

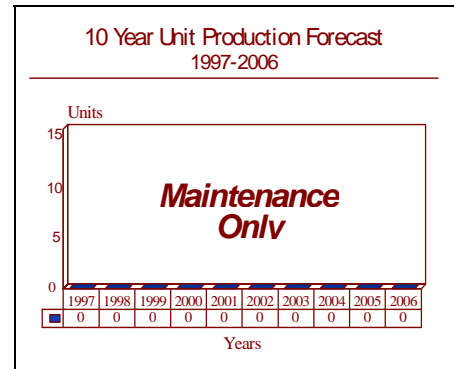
ARCHIVED REPORT

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Romeo Class - Archived 12/98

Outlook

- Based on 1950s Russian design
- High noise level, little in ASW capability
- Ming class derivative fitted with French sensors
- Outdated construction now, with the entry of Kilo, Song, Ming
- Even North Korea's licensed production believed to have ended



Orientation

Description. Diesel-electric patrol and torpedo attack submarine.

Sponsor

China National Import and Export Corp (Machimpex)
 Erligou
 Xijiao
 Beijing
 China

Contractors

Jiangnan Shipyard
 Wuzhang Shipyard

Licensees. The Romeo class has been produced under license in North Korea. Production licenses were

offered to Thailand, Iraq and Iran as well, but no production has been initiated in those countries.

Status. Maintenance only. Number of boats in service is diminishing rapidly.

Total Produced. The Soviet Union built reportedly only 20 of these submarines; China is estimated to have built 84 between mid-1962 and 1984, plus four for exports to Egypt and another four to North Korea. The number of boats in the Ming class, which were derived from Romeo, is estimated at 13, ending in 1996. North Korea is estimated to have built 15 indigenously, bringing the grand total to 140.

Pennant List

<u>Name</u>	<u>Country</u>	<u>Ordered</u>	<u>In Service</u>
83 <i>Nadezhda</i> ^(a)	Bulgaria	1956	1959 (Transferred 1985)
84 <i>Slava</i> ^(a)	Bulgaria	1956	1961 (Transferred 1986)
351 ^(b)	China	1962	1972
342 ^(c)	China	1986	1989
352 ^(c)	China	1986	1990
353 ^(c)	China	1987	1991
354 ^(c)	China	1987	1991
356 ^(c)	China	1988	1991
357 ^(c)	China	1988	1992
358 ^(c)	China	1989	1992

<u>Name</u>	<u>Country</u>	<u>Ordered</u>	<u>In Service</u>
359 ^(d)	China	1989	1994
360 ^(c)	China	1990	1993
361 ^(c)	China	1992	1995
232 ^(c)	China	1991	1994
233 ^(c)	China	1991	1994
(84 others)	China	1962-84	1970-87
849	Egypt	1977	1982
852	Egypt	1977	1982
855	Egypt	1979	1984
858	Egypt	1979	1984
841 ^(a)	Egypt	1956	1962 (Transferred 1966)
846 ^(a)	Egypt	1956	1962 (Transferred 1969)
(3)	North Korea	1968	1972
(2)	North Korea	1968	1973
(3)	North Korea	1968	1974
(3 ^(e))	North Korea	1972	1975
(2 ^(e))	North Korea	1972	1976
(13 ^(e))	North Korea	1972-94	1978-94
SS-11 ^(a)	Russia	1956	1962
SS-128 ^(a)	Russia	1956	1962
UTS-247 ^(a)	Russia	1956	1962
S-37 ^(a)	Russia	1956	1962
(a)	Syria	1956	1962 (Transferred 1985)
(a)	Syria	1956	1962 (Transferred 1985)
(a)	Syria	1956	1962 (Transferred 1986)
^(a) Russian-built Type 633			
^(b) Type 036 Wuhan-A			
^(c) Type 035 Ming			
^(d) Type 039 Wuhan-C			
^(e) North Korean-built			

Note: The above list is compiled from a number of sources and does not reflect the current status of the operational fleets. Russia's last units were stricken in 1987 and scrapped in 1989. China is believed to have only about 20 Romeos operational, from the estimated remaining 70 in 1995. Most of North Korea's Romeos are moored on the east coast, occasionally operating in the Sea of Japan.

