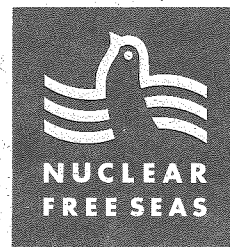


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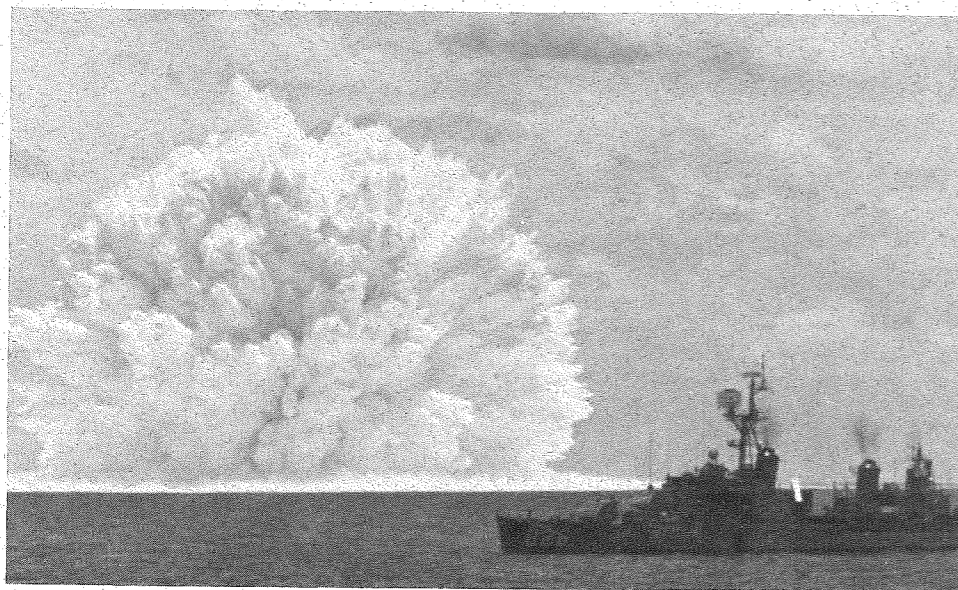
In July 1987, Greenpeace launched an international campaign to stop the nuclear arms race at sea—the Nuclear Free Seas campaign.

Combining research, political lobbying, and non-violent actions, the campaign is working in Europe, North America, and the Pacific to make the oceans free from all nuclear weapons and nuclear-propelled vessels.

This briefing paper outlines the extent of the naval arms race, analyzes the dangers of placing nuclear weapons and nuclear reactors at sea, and presents steps that should be taken to denuclearize the oceans.

Humanity lives by the sea. The oceans blanket almost three-quarters of the earth's surface, providing the world's population with food, trade, transportation, restoration. Of the forty countries most dependent on fish as a source of food, thirty-nine are developing countries. Over four-fifths of all international trade travels by sea. Yet in the last two decades, the oceans—our most vital resource—have become a dangerous arena for the nuclear arms race.

In July 1987, Greenpeace began a campaign to stop the nuclear arms race at sea. The campaign's first task was to make certain facts known: that the US, the Soviet Union,



An underwater nuclear explosion in 1962 was used to test a US anti-submarine nuclear rocket (ASROC). The ASROC will be retired by 1990.

Britain, France and China are engaged in a naval nuclear arms race, basing over 15,000 nuclear weapons on sea-going vessels; that these weapons are brought to every part of the globe, and can be launched without the consent of a head of state—multiplying the chances of an accidental nuclear war; that there are almost 550 nuclear power reactors based at sea, used to propel naval vessels; and that some nations, notably New Zealand and Iceland, have transformed their words against the nuclear arms race into deeds by banning nuclear-armed vessels from their waters.

Since 1987, many things have changed. All of the above remains true. But true as well has been the steady decline in East-West tensions, and a new sense of hope about arms reductions.

Among naval forces, these changes are dramatically illustrated by the turn of the Soviet Navy towards a less confrontational posture. Between 1984 and 1987, the Soviet Navy reduced its surface ship deployments by one quarter and its submarine deployments by half. In 1988, the Soviet Navy removed more ships from active service than in any year in recent history.

Equally significant has been the end of the US Navy's plan for a 600 ship navy, which expired along with the Reagan administration. Even more striking has been the decision of the US Navy, reported in April 1989, to retire its nuclear-armed Anti-Submarine Rockets (ASROCs and SUBROCs), and its nuclear-armed anti-air missiles (Terriers) by 1991 and

without any foreseeable nuclear replacements. By unilaterally scrapping these 1100 nuclear weapons—almost one-third of its tactical nuclear weapons—the US Navy acknowledged that nuclear arms are senseless for ocean combat.

Yet the need to denuclearize the oceans has grown more urgent. A new set of countries, including Brazil and Pakistan, now seek to build or purchase nuclear-powered submarines, multiplying the offensive capabilities of their navies and ensuring further radioactive pollution of the seas. India has already leased one nuclear-powered submarine from the Soviet fleet.

Meanwhile, a study jointly published by Greenpeace and the Institute for Policy Studies (IPS) in June 1989 found that naval accidents are far more numerous than previously reported. The study documented some 48 sunken nuclear weapons and 9 nuclear reactors on the ocean floor, the result of almost 1300 major naval accidents since 1945. The sinking of the Soviet *Mike* class submarine in the Norwegian Sea in April 1989—along with its two nuclear reactors and two nuclear weapons—grimly illustrates the danger of accidents aboard even the most sophisticated vessels, and underscores the environmental dangers of basing nuclear weapons and nuclear reactors at sea.

More fundamentally, the nuclear navies now stand as impediments to better East-West relations and further arms reductions. The Strategic Arms Reduction Talks (START), aimed at

“Nuclear war at sea is a concept whose time has passed.”

Vice Admiral Henry Mustin, former Deputy Chief of Naval Operations, US Navy, April 1989

achieving a major cut in US and Soviet long-range nuclear missiles, have been held up since 1987 largely by a dispute over limiting sea-launched cruise missiles (SLCMs).

Even on routine maneuvers the navies can create political turmoil. In February 1988, the US sent two nuclear-armed ships on routine operations into Soviet territorial waters in the Black Sea, clashing with Soviet vessels—just two months after the INF treaty was signed. Until the nuclear navies are brought under control and denuclearized, progress to reduce East-West strains will be precarious.

The opportunities and the need to ban naval nuclear weapons are plain. The US Navy's retirement of its ASROC, SUBROC, and Terrier missiles has catalyzed a debate over banning all tactical nuclear weapons at sea. By banning SLCMs a strong START treaty could be concluded. And banning nuclear propulsion at sea would shift the nuclear navies towards less aggressive operations, and help protect the oceans from radioactive contamination.

This is the least we can do. At a time when the Cold War is ending in Moscow, Washington, London, Paris and Bonn, it is time now to end the Cold War at sea.

In spite of the decline in East-West tensions, the US, Soviet, French, British and Chinese navies are all preparing new nuclear weapons systems for deployment at sea.

The US Maritime Strategy

The Maritime Strategy is the US Navy's plan for a protracted global conventional war with the Soviet Union. It is explicitly offensive and requires U.S. naval superiority.

Traditionally, the US Navy's primary assignment during a war with the Soviet Union in Europe was to ferry troops across the Atlantic, practice 'defensive sea control' against Soviet submarines, and support European land forces.

But under the Maritime Strategy, which was adopted under the Reagan Administration, the U.S. Navy no longer achieves its mission through a defensive role: in the event of war, the Navy should 'seize the initiative' and 'attack and destroy, rather than stay on the defense.'

The Maritime Strategy has also been adopted by NATO. According to Wesley McDonald, former Commander of NATO's Atlantic Fleet, "this strategy (was) developed in concert with our allies, one which reflects their input and planning."

Under the Maritime Strategy, the US Navy and its allies have three principle tasks: first, to attack Soviet vessels in their home waters before they can 'surge' to the open oceans; second, to pin down Soviet ground and tactical air forces around the world by escalating any conflict 'horizontally'—that is, geographically—thus drawing resources away from the primary theater in Europe or the Middle East; and finally, to destroy Soviet ballistic missile submarines in an effort to shift the strategic balance.

The US Navy claims that the Maritime Strategy would help stop a conventional war from escalating into a nuclear war.

But critics have pointed out that destroying Soviet strategic forces could provoke the Soviets to fire their missiles first, fearing they will otherwise be destroyed. "Of all possible Navy strategies," says naval expert Barry R. Posen, "this one is the most likely to cause the other side to reach for nuclear weapons."

Naval nuclear weapons fall into two categories.

Each of the five nuclear navies possesses **strategic** weapons, which are long range missiles designed to destroy targets in an adversary's homeland. Most strategic naval weapons are sea-launched ballistic missiles (SLBMs), launched from nuclear-powered ballistic missile submarines (SSBNs).

