Maximum Cavitation

Submarines unlike any other type of vehicle has always been immersed not only in water but in secrecy. All the information presented here is from public sources and some facts and factors involving the statistics given are my best guesses at what the ability and performance of these vehicles are.

Some Basic Submarine facts:

All submarines have some basic equipment on board.

Snort pipe: every once in a while submarine will have to come near the surface to 'snort' in more breathable air through a extendable tube similar to the periscope. The modern submarines have in most cases replaced this with a breathable gill system placed near the front of the boat. The snort pipes extend to about 18 meters allowing the submarines to remain underwater even when replenishing oxygen. One problem with this is that snort pipes along with the traditional periscope are subject to detection by radar which will give the submarines postion away to any ASW ships in the area.

Submarine Detection:

Submarines by their nature are designed not to be detected by surface warships and tactical stratigies can be employed to make detection by hunters even tougher.

Locating a submarine that is submerged can be difficult for surface ship two main factors influence difficulty levels, thermal layers and submarine noise factors. As can be seen in the chart below when a submarine dives below 600 meters surface vessels have almost no chance to detect an enemy submarine, this is where advanced dipping sonar and other sub hunting submarines come into play. Advanced dipping sonar is a type of sonar extended on a control wire up to 250 meters allowing surface ships to better detect deep diving submarines.

Depth in meters	Base Difficulty to detect at 75% of Max Speed	50% Max Speed	25% Max Speed	Full Stop
50 - 99 meters	Difficulty (5) Very Easy	(10) Easy	(15) Average	(20) Difficult
100 – 199 meters	Difficulty (10) Easy	(15) Average	(20) Difficult	(25) Very Difficult
200 – 299 meters	Difficulty (15) Average	(20) Difficult	(25) Very Difficult	(30) Near Impossible
300 – 399 meters	Difficulty (20) Difficulty	(25) Very Difficult	(30) Near Impossible	(35) Unthinkable
400 – 499 meters	Difficulty (25) Very Difficult	(30) Near Impossible	(35) Unthinkable	(40) Unattainable
500 + meters **	Difficulty (30) Near Impossible	(35) Unthinkable	(40) Unattainable	(45) Impossible

** Below 500 meters from the surface water temperature equalizes at 34 f with no more successive thermal layers.

A detection example: an older surface ship with basic hull mounted sonar attempts to detect and track a suspected submarine, a German 214 class which is currently at 415 meters depth a standard difficulty (25) but due to it's noise modifier of -4 the actually detection difficulty is (29). A newer and better equiped surface ship comes along with dipping sonar and attempts to locate this deep intruder, lower its sonar to it's maximum depth giving the newer ship a difficulty of (12) with noise reduction, since the submarine now is only 165 meters from the sonar.

Building Submarines: Maximum Cavitation

Name	Patrol/Coastal	Diesel Electric	Nuclear Attack	Nuclear Balistic Missile	Mini Subs
SDP Range	350-650	600-1200	1000-2500	2500-7000	25-150
SDP Limits	6.25 SDP per Space	6 SDP per Space	4 SDP per Space	7.75 SDP per Space	7 SDP per Space
SDP Cost	96 000 per SDP	155 000 per SDP	522 000 per SDP	750 million used	75 000 per SDP
Spaces	80 - 105	110 - 200	225 - 625	650 - 900	3 - 50
Top Speed	17 knots	20 knots	28 knots	25 knots	17
Range Submerged	32 hrs	6000km	3 months	3 months	12 hrs
Mass	1.25 tons per SDP	3 tons per SDP	3 tons per SDP	5 tons per SDP	.25 tons per SDP
Sonar Ranges	4km	6km	6km	5km	2km
Hull Type Standard	HY 50	HY 50	HY 80	HY 80	HY 30
Standard Crew Size	20-25	27-55	45-140	25-165	'1-5'
Crew Size With Cybernetic Controls	5	7	12	9	'1-5'
Average Length by Class	48.5 meters	100 meters	102 meters	171 meters	15 meters
Average Width (beam)	4.7 meters	8 meters	10 meters	18 meters	2.4 meters

Submarine Hull Compostion	Crush Depth feet/meters	Operational Depth feet/meters	Upgrade Cost	Added SDP points
HY 30: Steel	675/206	506/155	NA	NA
HY 40: Steel	900/275	675/206	125.00%	+ 10% more
HY 50 Steel	1125/343	844/257	140.00%	+ 15% more
HY 80 Steel	1800/550	1350/412	200.00%	+ 25% more
HY 100 Steel	2250/685	1688/514	275.00%	+30% more
HY 120 Steel	2700/823	2025/617	400.00%	+40% more
Titanium Welded Hull	4000/1219	3000/914	650.00%	+50% more

Propulsion:

Submarines have traditionally used one of two methods of underwater movement.