Application. The Romeo class was designed to conduct anti-surface ship operations using torpedoes and to execute mine-laying assignments off hostile ports. It has virtually no anti-submarine capability, due to high noise levels and inadequate sensor fit.

Price Range. As with all Chinese equipment, the cost is highly variable and depends largely on whether the buyer is able to claim "friendship prices", i.e., what military alliances the buyer is affiliated with. Generally, a unit cost of around US\$30 million seems to be widely accepted.

Technical Data

Characteristics

<i>Speed (surface):</i>	15 kts
<i>Speed (Submerged):</i>	13 kts
<i>Crush depth:</i>	300 m
<i>Maximum range:</i>	9,000 nm at 9 kts
<i>Endurance:</i>	54 days
<i>Normal crew:</i>	8 officers, 43 enlisted

Dimensions	<u>Metric</u>	<u>US</u>
<i>Length:</i>	76.6 m	251.3 ft
<i>Beam:</i>	6.7 m	22 ft
<i>Draft:</i>	5.2 m	17.1 ft
<i>Displacement (surfaced):</i>		1,475 tons
<i>Displacement (submerged):</i>		1,830 tons
Armament	<u>Type</u>	<u>Number</u>
<i>Torpedo tubes:</i>		
<i>Bow:</i>	53 cm	6
<i>Stern:</i>	53 cm	2
<i>Torpedoes:</i>	Yu-1	14
<i>Mines:</i>		28 in lieu of torpedoes
Electronics	<u>Type</u>	<u>Number</u>
<i>Radar:</i>	Snoop Plate	1
<i>Sonars:</i>		
<i>Passive search:</i>	Artika	1
<i>Active fire control:</i>	Herakles	1
<i>Underwater telephone:</i>	Fez	1
<i>Tactical data system:</i>	Leningrad	1
Countermeasures	<u>Type</u>	<u>Number</u>
<i>ESM:</i>	CEIEC-921A	1
Propulsion	<u>Type</u>	<u>Quantity</u>
<i>Type:</i>	Direct-drive diesel	
<i>Diesels:</i>	1Z38	2x2,400 shp
<i>Electric motors:</i>		2x2,700 shp
<i>Creep motors:</i>		2x100 shp
<i>Batteries:</i>	112 cell	2
<i>Propellers:</i>	Fixed-pitch	2

Design Features. Structurally, the Chinese Romeo class, codenamed Type 033, represents a slightly modified Russian-designed Romeo class, which was known in Russia as Type 633. This was a classic early 1950s medium-sized submarine exploiting German Type XXI design technology. The pressure hull is a simple externally framed cylinder, rather than the internally framed figure-of-eight used in Type XXI, and is divided into four watertight compartments. One example of what became known as the Modified Romeo class was built in China, with tilting missile launchers built-in alongside of the submarine's sail.

The Romeo class had a deeper diving depth and a greater operating range than its predecessor, the Whiskey class. It also had a deeper bow than the Whiskey, which carried two extra bow tubes for torpedoes.

The internal arrangements of the boat are of the one-and-a-half deck type. In the fore is the forward torpedo room, living accommodations and operational sections

are on the upper portion, with the lower section containing the batteries and fuel tanks. Aft of the control room, the hull has a single deck only containing the propulsion machinery and aft torpedo room. The outer casing is lined with free-flood holes. There are several different arrangements for these, but the variations are considered of marginal interest only.

The sail structure contains a prominent conning station in the upper portion. This is used for controlling the submarine when operating on the surface. In the derivative Ming class (Type 035), this facility is replaced by a large intercept sonar array, probably equivalent to the French DUUX-2 or DUUX-5. When operating underwater, the submarine is conned from the control room in the pressure hull. Aft of the conning station is the hoist section for periscopes, radar, ESM and communications antenna, while the aft portion of the sail contains the snort and diesel exhausts.

Strengthening for a 100 mm gun forward of the sail remains in the structure, but this is probably a leftover

from the older Russian Whiskey class design. There is no documentary evidence that the installation of a gun was ever contemplated for either Russian or Chinese-built Romeos. There are two torpedo rooms: the forward room containing six torpedo tubes and a complete set of reloads, and the aft room containing two torpedo tubes with no reloads.

