XIV. THE TANKER WAR AND THE LESSONS OF NAVAL CONFLICT

14.0 The Tanker and Naval Wars

The Iran-Iraq War involved two complex forms of naval conflict: Iraq's attempts to weaken Iran by destroying its ability to use tankers to export oil, and a U.S.-led Western naval presence in the Gulf that was intended to ensure the freedom of passage for tankers to Kuwait and the overall security of shipping to and from neutral Gulf countries. Both forms of conflict led to substantial escalation. Iran reacted to Iraq's tanker war by putting increasing military and political pressure on the Southern Gulf states to halt their support of Iraq. The U.S. and Western European presence in the Gulf led to growing clashes with Iran that escalated steadily to the point where they were a major factor in Iran's decision to agree to a ceasefire.

The history of these two naval conflicts, and their overall impact on the war, has already been described in some detail. The naval fighting involved the use of a wide range of naval, air, missile, and mine warfare systems, however, and presents a number of interesting lessons regarding the use of these systems in naval warfare. It also provides important insights into the effect of strategic air attacks on naval shipping, and the problems of conflict management and controlling escalation.

The key lessons and issues raised by the war may be summarized as follows:

- The tanker war was the most important aspect of the fighting at sea, but it never produced a major interruption in Iran's oil exports. Both for political and military reasons, Iraq never achieved the concentration of force necessary to severely reduce Iran's exports on a sustained basis, and lacked the targeting assets and the ability to use sufficiently lethal weapons to achieve decisive results.

- Iran was able to create a tactical counterweight to Iraq's high technology capability to strike at its tankers in the form of a relatively low grade revolutionary force which was equipped largely with small boats and minecraft and which was able to strike at ships going to nations friendly to Iraq. The naval branch of the Pasdaran was not successful largely because of U.S. intervention, but illustrated that unconventional war can be a major naval threat.

- U.S. and other Western forces were largely successful in using power projection help control and terminate the conflict in the Gulf. Nevertheless, they ran into serious problems in dealing with a number of major issues in low

level war. These ranged from serious problems in mine warfare capability to problems in managing missile defense and the IFF problems inherent in dealing with a mix of friendly and hostile ships and aircraft operating in the same area.

- On a technical level, the experiences of the Iran-Iraq War were somewhat similar to those of the Falklands conflict in that they illustrated the need for more reliable and quick reacting missile defenses, and more emphasis on fire fighting and damage control. They also indicated the need for mine warfare capabilities suited for low level conflict, for better identification of friend and foe systems, and for tailoring command and control systems and training to the special politico-military conditions inherent in a given low level conflict.

14.1 Naval Operations and The "Tanker War"

The "tanker war" served as a primary catalyst in shaping the outcome of the Iran-Iraq War. It gave Iraq a means of striking at Iraq at a time it was heavily on the offensive, and had no other means of putting pressure on Iran. The resulting Iranian reaction was also a key factor leading the U.S. and its European allies to intervene in the Gulf. The "tanker war", however, only acquired real importance in the fourth year of the war. While both sides struck at ships at the start of the conflict, the escalation to large scale strikes on third country shipping began in 1984. after that time, the "tanker war" became a war where Iraq has since repeatedly attempted to use air strike strikes against tankers and oil facilities to force Iran to a settlement. Iran, in turn, attempted to respond with air and naval strikes on neutral ships and tankers moving to countries supporting Iraq. As a result, the tanker war involved the West in a growing series of naval encounters.

The history of this conflict has already been described in detail. It is also important to stress that most of the lessons from this aspect of war were lessons in escalation and conflict management, rather than ones in tactics and technology. Nevertheless, several aspects of the "tanker war" merit special treatment.

14.1.1 The Beginning and Initial Impact of the "Tanker War": !980-1984

The beginnings of the tanker war provided some important insights into the process of escalation that helped shape the naval fighting. After 1985, the "tanker war" became so integrated into the overall structure of conflict in the Gulf, that it is impossible to separate the naval fighting from the overall patterns in the fighting. The history of the tanker war from 1980 to 1984 is different, however, and provides an interesting example of how a seemingly minor aspect of the Third world conflict can suddenly change its strategic impact and meaning for the West.

The early history of the "tanker war" is summarized in **Figure 14.1.** It is interesting to note that although Iraq experienced its most critical problems in terms of oil exports during the period from 1980-1984, it was comparatively slow to turn to the war at sea as a means of inflicting similar damage to Iran. This is partly explainable by the fact the Iranian Navy kept the Iraqi Navy in port during virtually all of the war and totally dominated the Gulf. It is also partly explainable by the difficulties Iraq faced in terms of the range and munitions capability of its fighter-bombers, and its reluctance to commit aircraft to missions where it ran a high risk of loss until Iran lost most of its air defense capabilities.