The first and classical form of underwater propulsion has been in the form of a large bank of batteries recharged by an air breathing diesel engine. Starting from the submarines of World War One subs have used this form of movement. The man disadvantage has always been the need for the submarines to come close to the surface after several hours of movement while submerged to turn on it's diesel engine to recharge the batteries and therefore making themselves very vunreable from sonar, visual detection and later on detection from sensitive radar.

Many submarines now still in service has partially overcome this problem by adding on an additional diesel engine nicknamed AIP for Air Independent Propulsion. In actuallality this is nothing but a diesel engine conversion modified to run off of liquid oxygen. The AIP engines allowed submarines a 400% increase in time spent submerged without having to come up to snorkle depth and run the loud diesel engines to recharge the batteries.

The Swedish Navy became the first to put AIP systems into its fleet operating units. The Kockums-built AIP system was first tested on the refurbished submarine Näcken in 1989. Today, almost all submarine that are not nuclear powered use the new AIP Stirling engine supplementing the conventional diesel-electric system. The Stirling engine turns a generator that produces electricity for propulsion and/or to charge the vessel's batteries.

The Second primary type of propulsion method employed by submarines is nuclear reactor driven propellors. There are several variations of this concept but most subs use a pressurized water coolant system with one or two reactors. Fuel cores must normally be replaced every five years.

Torpedoes and Anti Submarine Weapons:

Weapon Name	Torpedoes 12.75 "	Torpedoes 21"	Depth Charge 120mm	Depth Charge 80mm
Weapon Accuracy	Skill 15	Skill 17	0	0
Damage	60 + (4d10)	230 + (8d10)	80 + (6d10)	50 + (6d10)
Ammo	1	1	1	1
Rate of Fire	1	1	1	2
Penetration	5	9	7	5
Range Extreme	5 miles	13 miles	6000 meters	3500
Burst Radius	10 meters	24	6 meters	5 meters
Spaces	2	5	3	1
Weapon Cost	45000	85000	5000	1500
Ammo Cost per round	NA	NA	250	150

Torpedoes 12.75" are a standard surface ship variety of torpedo while 21" torpedoes are the standard for other submarines. Depth Charges come in two varieties based on anti submarine mortars aboard a surface ship. The main drawback to depth charges is their inability to attack submarines below 400 meters in depth, plus a surface ship must have successfully located the submarine by sonar each turn before an attack may begin. A successful hit with a depth charge is based off of range of the submarine from the firing ship and skill in heavy weapons of the crew member firing the weapon. Torpedoes, start with a base skill like missiles and need a (20) to hit it's target without any modifiers like defensive tactics on the part of the submarine.

Anti Torpedo Tactics:

All the tactics below except for changing thermal layers assumes that the submarine has already has been successfully detected by the adversary, if not further attempts at detection are automatic.

1 Dropping a noisemaker to cause cavitation in the water, creating the noise and sound of a large proppelor blade, that looks like a submarine to a sonar guided torpedo. Homing torpedos must make a difficulty 20+ roll to keep tracking the original target, when combined with a knuckle the difficulty increases by 2.

2 Knuckles: making a tight right or left degree turn causing a turbulance in the water similar to a noisemaker but with less effectiveness. Homing torpedos must make a roll of difficulty 20 to keep tracking the original target. This tactic can be combined with dropping a noise maker or with a decoy torpedo increasing tracking difficulty by 2

3 Decoy Torpedos: These are specially designed torpedos that are programmed to give off a decoy signature almost identicle to your submarines providing a second target for any homing enemy torpedos. These work as effectively as dropping a noise maker but reduce your combat load of torpedos on a 1 for 1 basis.

4 Thermal Layers: a natural ally of any sub-mariner, a layer of water which differs slighly in temperature from the layers above and below. Thermal layers effectively reduce the ability of sonar to track targets and get precise bearings. Thermal layers occur approximately every 100 meters or so of depth below the vehicle launching the weapon, this give subs that hunt other submarines the decisive advantage. Each layer reduces sonar effectiveness by one point of difficulty for targeting and acquisition.