The propulsion machinery drives two shafts. Each shaft is clutched either to a direct-drive diesel engine or to an electric motor running off the batteries, depending on the situation. There is also a creep electric motor which enables the submarine to crawl out from under a depth-charge attack. When running on the surface, the submarine either operates with both diesels providing propulsion, each clutched to a single shaft, or with one diesel driving the submarine and the other charging the batteries.

The submarine is equipped with a retractable snort housed in the rear of the sail. This is coupled to a standard diesel exhaust system which is mounted at the rear of the sail. The snort system reportedly exhibits very high noise levels, due to the lack of effective sound insulation on the diesels, and the anti-flooding valve system is reported unreliable.

Operational Characteristics. The primary armament of the Romeo class is the Chinese Yu-1 torpedo. This is a license-built version of the Russian Type 53 oxygen/kerosene powered, straight-running anti-ship torpedo. The Chinese substituted compressed-air propulsion for oxygen drive on safety grounds. Production order was placed in 1962 but the prototype failed acceptance trials in 1966; when it ran deep, its power output was unstable and its motor failed repeatedly.

These faults kept the Yu-1 from entering full-scale production until 1970. During the intervening period, the Chinese navy had no operational torpedoes. The Yu-1 is 53.3 cm in diameter, 7.8 meters long and has a warhead of 400 kg. It has a range of 3.5 km at 50 kts or 9 km at 39 kts. Mines can be carried on the basis of two mines replacing each torpedo. This should give a total of 28 mines, but there is some doubt as to whether the two stern tubes can truly be used for minelaying.

The Romeo is equipped with two sonars, passive surveillance system Pike Jaw (Chinese name Artika) in a bulbous bow dome above the waterline when the submarine is running on the surface, and an active fire control sonar called Herakles, in a teardrop-shaped housing over the bow. Pike Jaw has a range of approximately 5,000 m. Herakles is a searchlight sonar, with a range of approximately 2,000 m.

The associated fire control system is Leningrad. This is an electromechanical fire control computer similar in concept to the US World War II "Fruit Machine". Unlike Western systems, Leningrad turns torpedoes through two gyro angles in sequence. The torpedoes running in a spread are therefore heading parallel, reducing the implications of range errors in fire control solutions.

The diesel engines are reported to be of very poor build quality, exhibiting significant torsional flexing on the crankshafts. Excessive tolerances in the mechanical components result in rapid wear of all the moving parts and heavy oil loss. The latter is said to be enough to produce a visible oil slick on the surface when the submarine is running on its diesels.

The batteries, too, are reported to have very serious quality control problems. They presumably have great difficulty in acquiring and holding a full charge. The batteries have only a very limited life in terms of charge/discharge cycles, and they suffer from excessive gas generation and plate distortion if subjected to heavy power drain. The problems inherent in maintaining the batteries on these submarines may in fact well explain the low operational readiness of the boats.

The Romeo class is an archaic anachronism by any reasonable set of submarine standards. It is a World War II design, slow, noisy and equipped with very poor sensors. Its hull integrity is open to question, it is known to have extreme quality control problems with its diesels and its battery life is very limited. Its anti-ship armament capabilities are restricted to the use of straight-running torpedoes while its ASW capabilities range from crude to nonexistent.

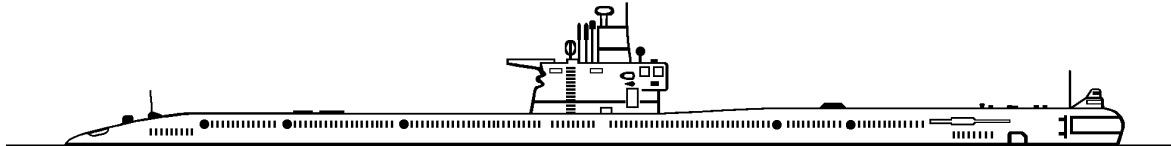
In view of its serious limitations, it is difficult to see why submarines of this design are still in existence, let alone still being built. The most obvious answer is that the potential users of the submarines, North Korea and nations of similar status, are unable to gain access, at present, to modern technology and they have made the judgment that some submarine capability, no matter how limited, is better than none. This, they may discover, is not necessarily the case.