The US, Soviet, French and British navies also deploy **tactical**, or non-strategic weapons, designed for short and medium-range ocean combat and land warfare. Tactical nuclear weapons include anti-submarine missiles and torpedoes, anti-aircraft weapons, depth bombs and land-attack bombs delivered by naval aircraft, and naval artillery.

In addition, the newest—and perhaps most dangerous—type of naval nuclear weapon is the sea-launched cruise missile (see sidebar), a high-tech, low-flying weapon that can be used for both medium-range tactical and long-range strategic attacks.

The US, Soviet Union, France, Britain and China have all been developing new generations of SLBMs.

The United States has developed the Trident II (D5) missile, for deployment beginning early 1990. Britain is also scheduled to purchase Trident II missiles for its own use in the

mid-to-late 1990s. The Trident II will considerably increase the range, accuracy, and destructive power of the British strategic naval arsenal, giving it the ability to destroy Soviet missiles in their silos—a "first strike" capability that the US Navy already has.

The Soviet Navy began deploying its new SLBM, the SS-N-23 missile, in 1986. The French Navy, after deploying its current SLBM (the M4) in 1985, is developing a replacement (the M5), which will be introduced aboard French submarines in the late 1990s.

The Chinese Navy has been testing its own CSS-N-3 SLBMs, for deployment aboard Xia-class SSBNs.

By contrast, the tactical arsenals of the nuclear navies are showing mixed trends.

The US Congress consistently turned down requests from the US Navy during the Carter and Reagan administrations to fund a new generation of tactical weapons. As a result, when the US retires 1100 aging anti-

submarine nuclear weapons and anti-air nuclear weapons by 1991, there will be no nuclear replacements.

The Soviet Navy, however, has made an effort to keep its tactical weapons up to date, deploying a new nuclear torpedo and a new nuclear depth bomb in the early 1980s.

Similarly, the French Navy has developed a new air-to-surface nuclear missile for its aircraft carriers.

Despite the diverse trends, there is a growing recognition among naval experts that fighting a naval war with nuclear weapons is suicidally foolish.

Sea-Launched Cruise Missiles

The newest and most troublesome nuclear weapon in the oceans is the sea-launched cruise missile (SLCM), a low-flying, single warhead missile known for its accuracy and versatility.

The SLCM has become a preferred weapon for the superpower navies in part because it exploits a loophole in the SALT II agreement. Under SALT II, limits were set on the number of SLBMs each navy could deploy, but few constraints were placed on SLCMs—even though SLCMs can attack many land targets just as effectively as SLBMs.

As a result, the US and Soviet navies have developed sophisticated SLCM technology, making them the most precise and undetectable nuclear weapon at sea.

The US Navy's SLCM is the Tomahawk, which carries a single warhead with a yield of up to 150 kilotons. It has a range of 2500 km and is accurate to within 30 meters. The US is developing an advanced version of the Tomahawk, dubbed "Excalibur," with a longer range and "stealth" qualities.

The Tomahawk is virtually identical to US ground-launched cruise missiles (GLCMs) banned under the INF treaty. European countries that applauded the removal of the 256 GLCMs from European soil have, ironically, greeted the arrival of some 350-400 SLCMs in their waters with indifference or even support.

The Soviet Union has developed two advanced SLCMs—the subsonic Sampson SS-N-21, which was first deployed in 1986 and has a range of 3000 km, and the supersonic SS-NX-24, which is still under development.

Under the START negotiations, the Soviet Union has offered a series of proposals to limit SLCMs. But the US has thus far objected to any meaningful limits on this pernicious weapon. The announcement in April 1989 that the US Navy would scrap its ASROC, SUBROC, and Terrier nuclear missiles ironically suggests that the US Navy expects to grow increasingly reliant on the Tomahawk.

Nuclear Capable Ships and Submarines

	U.S.	Soviet	U.K.	France	China	Total
Submarines						
Ballistic missile	35	76	4	6	4	125
Cruise missile	0	60	0	0	0	60
Attack	61	202	0	0	0	263
Total submarines	96	338	4	6	4	448
Surface ships						
Aircraft carriers	19	6	3	2	0	30
Battleships	3	0	0	0	0	3
Cruisers	37	34	0	0	0	71
Destroyers	64	52	12	0	0	128
Frigates	65	119	12	0	0	196
Patrol combatants	0	65	0	0	0	65
Total surface ships	188	276	27	2	0	493
Total	284	614	31	8	4	941

Source: William M. Arkin, The Bulletin of Atomic Scientists (Sept. 1988)

Nuclear Warheads at Sea

	U.S.	Soviet	U.K.	France	China	Total
Strategic	5,472	3,378	64	256	39	9,200+
Nonstrategic						
Cruise missiles	150	500	0	0	0	650
Aircraft bombs	1,450	0	50	36	0	1,666
Anti-submarine weapons	1,760	1,400	140	0	0	3,300
Anti-air weapons	300	260	0	0	0	560
Naval artillery	0	100	0	0	0	100
Coastal missiles	0	100	0	0	0	100
Subtotal	3,660	2,360	190	36	130	6,400+
Total	9,132	5,738	254	292	169	15,600+

†Totals may not add up due to rounding.

Source: William M. Arkin, The Bulletin of Atomic Scientists (Sept. 1988)

Since World War II, naval armaments have been virtually excluded from arms control discussions. Now a flurry of new proposals suggest whole categories of naval nuclear weapons should be eliminated.

Naval Arms Control: Chronology

1817: Under the Rush-Bagot Agreement, the US and Canada (Britain) limit naval forces on the North American Great Lakes. The political climate subsequently improves so much between these two nations—who had been at war only a few years earlier—that they later remove all military protection from their border. The treaty has been updated over the decades and is still in force today.

1856: The Paris Peace Conference demilitarizes the Black Sea with a series of measures, including agreements by Russia and Turkey not to establish any military-maritime arsenals on their shores. The Conference also demilitarizes the Aaland Islands in the Baltic Sea and sets out basic principles for the law of maritime warfare.

This Conference establishes a precedent for naval arms control in the Black Sea region, and is successfully followed by other treaties, including the Montreux Convention of 1936, which is still in effect. The Aaland Islands remain demilitarized today.

1902: Argentina and Chile, by the Pactos de Mayo, agree to cancel their orders for war vessels under construction and to give advance notice of any new construction, thus temporarily halting a naval arms race in the area.

1920: A treaty concluded in Paris gives Norway sovereignty over the Spitzbergen archipelago, in turn for Norway's agreement not to establish any naval bases there or use the archipelago for "any warlike purpose." The treaty remains in force.

1922: The Washington Conference on the Limitation of Arms establishes quantitative, qualitative, and numerical restrictions on large warships for France, Britain, Japan, Italy, and the US.

This ambitious treaty was superseded by the London Treaty of 1930, which contained further restrictions, although that treaty expired without a successor in 1936.

There is a long and important tradition of arms control at sea—and after 50 years of dormancy, it could soon be revived.

From 1817 to 1936, naval arms control agreements demilitarized, or partly demilitarized, the Great Lakes of North America, the Magellan Straits, the Spitzbergen archipelago, the Dardanelles and the Bosphorus, the Black Sea and other regions (see sidebar). Many of these treaties are still in force.

Yet since World War II, naval vessels and armaments have been uniquely excluded from virtually all arms control measures:

► The SALT I (1972) and SALT II (1979) agreements set overall limits on strategic nuclear missiles for the US and Soviet Union. But the sublimits set on SLBMs were so high they had little effect on the nuclear arsenals of the

two superpower navies. A provision in the SALT II agreement that suspended the deployment of nuclear-armed sea-launched cruise missiles (SLCMs) expired in 1981.

► In 1987, the Intermediate Nuclear Forces (INF) treaty banned all land-based nuclear missiles with ranges from 500 to 5000 kilometers, including ground-launched cruise missiles (GLCMs), yet it left sea-launched cruise missiles (SLCMs) with similar ranges untouched. Four European countries—the United Kingdom, Belgium, West Germany, and Italy—had GLCMs removed from their soil in 1988 only to later see SLCMs, which are virtually identical in design, enter their harbors aboard U.S. naval ships.

► The current negotiations on limiting conventional armed forces in Europe have excluded

any consideration of limits on naval forces—even though both sides base a major part of their navies in European waters.

The only arms control forum to consider limiting a specific naval nuclear system—sea-launched cruise missiles (SLCMs)—has been the Strategic Arms Reduction Talks (START), whose mandate could cut U.S. and Soviet strategic arsenals by approximately one-third. Under these negotiations, however, SLCMs have become a point of contention: the Soviet Union has favored banning or limiting them, while the U.S. has opposed all meaningful SLCM restrictions.