The practical problem that Iraq had to solve was to find a way to use aircraft to strike deep into Iranian waters with a high degree of survivability. Iran's sea control denied Iran other options, and it took some years before Iraq could acquire the mix of fighter-bombers and air-to-ship missiles if felt it needed. It is also evident from **Figure 14.1** that even the acquisition of Exocet was not a substitute for sea control. While Iraq made extensive use of advanced technology weapons like the Exocet air-to-surface missile, Iran also scored a high hit rate per sortie using unguided air-to-air rockets.

FIGURE 14.1 (OLD FIGURE 4.22)

THE TANKER WAR: A PARTIAL CHRONOLOGY

1980	
7 October	Three foreign freighters were sunk and two others damaged by Iranian shells in the Iranian port of Khorramshahr during exchange of fire with attacking Iraqi forces. At least 20 crewman killed.
1981	
21 May	Iraqi aircraft slightly damage Panamanian bulk carrier *Louise I* outside northern Iranian port of Bandar Khomeini.
19 October	Iraqi missile damaged Liberian bulk carrier *Al Tajdar* near Bandar Khomeini. The Panamanian bulk carrier *Moira* was bombed and seriously damaged. Both were later repaired.
25 October	Iraqi missiles set the Indian bulk carrier *Rashi Vish Wamitra* on fire near Bandar Khomeini, causing heavy damage.
1982	
11 January	Two Iraqi missiles set fire to the Panamanian freighter *Success* which was abandoned. Greek bulk carrier *Anabella* was damaged by a mine near Bandar Khomeini.
14 February	The 16,000-ton Iranian tanker *Mokran* was seriously damaged by mines laid by the Iraqis near the northern Iranian port of Bandar Mahshahr.
30 May	The Turkish tanker *Atlas* was seriously damaged during an Iraqi bomb attack on Kharg Island.
6 June	The Greek 26,000-ton bulk carrier *Good Luck* was damaged by Iraqi missiles off Bandar Khomeini. The crewmen were killed.
9 August	Iraqi missiles sank the 15,000-ton Greek freighter *Lition Bride* near Bandar Khomeini, and damaged the 16,000-ton South Korean bulk carrier *Sanbow Banner* beyond repair. Eight crewmen were missing and one was killed aboard *Sanbow Banner*.
4 September	The Turkish bulk carrier *Mar Transporter* was damaged beyond repair by a direct Iraqi missile hit on its engine room in waters near Bandar Khomeini. It was sailing in a ten-ship convoy escorted by Iranian naval vessels.
11 September	The Greek freighter *Evangelia S.* struck an Iraqi mine at the entrance to Bandar Khomeini harbor. It was grounded and abandoned.
1983	
2 January	Iraqi aircraft set fire to Singapore freighter *Eastern* and the *Orient Horizon* of Liberia, while in convoy from Bandar Khomeini, forcing them to run aground.
15 May	Panamanian oil tanker *Pan Oceanic Sane* was set ablaze by an Iraqi missile attack and was abandoned in Bandar Khomeini channel.
21 November	The Indian bulk carrier *Archana* was slightly damaged by an Iraqi missile attack near Iranian port of Bushehr.

18 December	Iraqi missiles set fire to the Greek tanker Scapmount. It was abandoned in the channel to Bandar Khomeini.
25 May	Iraqi aircraft slightly damaged the Panamanian supply ship *Seatrans-21*.
31 May	The Indian bulk carrier *Ati Priti* was seriously damaged by Iraqi missiles near Bandar Khomeini.
31 October	The Greek freighter *Avra* was set ablaze by Iraqi missiles near Bandar Khomeini as it sailed in a convoy escorted by Iranian naval vessels.
21 November	An Iraqi missile sank the 13,000-ton Greek bulk carrier *Antigoni* near Bandar Khomeini as she sailed in a convoy escorted by Iranian naval vessels.
8 December	The 16,000-ton Greek bulk carrier *Iapetos* Iapetos was attacked by Iraqi missiles off Bandar Khomeini and abandoned; it was later repaired.