A more reasonable procurement justification lies in the great effort and expense needed to set up an effective submarine arm. It takes years of training and experience to assemble a cadre of skilled and effective submarine officers and crews and to build up the infrastructure needed to support them. Yet, without such personnel, the submarines, no matter how high their paper capabilities, are ineffective. It therefore makes sense to economize on the original submarine purchase and invest the money saved in training and support facilities, replacing the cheap and ineffective

submarines with front-line boats when the crews needed to run them have been trained. This course has been followed by Singapore which purchased an old Swedish coastal submarines for training, prior to the acquisition of more expensive and effective ocean-going boats.

The total obsolescence of the Romeo class makes any attempt to use these submarines against a US or British naval group very futile. However, such a high level of expertise in ASW as exhibited by those superpowers is

very rare and there are many navies for whom ASW is a totally unfamiliar skill. In cases where the enemy lacks any ASW capability, the Romeo class remains a viable ship-killer. Although its effectiveness is low, so is its unit cost and this may make the design an acceptable first step to a navy with submarine ambitions. New-production has now ended, and the market has only second-hand units available, with China upgrading to Song and Kilo types that are much more modern in their capabilities.



ROMEIO CLASS (TYPE 033)

Source: Forecast International

Variants/Upgrades

Type 633. Russian designation for the original Romeo class submarine, derived from the older Whiskey class. It differs from the Chinese Type 033 in having two Type 37D diesels each rated at 2,000 shp. This gives a surface speed of 15.75 kts.

Romeo Type 633A. Missile launching version of Type 633, canceled in 1956 cutbacks. Type 633A would have carried six P-1 (SSN-1) missiles in elevating midships launch tubes.

Romeo Type 633RV. Testbed version of Type 633 with two 65 cm torpedo tubes in floodable housing on bow.

031. Chinese designation for Type 633 built in the former Soviet Union, serving with Chinese fleet.

033. Chinese designation for 633 built in China. One subtle difference between the Chinese-built Type 033 and the original Russian Type 633 is that the outer casing of the Chinese-built boats is slightly enlarged forward of the sail. This may be intended to improve seakeeping and/or to correct a minor trim problem, possibly resulting from the installation of more powerful but heavier diesels.

ES3B. Export designation for Type 033.

034/Ming Class. Triple-screwed, triple engine derivative of Type 033 with wider hull (76x7.6x5.1 m). Two built but deemed unsuccessful and subsequently scrapped.

035/Ming. Type 033 fitted with French sonars, radars, ESM and command system. Type 035 is equipped to fire the Yu-3 ASW torpedo (an electrically powered passive homer). This torpedo together with the enhanced sonar suite gives the Type 035 a limited ASW capability. The submarine is also reported to be able to fire Sub-Exocet missiles but this remains unconfirmed. The hull is smoother and has fewer flooding holes than the Type 033. The power train is reported to be different, with two 2,500 shp diesels. This implies that French diesels may have been installed.

ES5E. Export designation for Type 035.

036/Wuhan-A. A Chinese derivative of Type 633A, armed with six elevating tubes for C-801 missiles amidships in addition to its torpedo armament. The submarine has to surface to fire its missiles. Sensors remain unchanged, meaning that the submarine is unlikely to be capable of firing missiles on an over-the-horizon target. According to some reports, no boats of this type were ever built.

ES5G. Intended export designation for Type 036.

037/Wuhan-B. Type 035 fitted with elevating missile tubes amidships as in Type 036. One ship only obtained by conversion of Type 036.

ES5G. Export designation for Type 037.

Song Class (Type 039/Wuhan-C). An advanced version of Type 037 in which the missiles are moved to nonelevating launch tubes aft of the sail. The bow and stern lines have been refined further. The submarine is triple-screwed, suggesting a radical change in powerplant arrangement, but the two outer screws had not been installed on launch. The centerline screw is significantly larger, suggesting that the submarine is intended to run on this shaft while submerged, cutting in

the two outer screws for fast surface running when needed. Although the sail is sometimes reported to be stepped, this is believed to be inaccurate and the apparent step is due to the non-installation of a sail-mounted sonar array.

We will likely issue a new report on this class in our future issues, pending on availability of reliable information.