Aside from this one attempt to limit SLCMs, tactical naval nuclear weapons are the only category of nuclear weapons not subject to any past, present, or planned arms control discussions.

Moreover, even a successful START treaty would not stop the deployment of the new generation of SLBMs, including the US Trident II and the Soviet SS-N-23. Nor would it effect the new French, British, or Chinese SLBMs, as they are not party to the negotiations. Britain's acquisition of the Trident II will increase the destructive power of its SLBM force eightfold.

Yet after half a century of inactivity, naval arms control seems to be making a comeback. There are several factors behind this:

► the Soviet Union, in response to its economic pressures and military burden, has slowed down the modernization of its navy. Instead, since the mid-1980s it has combined unilateral

cuts in naval exercises and ship production with a series of proposals for naval arms control.

► The US Navy, also facing economic constraints, has given up plans to build a 600 ship fleet, and decided to unilaterally retire 1100 aging anti-submarine nuclear rockets (ASROCs and SUBROCs) and anti-aircraft nuclear weapons (Terrier missiles) by 1991. The US Congress has not funded nuclear-armed replacements for them.

► A growing recognition in both the East and the West that nuclear weapons at sea should not be exempt from arms reductions.

Skeptics often argue that tactical naval nuclear weapons should not be subject to arms reduction treaties, since their numbers are difficult to verify. Indeed, the secretive, independent, and mobile nature of naval forces poses special verification problems, but also offers special opportunities. Intrusive verification measures, including on-board inspection of ships and submarines, would curtail naval secrecy, build bilateral confidence, and ultimately improve global security.

Greenpeace calls for:

- **A ban on all tactical nuclear weapons at sea, including sea-launched cruise missiles;**
- **A ban on new strategic naval weapons, including the US and British Trident II, the Soviet SS-N-23, and the French M5;**
- **Complete naval nuclear disarmament, including the elimination of all strategic nuclear weapons at sea.**

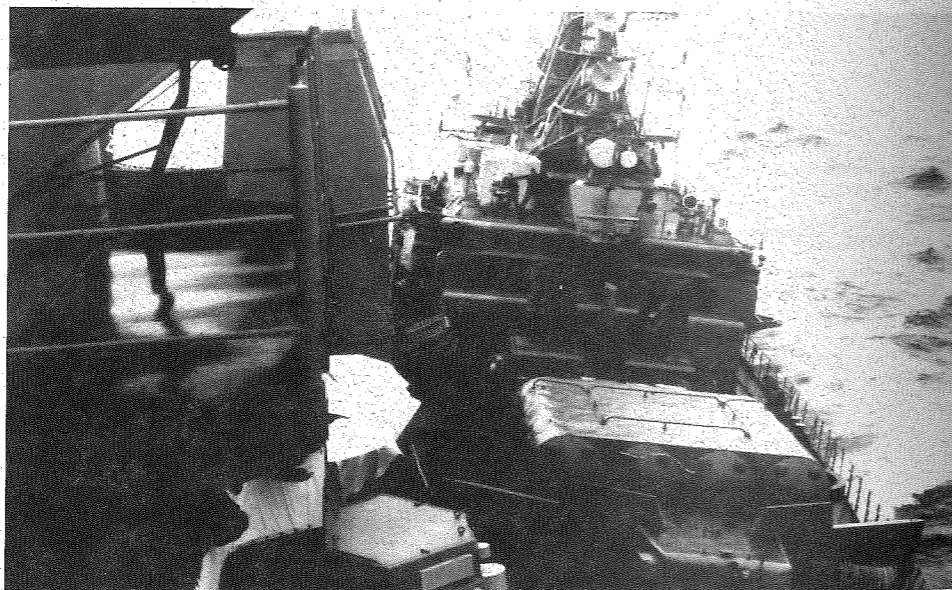
1936: The Montreux Convention lays down detailed restrictions on the militarization of the Black Sea, including rules for the passage of warships through the Dardanelles and the Bosphorus straits. All parties to the Convention continue to observe its provisions.

1983: The United Nations commissions a study on the naval arms race, the first multilateral consultations on naval arms control in almost 50 years. Both the US and the UK refuse to participate. Although the Soviet Union votes for the study, it declines to participate directly.

1986-89: Soviet General Secretary Gorbachev, in a series of speeches at Vladivostok, Murmansk, and Belgrade, offers an array of proposals for naval arms reductions, including confidence-building measures at sea and maritime nuclear-free zones in the Mediterranean, the Nordic region, the North Pacific, and the Indian Ocean. His proposals coincide with unilateral Soviet naval cutbacks, most visibly in naval operations and exercises outside of Soviet waters.

April 1988: A New York Times article reports that Paul Nitze, chief advisor to the US State Department on arms control, has sparked a controversy in the Reagan administration by favoring a US-Soviet ban on all tactical nuclear weapons at sea, including sea-launched cruise missiles. No proposals of this nature are formally made to the Soviet Union, however.

April 1989: An article in the New York Times, based on documents acquired by a Greenpeace researcher, reveals that the US Navy is unilaterally scrapping all of its ASROC, SUBROC, and Terrier nuclear missiles. The removal of these 1100 nuclear weapons reflects a change in US Navy thinking: according to Vice Adm. Muskin, "Nuclear war at sea is a concept whose time has passed."



The USS Yorktown, a nuclear-armed cruiser, clashes with a smaller Soviet ship after entering Soviet waters in the Black Sea in February 1988.

Almost 550 nuclear reactors are at sea, propelling many vessels of the five major nuclear powers. These reactors help the navies carry out offensive military strategies and present environmental dangers to the oceans.

The Spread of Nuclear Propulsion

Until 1988, nuclear-powered submarines were operated only by the US (since 1954), the Soviet Union (1958), Britain (1963), France (1971), and China (1974). In the late 1980s, however, a series of other countries sought to join this exclusive club:

Argentina: The Argentine National Atomic Energy Commission has conducted a feasibility study for producing a reactor for nuclear submarines. There is no clear evidence that Argentina has tried to construct one.

Brazil: The Brazilian Navy is conducting a nuclear propulsion research program to design and construct its own SSNs. The navy has established a nuclear research facility in Ipero, near Sorocaba in the state of Sao Paulo.

Canada: In June 1987 Canada announced plans to purchase 10-12 SSNs from either France or Britain. The plan was cancelled in April 1989 due to popular opposition and budgetary constraints.

India: The Soviet Union transferred a Charlie I class nuclear-powered submarine to India in January 1988 under a four-year lease. India is using the submarine, dubbed Chakra, to train its crews for future nuclear submarines.

Pakistan: Reports surfaced in 1988 that Pakistan sought to purchase nuclear-powered submarines. As Pakistan already has six French diesel-powered submarines, an SSN program might also look to French technology.

Nuclear reactors allow submarines to travel underwater without resurfacing or refueling for as long as the crew can endure, in many cases over two months. The stealth, speed, and range that submarines derive from nuclear propulsion enable them to carry out offensive military operations with greater ease—traveling to foreign waters undetected and threatening an opponent's territory.

Nuclear propulsion has also led to the development of mobile underwater missile silos in the form of ballistic missile submarines (SSBNs). These revolutionary vessels have added a new mission to the traditional maritime functions of the world's major navies, turning them into platforms for launching intercontinental nuclear attacks.

Nuclear-propelled naval vessels not only threaten adversaries, they also threaten the marine environment:

► Nuclear reactors at sea are more prone to disaster than their land-based counterparts. Naval nuclear reactors operate on submarines and ships that are constantly in motion, subject to collisions, fires, and sinkings. To reduce the weight of the vessel they propel, naval reactors are protected by only minimal containment structures. And when a submarine's nuclear reactor malfunctions, it cannot simply be shut down, or the submarine could lose power and sink. It must continue to run.

► Naval reactor accidents happen regularly (see section 5), and the risk of such an accident has caused harbor cities around the world to ban nuclear-propelled vessels—although most port cities remain oblivious to the dangers (see sidebar).

“Submarine propulsion systems, because of their size, mobility, and the hostile environment in which they must operate, are exposed to substantially greater risks than land-based nuclear power stations; accident situations are appreciably more numerous...”—Edwards and Tucker, “Royal Navy Requirements and Achievements in Nuclear Training”

► Like other reactors, naval reactors produce high level radioactive waste in the course of their operations. By the time a nuclear vessel is retired, substantial portions of the hull have become irradiated, in addition to the reactor itself. Over the next

three decades, hundreds of these irradiated vessels and reactors will be retired. There is no safe disposal method for them.

► The irradiated hulls of decommissioned US submarines are currently stored at Bremerton, Washington and buried in Hanford, Washington. Britain's first decommissioned submarine, the *HMS Dreadnought*, is currently moored at the Rosyth naval base. There is no safe disposal method for these hulls.