1984

1 February	A convoy of four Cypriot freighters--*Breeze*, *Neptune*, *Skaros*, and *City of Rio*--were attacked by Iraqi aircraft near Bandar Khomeini. The *Breeze* and *Skaros* were set afire by missiles and lost. The *City of Rio* struck a mine and was grounded. The Neptune was set ablaze, but was not extensively damaged.
16 February	Iraqi missiles extensively damaged the Liberian freighter *Al Tariq* in the Iranian port of Bushire.
1 March	The Indian bulk carrier *Apj Ankiba* was sunk by Iraqi missile in an attack on a 15-ship convoy sailing between Bushire and Bandar Khomeini. The 19,000-ton British bulk carrier *Charming* was set ablaze and grounded after and Iraqi missile hit its superstructure. The Turkish freighter *Sema-G* was set ablaze and abandoned.
27 March	In first operational use by the Iraqi Air Force, a Super Etendard jet fighter fired an Exocet missile at the 85,000-ton Greek tanker Filikon L., carrying 80,000 tons of crude oil from Kuwait, south of Kharg Island. The Iraqi pilot apparently assumed the tanker was carrying Iranian oil. The missile tore a gash in the hull, slightly damaging the starboard side of the bow, slop tank and number 4 tank, but failed to detonate. Two hundred tons of oil leaked out. U.S. experts later defused the missile.
29 March	The 16,000-ton Greek freighter *Iapetos* was set afire by an Iraqi missile and abandoned at the head of the Gulf.
3 April	Iranian shelling set fire to the Indian freighter *Varuna*.
18 April	An Iraqi missile slightly damaged the 52,000-ton Panamanian tanker *Robert Star* while sailing in ballast to Kharg Island.
25 April	The 357,000-ton Saudi tanker *Safina-Al-Arab*, carrying 340,000 tons of Iranian crude, was seriously damaged by an Iraqi missile south of Kharg Island. This missile blew a 240 square-foot hole in the starboard side, bending the hull plates inward, and causing an explosion and fire in the number 11 starboard tank which spread to numbers 9 and 10. The fire raged for two days and burnt 10,000 tons of oil. The ship was declared a total loss.
27 April	Iraq missiles slightly damaged the 179,000-ton Liberian freighter *Sea Eagle* near Bandar Khomeini.

7 May	The 118,000-ton Saudi tanker *Al-Ahood*, loaded with 114,000 tons of Iranian crude, was set ablaze by an Iraqi missile near Kharg Island. The fire took five days to extinguish, and burnt 34,000 tons of oil. The missile struck the accommodation section near the engine room and caused extensive damage. One crewman was lost.
13 May	An Iraqi missile slightly damaged the 69,000-ton Iranian tanker *Tabriz*, fully loaded with Iranian oil, south of Kharg Island.
13 May	In the first reported attack by an Iranian aircraft on commercial shipping, the 80,000-ton Kuwaiti tanker *Umm al-Casbah*, carrying 77,000 tons of Kuwaiti oil, was slightly damaged by Iranian rockets south of Kuwaiti. After being observed by a spotter plane, an Iranian F-4 jet fighter dove and fired two rockets. Both hit the deck.
14 May	An Iraqi missile set fire to the 62,000-ton Panamanian tanker *Esperanza II* while sailing in ballast to Kharg Island. The engine room and accommodation section were burned out.
16 May	An Iraqi rocket attack damaged the 215,000-ton Saudi tanker *Yanbu Pride*, carrying 120,000 tons of Saudi crude, within Saudi territorial waters near the port of Jubail. Of the five rockets fired by the two F-4s, two hit the vessel and caused fire and explosions. The fire started in the starboard hold, but was quickly extinguished. Prior to the firing, the F-4s circled the tanker for identification.
18 May	An Iraqi missile sank the 17,000-ton Panamanian bulk carrier *Fidelity* near the Iranian port of Bushire.
24 May	Iraqi missiles narrowly missed the *Arizona*, a fully loaded 140,000-ton Panamanian tanker, south of Kharg Island.
24 May	Two Iranian F-4s damaged the 29,000-ton Liberian tanker *Chemical Venture*, sailing in ballast in Saudi waters, near the port of Jubail. Iranian rockets hit the vessel in the middle of the superstructure, causing a fire in the accommodation wheelhouse was burned out. Ten crewmen were injured.
25 May	The 19,000-ton Liberian bulk carrier *Savoy Dean* was hit by an Iraqi missile in the Gulf.
3 June	The 153,000-ton Turkish tanker *Buyuk Hun*, sailing to ballast to Kharg Island, was damaged by an Iraqi missile 50 miles south of the island. The missile hit the accommodation section, killing three crewmen. The tanker was towed away by an Iranian tugboat.
7 June	An Iraqi mine blew a hole below the waterline of the Liberian freighter *Dashaki* near the Strait of Hormuz. The ship had dropped off cargo at Bandar Abbas and was heading for Saudi Arabia.
10 June	An Iranian F-4 attacked the 295,000-ton Kuwaiti tanker *Kazimah*, sailing in ballast east of Qatar. The plane dropped bombs which missed, then proceeded to hit with rockets. The damage was slight and no injuries occurred.
24 June	The 152,000-ton Greek tanker *Alexander the Great*, fully loaded with Iranian oil, was slightly damaged by an Iraqi missile at Kharg Island. The missile penetrated an oil tank, but failed to explode.