Program Review

Background. The Type 633 Romeo class was part of the second post-war generation of Russian diesel-electric submarines. The three designs forming the first generation (Type 611 Zulu, Type 613 Whiskey and Type 615 Quebec) were all close derivatives of pre-war designs, being modernized versions of the K, Schtch and M-IV classes, respectively. All were dated in concept and shared the deficiencies of the old designs (the Zulu being restricted to 50 m diving depth by faulty pressure hull metallurgy). Romeo and its fleet submarine equivalent, 641 Foxtrot, represented the application of German Type XXI technology to Russian submarine design practice.

As originally conceived, the Romeo design was to have been mass produced with well over 300 units projected, according to some sources up to 560 had been foreseen. In contrast, the much larger and more expensive Type 641 would have been restricted to much smaller numbers. Two subvariants of the Romeo design were proposed, the Type 633 torpedo attack submarine and the Type 633A anti-ship missile armed boat. The latter would have equipped the heavy brigades of submarine divisions with the torpedo-attack submarines constituting the light brigades. Each division would have had two light and one heavy brigades with seven submarines per brigade. It would appear that at least 16 such divisions were planned, giving a total of 336 boats.

This program fell apart in October 1956 when Khrushchev instituted a wave of mass cancellations throughout the Soviet navy fleet. The Type 633A design was canceled completely while the Type 633 program was curtailed with only 20 of the most advanced hulls exempted from the scrap heap. These were completed at low priority status and entered service in 1961-62.

In 1959, the Chinese and Russian governments signed a major naval cooperation agreement. Under the terms of this accord, the Russians supplied the Chinese with some existing ships and warship and submarine design technology in exchange for operational control over the Chinese navy in case of war. As part of this agreement,

the Russians completed and delivered four Type 633 class submarines to the Chinese navy and also handed over the production line tooling, blueprints and components assembled for the planned production run.

It took the Chinese three years to reconstruct the production line and to modify the Type 633 design to match Chinese building capabilities. By 1962, the Chinese were able to order the first group of submarines from the new yards. However, the rift between the Russians and Chinese took place at this point, causing the abrupt cessation of technical assistance for the Chinese building program. As a result, it took until 1971 before the first Type 033 (Chinese nomenclature for Type 633) was completed. Extreme problems with torpedo development may also have slowed the program, there being little point in building submarines without having torpedoes to arm them.

Chinese production of the Romeo slowly gained momentum until a rate of six hulls per year was achieved. In parallel with this mass-production effort, efforts to expand the capabilities of the basic design were initiated. One of these involved the installation of a triple-screwed power arrangement, similar to that on the Foxtrot class with fuller lines to the pressure hull. This was unsuccessful and the two prototypes were scrapped in 1977.

Another line of development stemmed from the abortive Type 633A design. This was also transferred to the Chinese and was used as the basis for the Type 036 missile-firing derivative of the Romeo design. This was armed with six C-801 Ying-ji missiles in elevating tubes amidships. The submarine still had to surface to fire and lacked any means of over-the-horizon targeting. This was not conducive to survival and the submarine remained an experimental one-off.

Efforts to enhance the performance of the Romeo lapsed due to the Cultural Revolution and were only resumed in the mid-1980s. Sometime during 1985/86, a major infusion of French weapons, sensor and electronics

technology into the Chinese navy took place. One aspect of this was the provision of Eledone sonar suites, Calypso radars, DR-2000U ESM systems and data processing equipment for the Type 033 submarines. The inclusion of this new equipment and hydrodynamic refinements of the hull, resulted in the Type 035 Ming class submarines. This design replaced the Romeo boats on the line in 1985 after 84 boats had been completed for the Chinese navy. The pair of Ming class submarines that entered service in 1994 have the same pennant number as two older Romeo class boats, implying that replacement of the older design continued. An additional Ming class submarine, the 11th, entered service in 1995; the last of the class, the 13th, was launched on May 25, 1996.

The French technology was also refitted to the one existing Type 036/Wuhan-A to produce the Type 037/Wuhan-B. This was much more than just a sensor modification – although Wuhan-B would still have to surface to fire, its ESM and sonar capabilities gave it a significant over-the-horizon targeting capability. In spite of this, the design was not followed up, according to one account because the French had supplied SM-39 Sub-Exocet missiles that could be fired from the torpedo tubes on Ming class submarines. No confirmation of this has been received.