► Even under ideal conditions, all nuclear-powered submarines must periodically discharge irradiated primary coolant water. In 1972, the US Navy recognized the hazards of pouring this water into US harbors, and began dumping it into the open ocean instead, where the effect is less apparent but equally pernicious. Naval forces are exempt from the pro-

visions of the London Dumping Convention, which banned the dumping of radioactive waste in the oceans in 1983.

Meanwhile, the problem of nuclear propulsion is becoming broader. In 1988, India leased a nuclear-powered submarine from the Soviet Union, and announced plans to acquire more. At the same time, Pakistan and Brazil are both trying to purchase or construct

their own SSNs (see sidebar), multiplying the predicament further still.

To shift the posture of naval forces from essentially offensive to essentially defensive, to curtail the production of radioactive materials, and to inhibit the proliferation of nuclear technology, Greenpeace calls for a global ban on all forms of maritime nuclear propulsion.

Health and Safety

Little is known about the health effects of nuclear weapons and nuclear propulsion in peacetime. What is known, however, is disturbing.

In March 1989, the US Navy released a study—14 years after it had been requested by Congress—that found that sailors who served aboard US ballistic missile submarines (SSBNs) were 40% more likely to get cancer than their civilian counterparts. The study was criticized by an independent biostatistician as a “gross underestimation.”

A February 1987 study by Prof. Jackson Davis found that a naval nuclear reactor accident in San Francisco harbor could cause some 2,000 deaths in the year following the accident, with dangerous levels of radioactive fallout traveling eleven kilometers from the site.

A similar study was conducted in December 1986 on the consequences of a major accident in the harbor of Sydney, Australia. Based on US government methodology, the study found that a nuclear weapons accident resulting from a three-hour shipboard fire, or a severe nuclear reactor accident aboard a ship, could result in up to 11,000 deaths. To the extent that decontamination was possible, it could cost billions of US dollars.

Studies like these should cause harbor officials around the world to regard visits of nuclear ships with trepidation. Yet few ports even have realistic procedures to deal with a nuclear accident—and many have no procedures at all.

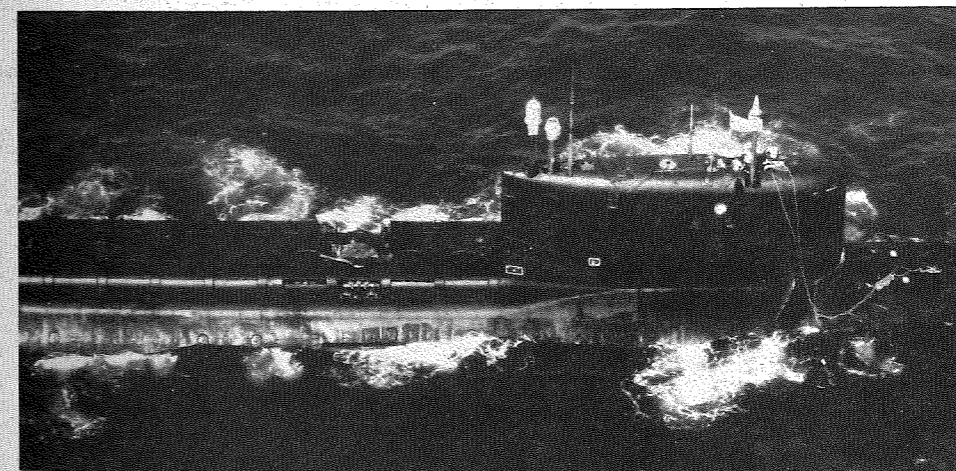
In Britain, evacuation plans for naval nuclear bases are limited to 550 meters—which happens to coincide with the perimeter fence of the bases.

More common is the case of Denmark, where officials insist that no nuclear emergency plans are necessary, since Denmark “officially” bars nuclear-armed ships from its harbors in peacetime—a policy that is known to be violated.

Nuclear Reactors on Naval Vessels

	U.S.	Soviet	U.K.	France	China	Total
Balistic missile submarines	35	125	4	6	2	172
Cruise missile submarines	0	79	0	0	0	79
Attack submarines	95	146	15	3	3	262
Aircraft carriers	16	0	0	0	0	16
Cruisers	18	4	0	0	0	22
Other	1	8	0	0	0	9
Total	165	362	19	9	5	560

Source: William M. Arkin, *The Bulletin of Atomic Scientists* (Sept. 1988)



Soviet submarine sank off Bermuda in October 1986, following a nuclear weapons accident. On board were two nuclear reactors and 32 nuclear weapons.

Since World War II, there has been an average of one major naval accident every two weeks. With some 15,000 nuclear weapons and 550 nuclear reactors at sea, the radioactive damage from these accidents is mounting.

US and Soviet Naval Nuclear Accidents: Abridged Chronology

April 10 1963: The USS Thresher's nuclear reactor shuts down while the submarine is on sea trials off the New England coast. The sub plunges to the sea floor, imploding and killing all 129 hands. The reactor's remains lie on the ocean bottom. The US Navy will neither confirm nor deny the presence of nuclear weapons aboard the submarine.

December 5 1965: An A-4E aircraft loaded with a B43 nuclear weapon rolls off the USS Ticonderoga while the ship is en route from Vietnam to Japan. The plane, pilot, and weapon sink to 2700 fathoms and are never recovered. The Pentagon later claims the accident took place "more than 500 miles from land," but Navy documents released by Greenpeace and IPS reveal the ship was about 70 miles east of Japan.

1967: A core meltdown and major radiation leak aboard the Soviet ice-breaker Lenin is believed to kill up to 30 people, and renders the ship too radioactive to use for over three years.

May 27 1968: The nuclear-propelled submarine USS Scorpion sinks about 400 miles southwest of the Azores, killing all 99 men on board. Pentagon information suggests the submarine was carrying nuclear weapons at the time of the disaster, although the US Navy neither confirms nor denies their presence.

April 12 1970: A Soviet nuclear-powered November class submarine sinks approximately 300 miles northwest of Spain. The accident is thought to be related to a problem in the nuclear propulsion system.

May 25 1975: A story in the New York Times details a secret US Navy intelligence operation named "Holystone," in

On April 7, 1989, a fire raged out of control aboard a Soviet Mike class submarine, forcing it to surface 150 miles southwest of Bear Island in the Norwegian Sea. Unable to put out the fire, the boat sank to the ocean floor, some 1800 meters below. Twenty-seven crew members survived. Forty-two did not.

On board when it sank were two nuclear torpedoes and two nuclear reactors. Although the Soviet Union later said the reactors had been "shut down" before the submarine was scuttled, the impact with the ocean floor and the pressure of the deep water may have done considerable damage to the reactors' containment structures and the nuclear warheads.

The reactors alone contained 10-20 million curies of radioactive material. Much of this material consists of longer-lived radionuclides that will remain highly toxic for thousands of years—certainly outlasting the battered containment structure.

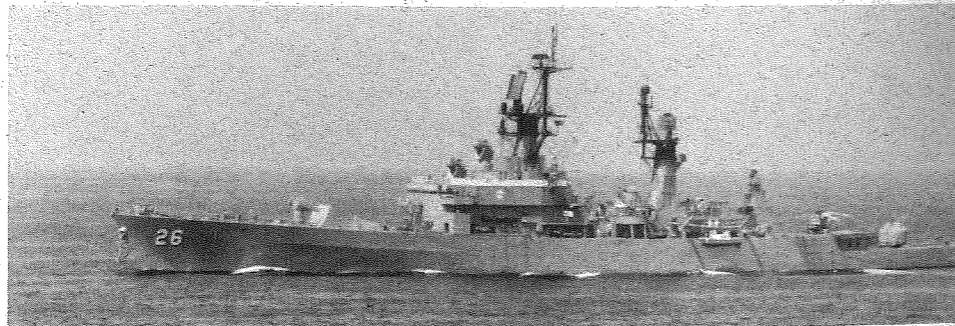
This tragic accident occurred in a major fishing ground for cod, herring, and shrimp. Strong ocean currents in the Norwegian Sea

could also bring any radioactive releases from the ocean floor to adjacent fishing areas.

Dramatic as it was, this accident is only one of almost 1300 major naval accidents recorded since 1945, according to a study published in June 1989 by Greenpeace and the Institute for Policy Studies. The study documents naval collisions, fires, groundings and explosions killing a total of almost 3000 people. Some 365 of these accidents have involved submarines.

From these accidents—a quarter of which had never been made public—48 nuclear warheads and 9 nuclear reactors have been left on the ocean floor.

When these accidents occur at sea, they threaten the marine environment. When they happen in crowded ports, they can threaten an entire city. Studies of the potential impact of a nuclear accident on different port cities, based on US government figures, show casualties ranging from 2,000 in San Francisco to 11,000 in Sydney to 30,000 in New York City (see sidebar page 11).