27 June	The Swiss-owned, Liberian-registered 260,000-ton Kuwaiti tanker *Tiburon*, loaded with 250,000 tons of Iranian oil, was damaged by an Iraqi missile southeast of Kharg Island. The missile hit the engine room, and 100-foot flames spread to the accommodation section. Fire and subsequent explosions destroyed the entire superstructure and caused the funnel to collapse. Two days after the attack, the ship was wallowing with only three feet of hull above the water. Salvage tugboats saved the oil by extinguishing the fire before it reached the tanks. Eight crewmen were killed and three seriously injured. The tanker was towed to Bahrain.
1 July	The 6,200-ton South Korean cargo vessel *Wonju-Ho* was damaged by an Iraqi missile while on her way to Bandar Khomeini. The 13,000-ton Greek freighter *Alexander-Dyo* was heavily damaged by an Iraqi missile during the same attack. Two crewmen were killed and four injured.
5 July	Iranian jets damaged the Japanese-owned, Liberian-registered supertanker *Primrose*. It was hit by two rockets, but continued at full speed.
10 July	In an apparent case of mistaken identification, an Iranian F-4 attacked the 133,000-ton British tanker *British Renown* while sailing to pick up crude from the tanker *Tiburon*, which had been struck by Iraqi missile on 27 June. Following the appearance of a spotter plane, an F-4 fired two rockets at the tanker. One bounced off the deck, and another hit its oil-loading equipment, igniting a small fire which was quickly extinguished. The attack took place in international waters 70 miles northwest of Bahrain.
7 August	An Iraqi missile slightly damaged the 123,000-ton Greek tanker *Friendship L*., fully loaded with Iranian oil, 30 miles south of Kharg Island. The missile pierced an oil tank and caused a minor fire, which spread to the engine room and accommodation section, but was quickly extinguished.
15 August	An Iranian jet fired two rockets at the 89,000-ton Pakistani tanker *Joharm*, but missed. The tanker was attacked while sailing to Saudi Arabia to load oil.
18 August	47,000-ton Panamanian tanker *Endeabor* attacked by Iranian jet 100 miles east of Bahrain with full load of Kuwaiti oil. One rocket struck starboard side, starting a small fire on the deck and in the main tank, but was brought under control. The tanker continued on toward Dubai.
24 August	The 53,000-ton Cypriot tanker *Amethyst*, carrying 50,000 tons of Iranian crude, is damaged by an Iraqi missile south of Kharg Island. It was saved from sinking by tugboats which brought the blaze under control. The fire spread from the engine room to the accommodation section and some oil tanks. One crewman was lost.
27 August	The 21,000-ton Panamanian tanker *Cleo-1* hit by Iranian rocket 70 miles northeast of Qatar on way to Ras Tanura to load oil. Proceeded to Dubai.
11 September	The fully loaded, Liberian-registered, Norwegian-owned 251,000-ton tanker *St. Tobias* is slightly damaged by an Iraqi Exocet, 50 miles south of Kharg Island. The missile blew a 6-foot hole on the ship's starboard, and started a fire that was quickly extinguished. The oil cargo remained intact, and the tanker continued to Abu Dhabi under her own power.
12 September	The 500-ton German supply ship *Seatrans 21*, which had been slightly damaged on 25 May, was sunk by Iraqi missile 50 miles south of Kharg Island.
16 September	The Greek-owned, Liberian-registered tanker *Medheron*, 122,000 tons, struck by Iranian rockets on way to Ras Tanura. The rockets were fired at close