During the early 1970s the Chinese transferred a number of completed Type 033 submarines as well as design and building technology to North Korea. This enabled the North Koreans to begin production of Type 033 indigenously. They subsequently a production rate of one boat about every 14 months until the program was terminated in 1995, in favor of the small intelligence submarine, the Sang-O class. The North Korean Romeos have seen extensive service, one being reportedly sunk by South Korean warships in 1985. Additional boats were sold to Egypt in 1977 and 1979. They were delivered in March 1982.

The Chinese continued to make strong efforts to sell the Romeo design and its derivatives on the international market throughout the 1980s. Their targets were those countries which had a requirement for submarines, but which faced great difficulty in finding the resources

needed to finance the acquisition. Countries approached included Thailand, Indonesia, Iran, Iraq, Nigeria and Argentina, after the Falkland Islands war. None of these approaches were successful, however.

In 1994, two events overtook the Ming class production program. One was the acquisition by the Chinese navy of a production license for the Russian Kilo class (Type 636) submarine. This will be the standard production SSK of the Chinese navy, replacing tentative plans to build a version of the French Agosta 90 class. Also, the Chinese launched the first of an indigenous submarine design, the Wuhan-C. This caused great excitement at first, but subsequent assessment revealed the new boat to be just another experimental modification of the basic Ming Type 035 design. The incomplete state of the boat on launch strongly suggested that it had been put in the water simply to clear its production slip for Type 636 construction. This class was later renamed the Song class. The first of this type ships was launched in May 1994, with sea trials beginning in April 1995. The second boat of this series was expected to be ready by mid-1997; two Songs a year are expected to be delivered from now on.

Both Type 033 Romeo and Type 035 Ming class submarines participated in the Chinese naval “maneuvers” that accompanied the Taiwanese elections. Their presence was overshadowed by the first deployment of the Chinese-owned Type 877EKM Kilo class submarines. Even so, the operations of the older submarines did not reveal any new information.

A much more interesting development was the grounding and capture of a North Korean Sang-O class submarine off the coast of South Korea. Inspection of the captured submarine revealed it to displace about 360 tons and 106 feet long. This is a much more substantial coastal type than the midget (less than 80 ton) design previously believed. Some sources have stated that production of the Sang-O class has recently gone up to 5-6 a year from its previous level of 1 or 2 per year. Since it is not realistic to assume that this would represent new production capacity, this shift, if correct, probably indicates a move from Type 033 to Sang-O class construction.

Funding

The Romeo family has been funded by the Chinese government, for the Chinese navy.

Recent Contracts

No contractual information has been released.

Timetable

	1953	Design of Type 633 started
	1956	First hulls laid down
Oct	1956	Mass cancellations on Soviet navy's programs
	1959	Type 633 design sold to China
	1962	First Type 033 laid down
	1971	First Type 033 (Romeo) commissioned
	1987	Last Romeo built in China; Ming program resumed at Wuhan SY
	1989	First Ming of new batch commissioned
Aug	1994	First Song launched
	1995	North Korea ends Romeo production
May	1996	Last Ming launched in China

Worldwide Distribution

The following countries are known to have operational Romeos on their fleets still today. Exact numbers of operational boats are difficult to obtain, especially in the case of China where each submarine spends no more than a few days at sea at a time, due to lack of qualified personnel.

Algeria

Bulgaria

China

Egypt

North Korea

Forecast Rationale

The following forecast is based on limited procurement, terminating within the next three or four years, of Ming class submarines for Chinese navy service. The very low unit cost of these submarines is likely to commend them to navies who wish to establish a submarine capability and require low-cost boats for training and operational experience accumulation. For this reason, we are projecting a limited number of exports. The through-year total shows the number of submarines built; many of these have been scrapped or lost for a variety of reasons.

Production of the Romeo class has discontinued in China and is not likely to be resume in today's North

Korea, either. In China, this class is being replaced by the more modern and more capable Kilo and Song classes, while the North Korean economy suffers from such shortage of funds that if any production of submarines is sustained in that country, it is for the small Sang-O class surveillance boats.

It is not likely that any other country would procure these boats anymore, even if strapped for cash, because their technology is so antiquated that they do not serve the purpose of training, either. No modernization of the electronics or weaponry suites is expected on the Romeos, either, and this report will be dropped next year.

Ten-Year Outlook

No further production is forecast; the chart is therefore omitted.

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