The USS Belknap before and after a fire in November 1975 off the Italian coast. The ship's

A full evaluation of the environmental damage already done by nuclear accidents at sea is difficult to undertake, since little information is usually released by the navies. Naval secrecy, normally invoked to protect defense information, has been repeatedly used to cover up accidents, blunders, and possible environmental damage.

For example, on April 21, 1973, the nuclear-powered attack submarine USS Guardfish lost its primary coolant—the liquid that prevents its nuclear reactors from overheating and melting down—while submerged about 370 miles south southwest of Puget Sound, Washington. The submarine surfaced and managed to repair the damage, but not before four crew members were sent to a naval hospital for radioactive monitoring. To cover up the accident, the deck log and command history of the ship were falsified.

This undisclosed accident, revealed by Greenpeace, contradicts the US Navy's assertion that it has never had a nuclear propulsion accident.

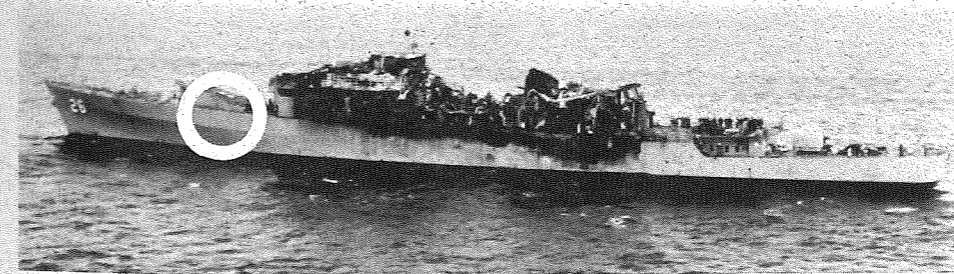
"It is prohibited to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment"

—article 35, 1977 Protocol to the 1949 Geneva Conventions

The London Dumping Convention has declared a moratorium on the ocean dumping of radioactive waste. But the Convention has no jurisdiction over naval matters. Thus the nuclear navies, through both their routine operations and frequent mishaps,

continue to discharge perilous quantities of low, medium, and high level radioactive materials in the seas.

Accidents will always happen. As long as naval vessels carry nuclear weapons and nuclear reactors, they will further contaminate the seas. Only by eliminating both nuclear weapons and nuclear propulsion can the oceans be protected.



nuclear weapons, stored in the forward missile magazine (circle), barely escaped damage.

which nuclear-armed and nuclear-powered US submarines were sent into Soviet territorial waters. Several accidents resulted from these missions, including the damaging of a US submarine that surfaced under a Soviet ship.

November 22 1975: The USS Belknap and the USS John F. Kennedy collide at night about 70 miles east of Sicily, setting off fires on the Belknap that burn the ship to the water line. An early Navy "Broken Arrow" bulletin warns of "a high probability that nuclear weapons on the USS Belknap were involved in fire and explosions," although later reports assure that "no radiation hazard exists." The US Navy never acknowledges that the ship carries nuclear weapons.

June 1983: A Soviet Charlie class nuclear-powered submarine sinks east of Petropavlovsk in the Pacific. US intelligence reports most or all of the 90 person crew lost. The submarine is raised by Soviet vessels in August 1983.

October 6 1986: A Soviet Yankee I class nuclear-powered submarine sinks in the Atlantic 600 miles east of Bermuda, after an explosion in the liquid propellant of one of the nuclear missiles. Two nuclear reactors and 32 nuclear weapons go down with the sub in 18,000 feet of water.

April 7 1989: A fire breaks out aboard a Soviet Mike class nuclear submarine, in the Norwegian Sea about 150 miles south-southwest of Bear Island. Several hours later, the submarine sinks in 6000 feet of water. After several days, the Soviet government confirms that the submarine sank with two nuclear missiles on board, although little other information about the radioactive dangers is provided.

In the 1980s, some nations took a stand against the global spread of nuclear weapons by banning nuclear-armed ships from their ports.

Allergic Nations

When New Zealand banned port calls by nuclear-armed and nuclear-powered ships in 1985, it catalyzed a worldwide movement against these vessels. Below is a partial listing of countries growing "allergic" to nuclear weapons.

Australia—Popular opposition to nuclear-armed warships was most forcefully demonstrated in October 1988, when striking anti-nuclear dockworkers, backed by popular protests, prevented two British warships from entering Port Melbourne. Polls show support for visits by nuclear-armed ships dropped from 47% in 1982 to 24% in 1988.

Canada—A policy made public in 1986 restricts visiting nuclear-powered vessels to three military ports, although nuclear-armed ships still call at civilian harbors. A government plan to buy nuclear-powered submarines was dropped in April 1989 in the face of strong public opposition.

Denmark—In April 1988, the Danish government fell when the Parliament moved to enforce a 30 year old policy barring nuclear weapons from its land and waters in peacetime. Following an inconclusive election, a "compromise" was found allowing port calls to resume, but the issue remains volatile.

Iceland—In April 1985, this strategically placed NATO ally announced it would enforce its longstanding nuclear free policies and no longer allow nuclear-armed ships in its harbors. The U.S. Navy has not challenged this position.

Ireland—An independent poll in October 1988 found 88% of the public supports a ban on nuclear-armed ships. Port calls by these ships in Cork and Dublin have recently met with popular protests.

Italy—There is a vigorous movement in Sardinia against the US naval base at La Maddalena. In March 1989, Italy's Constitutional Court rejected the Sardinian government's bid to hold a series of popular referenda on banning nuclear-armed and nuclear-propelled ships.

Japan—Although long-standing Japanese policy bans the introduction of nuclear weapons, there is consider-

able evidence that this policy is routinely violated by US ships. There were large protests in the summer of 1988 when two US Navy ships certified to carry nuclear-armed SLCMs were homeported in Yokosuka.

In January 1985, New Zealand Prime Minister David Lange announced that foreign naval vessels were permitted in New Zealand ports only if they would abide by the country's non-nuclear policy and leave their nuclear weapons behind. Alarmed that an allied country didn't want US nuclear weapons in its harbors, the US suspended its military relationship with New Zealand under the ANZUS mutual security treaty, severing defense and intelligence ties.

The Pentagon hoped its response to New Zealand would act as a kind of deterrent—not to deter hostile powers, but to deter other US allies who might question the wisdom of allowing nuclear weapons to be stationed in their harbors. By making an example of New Zealand, the Pentagon sought to forestall a "nuclear allergy" among countries inclined to reject visits by nuclear-armed ships. The Pentagon's policy has fared poorly (see sidebar).

Many countries have laws or policies banning nuclear weapons from their territory, yet few enforce them when nuclear-armed ships enter their waters. For countries like Japan, Canada, Ireland, Norway, Sweden, Spain and

Denmark, these contradictory policies have grown increasingly controversial as the dangers of naval nuclear arms have become more widely known.

"The Prime Minister may only grant approval for the entry into the internal waters of New Zealand by foreign warships if the Prime Minister is satisfied that the warships will not be carrying any nuclear explosive device..."

—New Zealand's

Nuclear Free Zone law (1987)

Governments that prefer to ignore the presence of nuclear arms in their harbors are assisted by the US, French, and British policy of "neither confirming nor denying" the existence of these weapons on their ships. The Soviet Union has announced it is abandon-

ing its "neither confirm nor deny" policy, but has still failed to identify its nuclear ships. Which ships carry nuclear weapons is nonetheless widely known, in part due to a paper published by Greenpeace and IPS in May 1988 that lists all nuclear-armed vessels in the five nuclear navies.

The spread of the "nuclear allergy" illustrates the uniquely global character of naval nuclear weaponry. The US stores land-based nuclear weapons in eight foreign countries, the Soviet Union in four, Britain in one, and France and China in none. But sea-based nuclear weapons are brought into over 110 countries each year, many of which are other-

wise nuclear-free and have no desire to be drawn into the nuclear arms race or to face the consequences of a nuclear accident.

Since New Zealand made its stand in 1985, a series of countries—mostly Western allies—have shown symptoms of catching the "nuclear allergy." Faced with a series of allies who are increasingly uncomfortable about hosting

nuclear-armed ships, Washington policy makers have been taking a closer look at naval nuclear arms reductions.

Greenpeace calls for all non-nuclear coastal countries to take a stand against the nuclearization of the oceans by banning nuclear-armed and nuclear-propelled ships from their territorial waters.



Australia's bicentennial gala in September 1988 brought sixty warships, scores of nuclear weapons, and hundreds of demonstrators to Sydney harbor.

able evidence that this policy is routinely violated by US ships. There were large protests in the summer of 1988 when two US Navy ships certified to carry nuclear-armed SLCMs were homeported in Yokosuka.