	range following the appearance of a spotter plane. Serious damage--the bridge and 30 percent of the crew quarters were destroyed, and three crewmen were injured. The incident occurred in the central Gulf, and the ship sailed to Bahrain for repairs. The 127,000-ton South Korean tanker *Royal Colombo* is hit by Iranian planes on way to Ras Tanura. Rockets ripped through the engine room and injured three crewmen. Damage was slight and tanker proceeded to load oil at the Saudi terminal.
8 October	The Liberian-registered 258,000-ton tanker *World Knight* struck by Iraqi missile southwest of Kharg Island. Damage is heavy. The missile wrecked engine room and set fire to the crew quarters. Seven crewmen killed and five badly injured. Tanker was on its way to Kharg Island.
11 October	The Indian 21,000-ton tanker *Jag Pari* struck by Iranian planes on the way to Kuwait. Ship suffered minor damage and one crewman wounded. Proceeded to Bahrain.
12 October	Fully loaded liquified Panamanian gas tanker *Gaz Fountain*, 24,000 tons, damaged by three rockets fired from Iranian aircraft in the central Gulf after loading nearly 20,000 tons of pressurized propane and butane gas at Ras Tanura. The crew abandoned the ship--declared a total loss.
15 October	The fully loaded Iranian 219,000-ton tanker *Sivand* hit by Iraq missiles and set afire after leaving the Kharg Island oil terminal.
19 October	In southern Gulf, Iranian F-4 jet fighter fired rockets into a Panamanian-registered diving support ship, the 1,538-ton *Pacific prospector*, east of Bahrain, setting it ablaze and killing two people.
3 December	386,000-ton Cypriot tanker *Minotaru* damaged by Iraqi missile on way to the Kharg Island oil terminal. Engine room set ablaze, but the fire was under control five hours after the hit.
8 December	Iranian F-4 jet fighter rocketed Kuwaiti supply boat in neutral waters off the exclusion zone imposed by Iraq around Kharg Island.
9 December	Iraqi warplane fires an Exocet missile at Bahamian-registered, 163,000-ton tanker *B. T. Investor*, on way to the Kharg Island oil terminal. Missile punches a hole in a port tank, just above the waterline. It fails to ignite a fire and causes negligible damage. No crewmen were hurt.
15 December	241,000-ton Greek tanker *Ninemia* heavily damaged by two Iraqi missiles on way to Kharg Island. First missile set tanker's engine room afire, killing two crewmen.
17 December	21,000-ton Greek cargo ship *Aegis Cosmic* hit in a port side cargo hold, apparently by an Iraqi missile, 85 miles north of Bahrain. vessel only slightly damaged. Crew suffered no casualties. Ship continued journey.
21 December	53,000-ton Liberian-registered tanker *Magnolia* hit by Iraqi missile 31 miles south of Kharg Island, and two crewman killed. Norwegian supertanker *Thorshavet*, loaded with 230,000 tons of Iranian oil, heavily damaged by Iraqi missile during same attack. 26 Crewmen abandoned ship.
25 December	Fully loaded, 277,000-ton Indian tanker *Kanchenjunga* hit by Iranian planes, setting fire to vessel's bridge and control room, and wounding crewmen. Fire brought under control within a few hours. Rocket attack was carried out 70 miles northeast of Qatar, after the tanker had taken on a full load of crude oil

	at Saudi Arabia's Ras Tanura terminal and was heading to Indiana. The ship headed instead for Dubai for repairs.
26 December	239,000-ton Spanish supertanker *Aragon* damaged by two rockets fired from Iranian warplanes. The tanker, which was on way to Ras Tanura to pick up load of Saudi crude destined for Spain, continued the journey.

Adapted from Dr. Raphael Danziger, "The Persian Gulf Tanker War," Proceedings, Volume III/5/987 (May 1985), pp. 160-175, and Nigel Line, "Merchantmen in the Gulf Front Line," Jane's Naval Review (1985), pp. 55-64.

To the extent that the lessons of the early phases of the tanker war can be separated from the later phases of the conflict, they may be summarized as follows:

- The "tanker war" escalated so slowly in large part because Iraq did not have a fully modern long-range fighter bomber with the kind of sensors and air-to-surface munitions available in an aircraft like the Su-24, Tornado, and F-15E. Iraq experienced some of its initial problems in carrying out such strikes, and in hitting ships near Kharg or further east, because its nearest secure air base was at Nasiriya, about 150 miles northwest of the Gulf and 300 miles from Kharg Island. Iraq initially could only fire anti-ship missiles from Super Frelon helicopters with a maximum combat radius well under 200 miles. The five Super Etendards Iraq obtained in November 1983 had a maximum combat radius of well over 200 miles, but still had range problems. Only the extended range Mirage F-1s Iraq began to receive in 1985 provided a combat a radius of over 300 miles. Iraq then had to overcome its fear of combat losses, lack of a targeting system with long range and endurance, and lack of operational experience. The key lesson Iraq learned was the need for long range target acquisition and attack capability -- a lesson similar to the one learned by the Argentine air force in the Falklands, [1]

- Iraq asked for the loan for the Super Etendards as early as February 1983, and began immediate training in France. It took delivery on the planes in November 1983. Nevertheless, it could not make them operational until six months later. Iraq then seems to have lost at least one of the five Etendards to maintenance problems and pilot error. This again illustrates the problem developing nations face in rapidly absorbing purchases of advanced arms.

