comparable to Project 945 Sierra I SSN.

Type 09IV SSBN

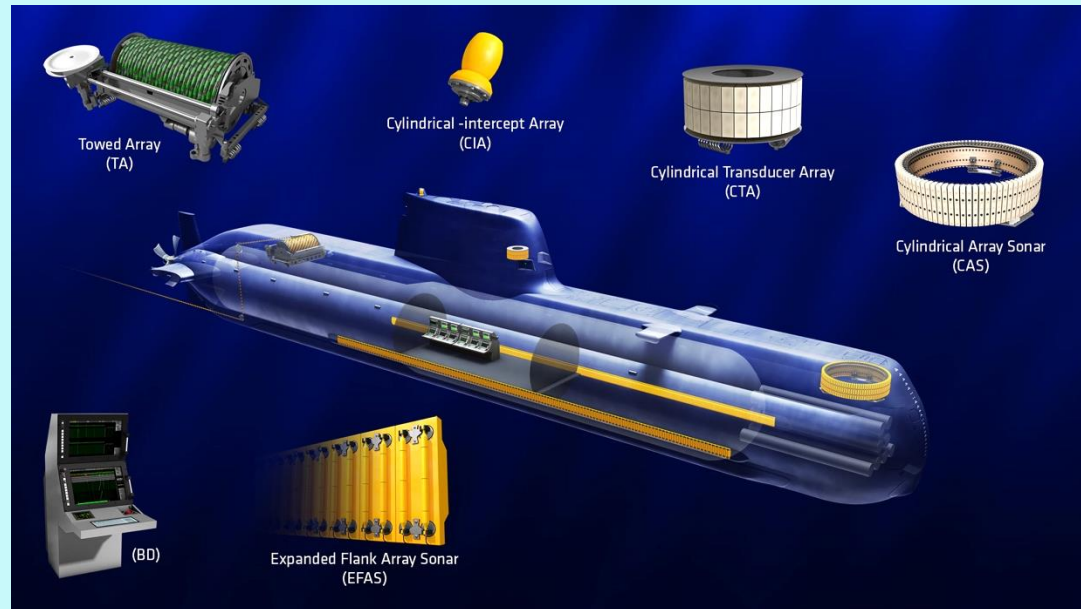


- ◆ Class evolution similar to the Type 09III SSN.
 - Six built thus far. First two units are more “Walk” type submarines.
 - Similar acoustic noise level comparisons.
- ◆ Submerged displacement: 11,500 tons.
- ◆ Fillet and rounded top modifications made to the sail on the last four units.
- ◆ Twelve JL-2/JL-3 missiles give PLAN a long-range strike capability.
 - JL-2 SLBM has a range of 7,200 km (3,888 nmi).
 - JL-3 SLBM has a range of 10,000+ km (5,400+ nmi).

Submarine Sonars - Run



Type 039B sonar operator consoles



German ISUS 100 integrated sonar suite

◆ SQZ-265 series submarine sonar suite.

- Integrated, digital system with multifunction consoles.
- Fully integrates active/passive hull, flank, and towed arrays, similar to modern European systems.
- VLF through HF search capability.
- Limited number of operators suggests reliance on automatic detection algorithms.

◆ Combining possible Russian size arrays with state-of-the-art computer signal processing and display would give late BQQ-5 system like performance.

Submarine Sonars - Run



SQG-207 flank array test panels



Type 039B Yuan class

- ◆ SQG-207 LF passive flank array.
 - Single hydrophones mounted on sound dampening plates.
- ◆ Largely supports long-range detection of surface ships.

Submarine Sonars - Run



Type 09IV SSBN stern tube



Type 09III SSN stern tube



Project 667BDR SSBN towed array

- ◆ Likely derived from Russian submarine towed array designs.
 - Thin line: 40 mm in diameter.
 - Large aperture: 350 m total length.
- ◆ Significant improvement in passive search capability.
 - VLF narrowband; necessary for effective ASW.

Submarine Torpedoes - Run

Yu-12 torpedo (Vietnam beach).



Yu-6 torpedo – the Yu-10 will look the same.



- ◆ Yu-10 has hydroxyl ammonium perchlorate (HAP) added to the Otto fuel – gives Mk 48 ADCAP like propulsion performance.
 - Dual purpose, wire-guided.
 - Range: 21.8 nmi, Speed: 60 knots.
 - Includes wake-homing feature.
- ◆ Yu-12 electric, dual purpose, wire-guided.
 - Range: 11.0 nmi, Speed: 50 knots
 - Aluminum-Silver battery.
 - Includes wake-homing feature.
 - Probably a quiet torpedo, similar to European torpedoes.

Submarine ASCMs - Run

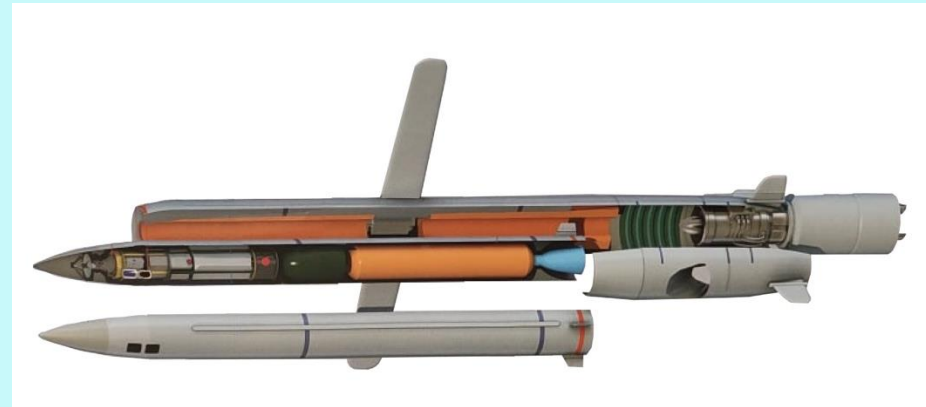


Type 032 Qing class with four VLS hatches



YJ-18A display at 2019 National Military Parade

- ◆ YJ-18/18A based on Russian SS-N-27b Sizzler.
 - Range: 290 nmi
 - Mach 0.9
 - Sea skimmer w/ Mach 3 sprint body
 - IOC: 2018
- ◆ YJ-18 is about 1.1 m shorter than the Russian missile.
 - Much longer range likely due to high density fuel (e.g. JP-10) with aluminum nanopowder.
- ◆ Submarine VLS system being tested.
 - Will provide strike capability with CJ-10 SLCM.



YJ-18 exploded diagram – best guess

Conclusions



- ◆ China entered the submarine game late and was initially slow in developing indigenous submarine design and production capability.
 - Built World War II based designs up through 2004.
 - Maritime strategy emphasis on coastal defense a key factor.
 - Limited warfare capability – anti-surface warfare focus until after 2012.
- ◆ China accelerated the development of their submarines around 2004.
 - Shift in maritime strategy to Far Seas Operations while maintaining defense of the near seas.
 - Highly organized harvesting of foreign technology and adapting systems to suit their needs.
- ◆ Latest Chinese submarines are quiet, multi-mission platforms.
 - Working up to a full sprint.