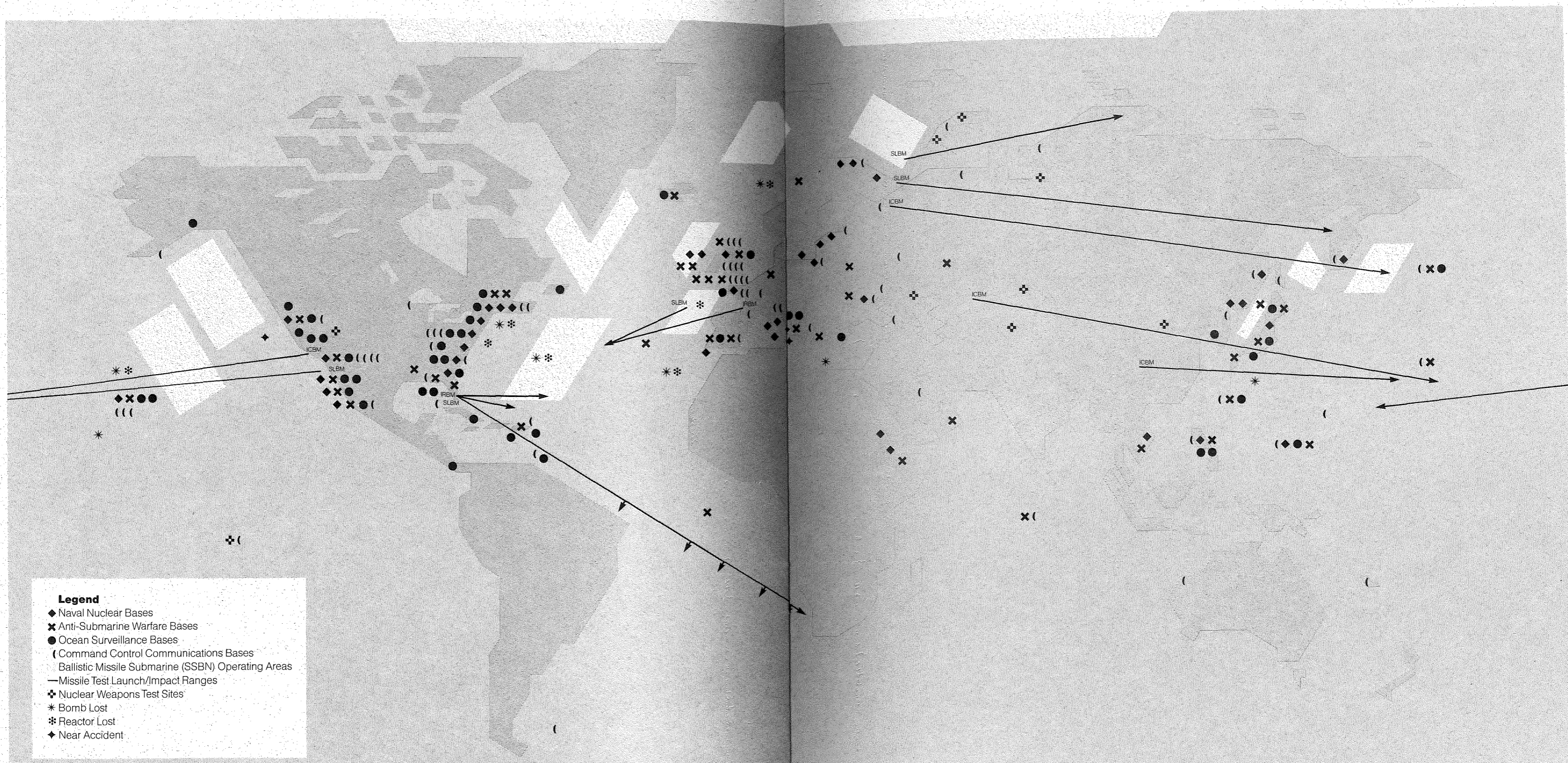
Malta—This non-aligned island nation in the Mediterranean was the site of considerable turmoil in July 1988, when striking anti-nuclear dockworkers blocked the entry of the HMS Ark Royal into Valetta with an empty oil tanker. The legality of nuclear ships visits has been questioned in Malta's highest court, and debated in the Parliament.

Palau—This Pacific island nation, still administered by the United States as a "strategic trust territory," is engaged in a battle of wills with the US to retain its nuclear-free constitution. The US wants Palau to abandon the constitution's nuclear ban, which outlaws port calls by nuclear-armed and nuclear-propelled ships. Palau hopes to remain in the company of two other Pacific island nations, Vanuatu and the Solomon Islands, that have also banned nuclear ship visits.

Philippines—In May 1988, the Philippine Senate passed legislation to ban nuclear weapons from its territory. This was intended to cover US naval and air bases on Philippine soil. There is political pressure in the Philippines to include an anti-nuclear clause in the US bases treaty, if it is renewed in 1991.

Spain—In a March 1986 referendum, Spanish voters agreed to join NATO under the condition that no nuclear weapons would be "introduced to Spanish territory." Under a new US-Spain treaty ratified in March 1989, however, the Spanish government has agreed not to ask the US whether it is carrying nuclear weapons into Spanish harbors. Nonetheless, US Navy port calls have grown less frequent over the last several years, as anti-nuclear sentiment has grown.

USSR—In March 1989, four far eastern Soviet ports refused entry to a nuclear-powered merchant vessel, out of fear of possible radiation contamination. After a nine day wait, it was finally allowed to dock in Vladivostock, despite reports that its nuclear propulsion system had suffered fractures.



Legend

- ◆ Naval Nuclear Bases
- ✕ Anti-Submarine Warfare Bases
- Ocean Surveillance Bases
- (Command Control Communications Bases
- Ballistic Missile Submarine (SSBN) Operating Areas
- Missile Test Launch/Impact Ranges
- ⊕ Nuclear Weapons Test Sites
- * Bomb Lost
- ✱ Reactor Lost
- ◆ Near Accident

Sources: William M. Arkin, Richard W. Fieldhouse, Nuclear Battlefields, Ballinger (1985); William M. Arkin, Joshua Handler, Neptune Paper III, Naval Accidents 1945-88 (June 1989)

**Nuclear Free Seas Campaign:
Abridged Chronology**

1987

June 9—Brisbane, Australia The Greenpeace ketch Vega places itself in the path of the USS Ramsey, a nuclear capable frigate, as it cruises up the Brisbane River. The Vega is rammed by a police boat and the crew is arrested. All charges are later dropped.

July 10—Auckland, New Zealand On the second anniversary of the Rainbow Warrior bombing, a group of Greenpeace climbers suspend themselves below the Auckland Harbour Bridge, unfurling a Nuclear Free Seas banner.

July 15—Vancouver, Canada Two activists scale the Lion's Gate Bridge to hang a banner reading "Nuclear Free Seas," to protest the arrival of 10 U.S. warships. After a 24 hour vigil, they descend and are arrested.

October 27—Washington D.C., USA The first in a series of monographs, called Neptune Papers, is released. Written by military expert William M. Arkin, it is entitled "The Nuclear Arms Race at Sea," and details the scope and dangers of naval nuclear operations.

1988

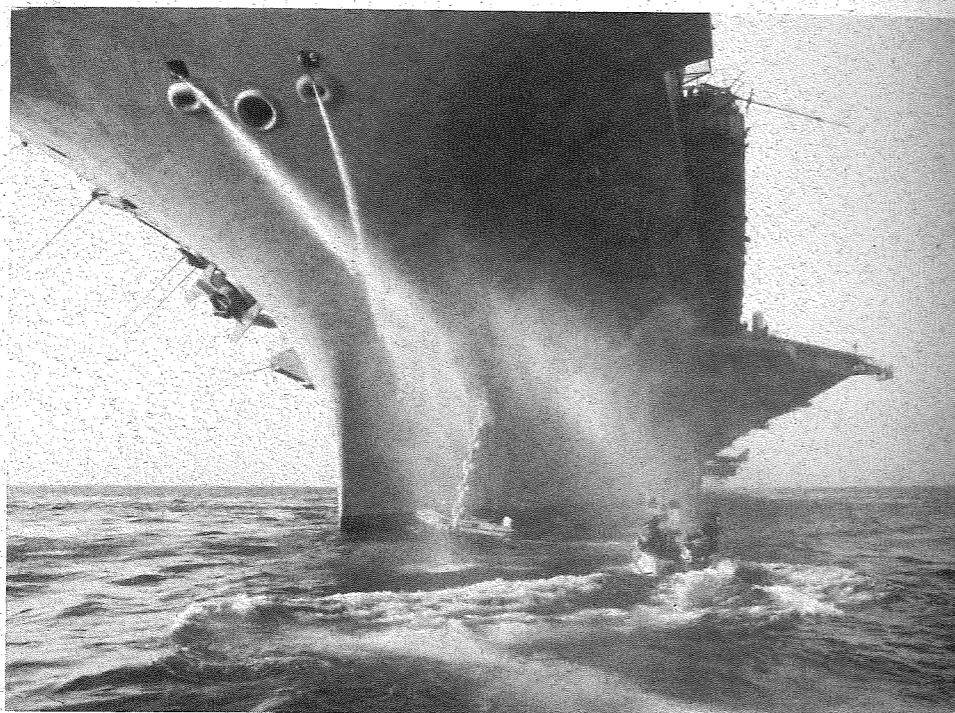
March 5—Hamburg, Germany Greenpeace protests a port call by the nuclear capable British aircraft carrier Ark Royal, with a pontoon boat ferrying large mock nuclear weapons, and a banner reading, "Warning: Nuclear Weapons on Board."