- The fighter radars on the Super Etendard did not allow the pilot to properly characterize targets. This led the Iraqis to waste missiles on peripheral targets where overflights or maritime reconnaissance aircraft would have led to better targeting. Iraq could not solve this problem with its Mirage F-1s, and it indicates a need for either some form of modern naval reconnaissance

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1 "Iraq: Those Reports of New Weapons," Defense and Foreign Affairs Daily, Vol. XIII (June 25, 1984), p. 24.

aircraft or for a "smart" radar and avionics on the fighters used to deliver air-to-ship missiles that can do far more to characterize the nature of naval targets.

- The Iraqis did use direct air strikes and air-dropped mines from their Mirage F-1s and MiG-23BMs early in the "tanker war," but rarely hit moored ships with bombs and could not predict the targets with mines or ensure high lethality. They seem to have avoided direct rocket attacks by fighters for vulnerability and/or political reason. There are few confirmed cases of Iraqi fighters striking at moving ships with rockets or bombs, although both the Mirage F-1 and MiG-23BM should be relatively effective against such targets with such ordnance. This is in sharp contrast to the U.S. ability to sink Iranian ships in 1988, using A-6s with laser guided bombs. The importance of air ordnance that can cheaply and effectively kill commercial vessels is obvious.[2]

- Some reports claim that the Exocets launched through 1984 scored a very high ratio of hits: 52 out of the 53 missiles hit their targets, and only two out of 53 clearly failed to explode. Other sources indicate that the Exocets have experienced a number of detonation problems, similar to those fired in the Falklands, although it is difficult to tell whether the missiles' proximity and/or delay fuses failed or Iraqi arming and service crews should be blamed. This illustrates another lesson of war: The acute difficulty in getting reliable data on the actual performance of individual weapons systems.

- The Exocets and other small missiles generally failed to "kill" large merchant ships. They did, however, significant damage to 11 out of 17 tankers hit in 1984, which displaced over 50,000 tons, and slightly damaged six. The Exocets were more effective against smaller vessels, and against more complex or automated ships (the automated Safina al-Arab had to be written off because her machinery was too sophisticated to repair), and against ships where the hit happened to trigger a fire. Seven of the 33 small to medium-

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2 Rupert Pengelly, "Gulf War Intensifies," International Defense Review, 3/1987, pp. 279-280.

sized vessels were sunk, 19 were heavily damaged, and only seven received slight damage.[3]

- o Iraq was slow to turn to bombers using air-to-ship missiles. It waited until 1987, and then seems to haven used the Chinese Silkworm. This illustrates the problem of predicting intentions rather than analyzing capability. Some reports indicate the Egyptians sold and delivered eight Badger-A, and six Badger-G bombers to Iraq in 1982. Both types of aircraft had a free-fall bomb capability but the Badger-G also had an air-to-surface missile launch capability. As **Figure 14.1 (Old Figure 4.20)** shows, this capability was particularly important because there are rumors that AS-4 Kelt liquid-fueled missiles were included in the transaction, and that Iraq sought to purchase AS-6s from the USSR. Later reports indicated that Iraq obtained AS-4s from the USSR or that it obtained air-launched Silkworm missiles from the PRC.

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3 The hit effect of the Exocet was often impressive, given the comparatively small size of the missile. The AM 39 Exocet has a launch weight of 655 kg, and a 165 kg warhead, with ability to trigger burning of its remaining fuel on impact. It normally penetrates before exploding or burning (which means oil will damp out many of its effects unless oxygen is present in the burn explosion area), but lacks the power to burst most naval compartmentation. This indicates large warships like carriers would be far less vulnerable to such missiles.