Example Submarine Anti Torpedo Tactics: A German 214 Class submarine is trying to avoid being hit by a 12.75" torpedo launched by a surface vessel homing in on it. The submarine is at 415 meters depth drops a noisemaker and makes a knuckle turn, this increases the difficulty of the homing torpedo attack to (24) which will in most cases divert the torpedo from hitting the submarine.

Sinking a submarine:

The rules for sinking a submarine are almost identical to those for sink a surface ship with the exceptions listed below:

1 Submarine follow exactly the same rules as surface ship for damage and sinking while not submerged.

2 While submerged a submarine taking over 50% damage will begin to sink 3 meters per round in addition to all other problems until it reaches the bottom.

3 Once a submarine has reached 75% damage a major rupture has breached the outer pressure hull and 25% of the crew is sucked out or drowns in the next round, plus the submarin sinks 10 meters per round. At this point the only way to make this situation survivable is for the captain to make an emergency blow manuever bringing the submarine quickly to the surface difficulty 25 in this damaged state. If the difficult rool is not made another rupture occurs in the pressure hull completely breaking the ship in two.

Diving Deep or exceeding depth limits:

Submarine may attempt to exceed their maximum depth limits and dive deeper than stated in their statistics. Submarine captains that attempt this manuever will need to make a difficulty 20 luck roll, every round, to avoid taking any pressure damage beyond 30 meters below their boats maxium depth.

At 50 meters a difficulty 25 luck roll will need to be made every round to avoid taking damage

At 75 meters a near impossible luck roll will need to be made every round to aviod damage.

On any failed luck roll damage equal to 10 sdp * meters will occur to the submarine per round of submersion. Otherwise you can exceed your operation depth of your submarine but sooner or later your luck will run out

Submarine Weapons:

Weapon Name	Torpedoes 12.75 "	Torpedoes 21"	Harpoon ASM ##	Cruise & SSN: ASM ##	Mine Small	Mine Large
Weapon Accuracy	Skill 15	Skill 17	Skill 17	Skill 16	2	2
Damage	60 + (4d10)	230 + (8d10)	190 + (8d10)	350 + (10d10)	75 + (6d10)	185 + (6d10)
Ammo	1	1	1	1	NA	NA
Rate of Fire	1	1	1	1	NA	NA
Penetration	5	9	16	30	8	10
Range Extreme	5 miles	13 miles	75 miles	1500 miles	NA	NA
Burst Radius	10 meters	24	48 meters	72 meters	48	72
Spaces	2	5	8	15	2	4
Weapon Cost	45000	85000	185000 Eb	265000 Eb	NA	NA
Ammo Cost per round	NA	NA	NA	NA	1000	1400

These are the standard weapons that would normally be mounted on a military class vehicle that would in no way effect the operation of the ship. The 21 inch torpedoes are standard armament for most of the larger classes while Harpoon missiles can be launched from either a 21 inch torpedoe tube or from a verticle launch tube, as in the Los Angeles and Seawolf class submarines. Cruise missile have been adapted to be launched in any of three ways, via torpedoe tube, out of a verticle launch tube or in balistic missile submarines as a replacement for long range tacticle missiles.

Mines can be either dropped off from a rack attached to small Coastal class submarines and take up a stationary position or launched out of a torpedo tube and lie near the floor of the ocean waiting until a target approaches and then attacks as a torpedo.

Other Possible Submarine Weapons:

The weapons below all will reduce the effective ability of a submarine to remain quiet and undetected unless a mechanism is used to lower the weapon down into the hull of the submarine when submerged. The cost to hide the weapon inside the hull of the submarine will be double the normal cost and spaces needed.

Lighter deck weapons such as small autocannons under 25mm and machineguns may have removable mounting points that can be carryed into a normal or cargo hatch. Listed below are common deck guns from ancient submarines and certain missile launching systems common to older class of soviet ships.

Weapon Name	57 mm Cannon	76 mm Cannon	VSAM
Weapon Accuracy	0	0	Skill 15
Damage	70 + (5d10)	85 + (6d10)	110 + (6D10)
Ammo	80	50	1
Rate of Fire	6	2	1
Penetration	6	7	8
Range Extreme	6 miles	11 miles/18km	12km
Burst Radius	3 meters	5 meters	10 meters
Spaces	5	7	1
Weapon Cost	60000	80000	10000 Eb
Ammo Cost per round	3000	4000	