May 6—Great Belt near Korsør, Denmark The Greenpeace ship Moby Dick and three inflatables pursue the Soviet frigate Sil'nyy through the straits of Denmark. Activists on one inflatable

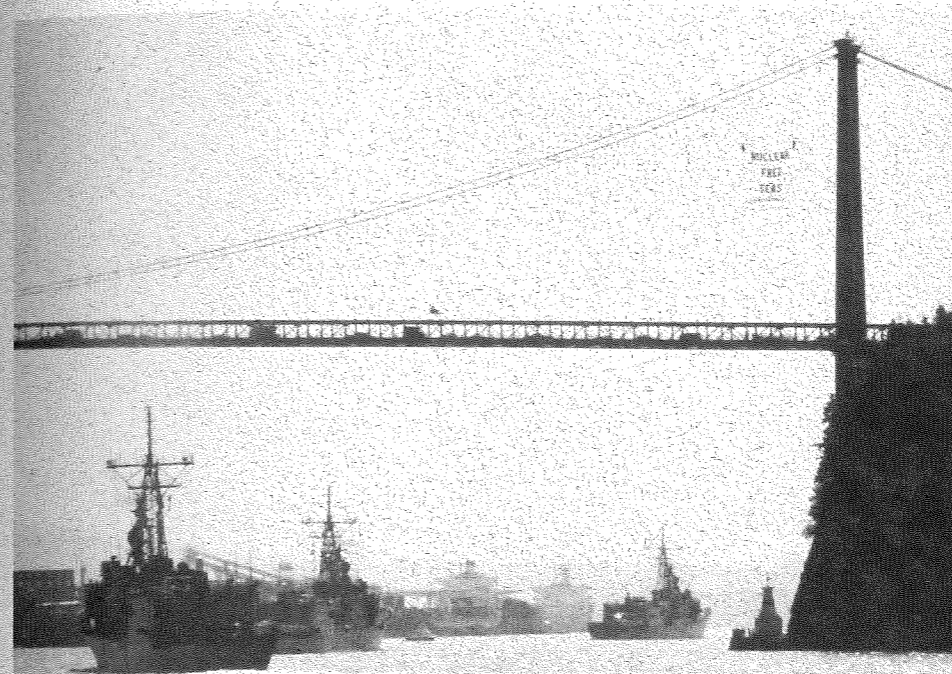
Greenpeace was founded in 1971, when a small band of Vancouver activists sailed towards the Aleutian Islands to protest American nuclear testing in the Pacific. From this first "direct action," and later voyages to protest French nuclear testing on the Pacific atoll of Muroroa, has come Greenpeace's ongoing commitment to a comprehensive ban on nuclear weapons testing, as a vital step towards complete nuclear disarmament.

In 1987, Greenpeace launched the Nuclear Free Seas campaign, devoted to ending the nuclear arms race at sea. Using non-violent actions, political lobbying, and research to create new knowledge, Greenpeace works to make the oceans free from all nuclear weapons and nuclear-propelled vessels.

The campaign is active today in Europe, the Pacific, and North America.



July 1988: Greenpeace inflatables attempt to block the entry of the USS Eisenhower, a nuclear-armed and nuclear-propelled aircraft carrier, into the Spanish port of Palma de Mallorca.



July 1987: Two Greenpeace climbers scale Vancouver's Lions Gate Bridge to protest the entry of nuclear-armed US warships.

place a flag with a radiation symbol on the vessel's stern, before capsizing from the force of the frigate's propeller.

May 17—Washington D.C., USA The second Neptune Paper, "Nuclear Warships and Naval Nuclear Weapons: A Complete Inventory" is released, listing all nuclear-armed ships in the Soviet, US, British, French and Chinese navies.

June 9—Palma de Majorca, Spain The Greenpeace ship Sirius attempts to prevent the U.S. nuclear aircraft carrier Dwight D. Eisenhower from entering the port of Palma. After a drenching from the ship's water hoses, the Sirius withdraws.

June 9—New York City, USA Dr. Gerd Leipold, coordinator of the Nuclear Free Seas campaign, addresses the United Nations Special Session on Disarmament, calling on delegate nations to ban armed ships from their harbors and work actively for naval nuclear disarmament.

June 18—Gulf of Hammamet, near Tunisia Greenpeace's Sirius conducts simultaneous actions against the Soviet Union's new aircraft carrier, the Baku, and the U.S. frigate Thomas C. Hart, painting radiation symbols on the hulls of the two vessels. The shallow waters in this region in are sometimes used by the Soviet Union in lieu of a naval base.

June 24—La Maddalena, Italy To protest the presence of nuclear armed SLCMs, the Sirius enters the U.S. naval base at La Maddalena and ties a mock "yellow submarine," symbolizing the peaceful uses of the oceans, to the U.S. submarine tender Frank S. Cable. After a skirmish with U.S. and Italian naval boats and a drenching by water hoses, the Sirius withdraws.

July 2—Aalborg, Denmark The Greenpeace ship Moby Dick blocks the nuclear destroyer USS Conyngham as it attempts to dock in the town of Aalborg. After an eight hour standoff, the entire Greenpeace crew is arrested and the Moby Dick is towed away.

July 8—Cork, Ireland Less than one week after the blockade in Denmark, the USS Conyngham is confronted by the Greenpeace ketch Rubicon as it sails into Cork. A U.S. Embassy representative accepts a letter from Greenpeace and other activists, protesting the violation of Ireland's non-nuclear policy.

July-August—Rosyth, Faslane, Holy Loch, Plymouth, Portsmouth, UK The Greenpeace ship Moby Dick visits these British naval nuclear bases both to sample for radioactive sediments and to highlight dangers of reactor accidents. The sample results, released in January 1989, showed disturbingly high levels of radioactive sediments.

September 26—Sydney, Australia After successfully eluding thirty police, navy, and harbor vessels, Greenpeace activists tag four US and British nuclear capable ships with radiation symbols, as they enter Sydney Harbour.

October 21—San Francisco, USA Four Greenpeace climbers rappel below the Golden Gate Bridge, and unfurl banners protesting the visit of five nuclear-armed US ships into San Francisco Bay. After two hours they lower themselves to the water and are arrested.

1989

March 19—Cork, Ireland A Greenpeace activist chained to a bollard, and a strike by anti-nuclear dockworkers, prevent the USS Yorktown from docking for several hours.

June 6—Washington D.C., USA The third Neptune Paper, entitled "Naval Accidents 1945-1988" is released, disclosing information about almost 1300 naval nuclear accidents, hundreds of which had never been made public.

The goals of the international Greenpeace campaign are:

1. A ban on all tactical naval nuclear weapons, including sea-launched cruise missiles.

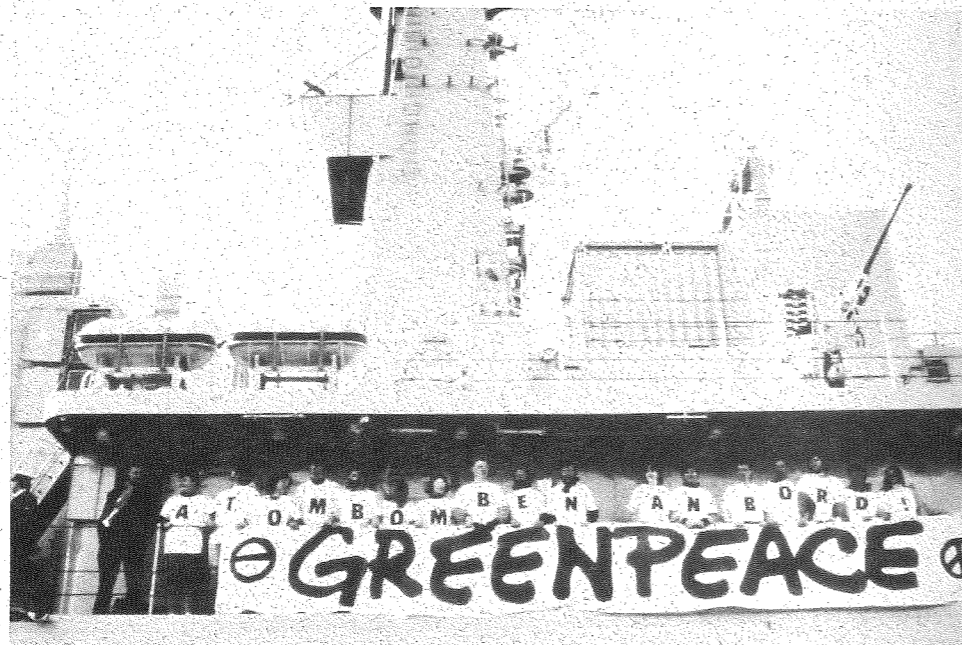
2. A ban on new strategic naval weapons—the US and British Trident II missile, the Soviet SS-N-23, and the French M5—as a step towards eliminating all sea-launched

ballistic missiles and achieving nuclear disarmament at sea.