What is clear is that Iraq was able to launch such missiles by 1987. The capabilities of these missiles is described in **Figure 14.2 (old Figure 4.21)**. The key systems include the (a) AS-2 Kipper, and obsolete Soviet anti-shipping missile; (b) the AS-4, a stand-off missile which is carried by Soviet Tu-22 Blinder bombers, and could be used by Iraq's Tu-16s or Tu-22s; and (c) the AS-6 Kingfish, a precision-guided Mach 3 missile which has not been widely exported.1

- While Iran never actually used suicide aircraft, there were recurrent unconfirmed reports of Iranian training efforts to use specially armed F-5s or F-7s in suicide attacks on warships. The chronology of the early days of the tanker war indicates that such attacks might have been a quite effective use of technology in a narrow "cockpit," like the Straits of Hormuz or the Gulf. where ships normally have only 15 to 20 km of low altitude warning (less than five minutes flight time), because of terrain masking. Such attacks would now risk major U.S. reprisals, however, and could be detected by E-2C and E-3A aircraft.[4]

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4 Tony Banks, "Running the Gauntlet in the Gulf," Jane's Defense Weekly, August 1, 1987, p. 182; Larry R. Dickerson, "Iranian Power Projection in the Persian Gulf," World Weapons Review, August 12, 1987, pp. 7-11; Rupert Pengelly, "Gulf War Intensifies," International Defense Review, 3/1987, pp. 279-280; and U.S. State Department, "U.S. Policy in the Persian Gulf," Special Report No. 166, July, 1987.

Figure 14.2

Air-to-Ship Missiles Affecting a Gulf Conflict

Type	Exocet AM.39	Harpoon AGM-84A	Maverick AGM-65B/C	AS-2 Kipper	AS-4 Kitchen	AS-5 Kelt	AS-6 Kingfish	Sea Killer	
Make	French	U.S.	U.S.		USSR	USSR	USSR	USSR	Italy
Launch Weight (Kg)	655	526	210		4500	5900	300	5000	300
Warhead Weight (Kg)	365	227	37.6		1,000	1,000	1,000	1,000	70
Warhead Type	Serat/ Hexolite Block	NWC	Shaped/ Blast Frag.		HE/N	HE/N	HE/N	HE/N	HE
Range (Km)									
o High Alt. Launch	70	92+	40		350	460	250	560	NA
o Low Atl. Launch	50	60	16		200	200+	180	250	6-25
o Launch w/ Remote TA	--	92+	--		--	400+	-	500+	--
Guidance	(a)	(a)	TV/ Optical Homing		(b)	(c)	(d)	(e)	(f)
Flight Profile	Dives to Skim	Dives to Skim	Optical to Target		Med. Alt. & Final Skim	Med. to Low Alt. & Skim	Med. to Low Alt.	Skim or Med. Alt. & Dive	Sea Skim
Fuzing	Prox & Delay	Impact/ Delay & Prox	Impact/ Prox.		Prox.	?	Prox.	Prox.	Contact & Prox.
Speed (Mach)									
o High Alt.	0.85	1.2	1.2		1.2	3.5	1.2	3	NA
o Low alt.	0.7	0.75	1+		0.7	0.95+	0.85-0.95	0.95	0.9
Typical Launch Aircraft	Super Frelon/ Super Etendard/ Mirage F-1	P-3C/ F-15CD MSIP/	F-5EII F-4F F-16		TU-16	TU-22/ TU-16	TU-16 B/G	TU-16G/ TU-22	Heli-copter

(a) Radar programmed with inertial mid-course correction, and X-band radar terminal homing for Exocet and advanced active radar homing for Harpoon.
(b) Simple autopilot midcourse correction with SARH.
(c) Inertial with midcourse correction and unknown homing system.
(d) AEM or SARH and IR with autopilot and midcourse correction
(e) SARH/IR and ARM with autopilot and midcourse correction.
(f) Radar beam riding with radar altimeter, plus command if required. Backup optical guidance.

Sources: Adapted from General Dynamics, The World's Missile Systems, 7th Ed., 1982; various editions of Jane's Weapons Systems and Soviet Military Power, 1985.

14.1.2 The Final Impact of the "Tanker War": 1984-1988

Figure 14.3 (Old Figure 4.24) summarizes the overall impact of the "tanker war" from 1984-1988. It is clear from this data that Iraq stepped up its attacks as Iran shifted to a tanker shuttle. It is also clear that Iran stepped up its attacks as it began to use the Seakiller, naval Guards, and Silkworm. It is interesting to note, however, that in the four years of war that took place after 1984, the time when the "tanker war" first reached serious intensity, and the ceasefire in 1988, there was remarkably little decisive combat.