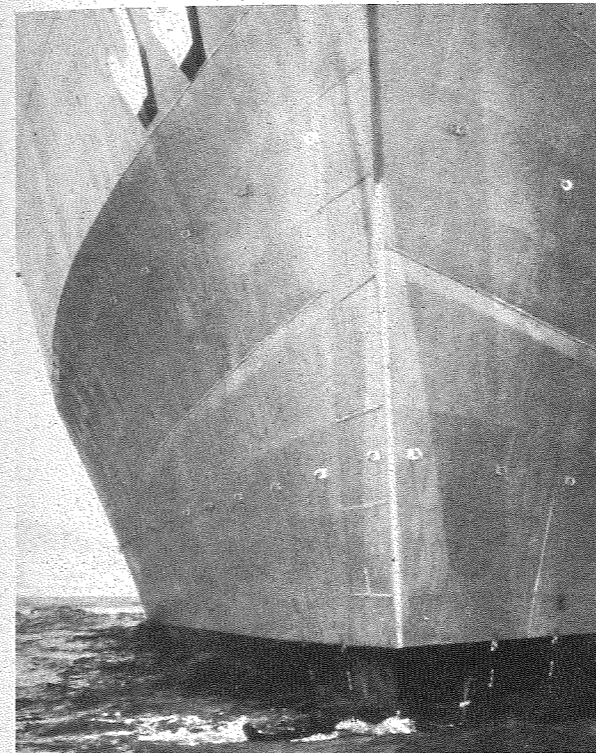
3. A global ban on nuclear propulsion for ships and submarines.

4. For non-nuclear countries to ban nuclear-armed and nuclear-propelled vessels from their territorial waters.

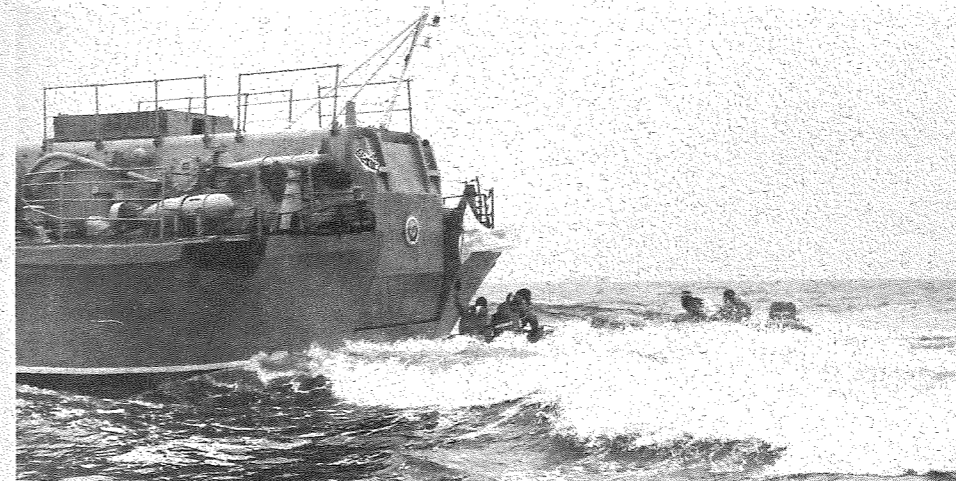
5. To promote freedom of the high seas for civilian vessels.



April 1988: Greenpeace protestors from six countries aboard the HMS Brave, a nuclear-armed British frigate, in the German port of Flensburg. The slogan reads "Nuclear Weapons on Board."



April 1987: Greenpeace swimmer apprehends the USS Texas, a nuclear-armed and nuclear-propelled cruiser in San Francisco Bay.



May 1988: Greenpeace activists apprehend the Soviet nuclear-armed frigate Sil'ny as it transits the Danish straits, placing a radiation symbol on the vessel's stern.

Freedom of the Seas

Since 1609 when the Dutch statesman Grotius wrote his treatise *Mare Liberum*, the law of the high seas has been based on the concept of "freedom of the seas"—that the high seas are humanity's common heritage and should be accessible to all who use it peacefully.

Until 1982, most littoral nations enforced a territorial zone extending three miles from their coasts. The three mile limit was historically considered "usque armorum vis"—"as far as the weapons can reach."

But today's nuclear-propelled vessels and missiles can reach everywhere, and thus the nuclear navies have taken the high seas as their own.

With scant legal justification, the nuclear navies establish "exclusionary zones" in international waters when conducting naval exercises or testing missiles. These zones can extend over thousands of square miles, curtailing the movement, and rights, of civilian vessels. Never before in history have large expanses of international waters been reserved for military use.

The navies further subvert international law by circumventing any attempts to regulate their activities.

The Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco, 1967) could denuclearize large areas of the Atlantic and Pacific, but France, the UK, the US and the USSR have all stated they would not comply with this provision of the treaty. To avoid a similar problem of non-compliance, the South Pacific Nuclear Free Zone Treaty (Treaty of Rarotonga, 1985) refrains from mentioning any constraints on nuclear-equipped or nuclear-propelled vessels.

By appropriating the high seas for military purposes, and by undermining efforts to establish nuclear-free zones at sea, the nuclear navies have mocked the notion that military activities should be subject to civilian law, and eroded the freedom of civilian vessels to enjoy humanity's "common heritage."

ASROC: Anti-Submarine Rocket, a ship-launched anti-submarine weapon deployed by the US Navy. It is scheduled for retirement by 1990.

ANZUS: A treaty among Australia, New Zealand, and the US, for cooperation in military affairs.

D5: see Trident II

GLCM: Ground-launched cruise missile, a low-flying medium-range nuclear missile banned under the INF treaty.

INF: Intermediate Nuclear Forces treaty, an agreement signed by the US and Soviet Union in December 1987 that banned all land-based nuclear missiles with ranges between 500 and 5,000 km.

M4: A submarine-launched ballistic missile currently deployed by the French Navy.

M5: A submarine-launched ballistic missile expected to replace the French Navy's M4 in the late 1990's.

SLBM: Submarine-launched ballistic missile, a long-range nuclear missile launched from ballistic missile submarines. SLBMs are distinguished from SLCMs by their high trajectories, multiple warheads, and longer range. The US, Soviet, British, French, and Chinese navies all have SLBMs.

SLCM: Sea-launched cruise missile, a low-flying missile launched from ships or submarines. There are both conventional and nuclear-armed SLCMs in the US and Soviet arsenals. The current generation of SLCMs has advanced terrain guidance features, allowing it to travel thousands of kilometers at low altitudes and strike targets with great accuracy (see sidebar page 7).

SSBN: Ballistic missile submarines, carrying SLBMs, and which are nuclear-powered. The US, Soviet, French, British, and Chinese navies all have SSBNs.

SSN: Attack submarine, nuclear-powered. SSNs are used primarily for attacking ships and other submarines, although US SSNs armed with Tomahawk SLCMs have the added capability of attacking land targets.

SS-N-23: The newest Soviet SLBM, first deployed in 1986.

START: Strategic Arms Reduction Talks, ongoing US-Soviet negotiations to cut long-range strategic nuclear weapons by approximately one-third.

SUBROC: Submarine launched rocket, a nuclear-armed anti-submarine weapon deployed on US submarines. In April 1989 a US Navy official said the retirement of the SUBROC was "imminent."

Terrier: A US ship-based anti-aircraft nuclear missile. First deployed in 1955, it is scheduled for retirement by 1991.

Tomahawk: The US Navy's SLCM, a sophisticated, low-flying, highly accurate missile. First deployed in 1984, 3,994 Tomahawks are scheduled for placement aboard 198 ships and submarines. Of these, 758 will be nuclear-armed and have a 2500 km range.

Trident I: A US Navy SLBM, the Trident I (or C4) missile has 8 independently-targeted warheads, and a range of 7400 km.

Trident II: The newest SLBM developed by the US Navy, the Trident II (or D5) will also be used by Britain's Royal Navy. It is expected to have eight independently-targeted warheads and a range of approximately 10000 km. First deployment is in early 1990 in the US, and the mid to late 1990s for the UK.

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