This is easy to understand in the case of Iran. There were no Iraqi targets, and when it put too much pressure on ships going to neutral ports, the West intervened. While Iran might have dominated the "tanker war" by using low technology small craft and light weapons against ships going to nations friendly to Iraq, and by forcing these nations to pressure Iraq to halt its strikes on tankers, the West never gave Iran the opportunity to find out.

What is harder to understand is why Iraq never committed enough aircraft to achieve decisive military results. Ships continued to sail to and from Iran, and oil continued to be exported. Although Iran was forced into an expensive tanker shuttle between Kharg Island and transshipment points in the lower Gulf, it was always able to continue exporting oil.

Iraq's failure to achieve decisive results has a number of possible explanations. One is that Iraq was unable to achieve decisive results because it lacked the combination of maritime patrol aircraft or other sensors necessary to find its targets and long range attack aircraft with munitions powerful enough to kill large commercial ships. Another explanation is that Iraq was forced to act with considerable political restraint and had to to conserve its military assets.

On a purely technical basis, Iraq's main problem seems to have been target acquisition, although it is surprising that it could not cover the waters around Kharg Island more effectively. On a political level, Iraq may have been worried about provoking Iran into massive new land offensives and a "backlash" from friendly Gulf states who became caught up in Iran's attacks. One also cannot dismiss the fact that Iraq simply lacked the commanders and experienced pilots to conduct the kind of well planned and continuous attacks it needed to make. Iraq did, for example, claim to have carried out far more strikes than it ever executed and while these claims may have been propaganda, they may also reflect a considerable lack of realism and battle management capability within the Iraqi Air Force.

Figure 14.3 (Old Figure 4.24)

Patterns in the "Tanker War": 1979 -1987 - Part One

Targets in the Tanker War

Year/Country	by Iran	by Iraq	Total
Total Attacks By Source (Including Mines)			
1981	0	5	5
1982	0	22	22
1983	0	16	16
1984	53	18	71
1985	33	14	47
1986	66	45	111
1987	91	88	179
1988	39	-	-
Target By National Flag of Ship Involved			
Australia	0	1	1
Bahamas	1	2	3
Belgium	1	0	1
China	1	0	1
Cyprus	9	33	43
FRG	1	4	5
France	5	0	5
Greece	10	22	32
India	4	4	8
Iran	0	48	48
Italy	1	1	2
Japan	9	0	9
Kuwait	11	0	11
Liberia	24	36	60
Malta	1	11	13
Netherlands	0	2	2
North Korea	0	1	1
Norway	4	1	5
Pakistan	2	0	2
Panama	18	28	46
Philippines	3	0	3
Qatar	2	1	3
Saudi Arabia	9	2	11
Singapore	1	5	6
South Korea	3	3	6

Figure 14.3 (Old Figure 4.24)

Patterns in the "Tanker War": 1979 -1987 - Part Two

Targets in the Tanker War

Country	by Iran	by Iraq	Total
Spain	3	0	3
Sri Lanka	1	0	1
Turkey	2	8	10
UAE	1	0	1
U.S.	1	0	1
USSR	2	0	2
Yugoslavia	1	0	1
Unknown	2	42	44

The Pattern of Attacks By Nature of Attack System

Year	Air Launched Systems			Helicopter Launched	Missiles From	Rockets	Mines	Unknown	Total Attacks
	Missiles	Rockets	Bombs	Missiles	Ships	Grenades Gunfire from Ships			
1984									
Iraq	35	-	-	-	-	-	2	16	53
Iran	(18	)	-	-	-	-	-	-	18
Total	52	-	-	-	-	-	-	16	71
1985									
Iraq	32	-	1	-	-	-	-	-	33
Iran	(10	)	-	3	-	-	-	1	14
Total	(42	)	-	3	-	-	-	1	47
1986									
Iraq	52	4	1	1	-	-	-	8	66
Iran	(9	)	-	26	4	1	-	5	45
Total	(65	)	1	27	4	1	-	13	110
1987 (To October 12, 1987)									
Iraq	57	-	3	-	-	-	-	2	62
Iran	-	-	-	1	14	34	8	5	62
Total	57	-	3	1	14	34	8	7	124
Total: 1984 to 1987									
Iraq	176	4	5	1	-	-	2	26	214
Iran	(37	)	-	30	18	35	8	11	139
Total	(217	)	5	31	18	35	10	37	353

Figure 14.3 (Old Figure 4.24)

Patterns in the "Tanker War": 1979 -1987 - Part Three

Casualties and Losses by Year

Type	1984	1985	1986	1987	Total	
Killed		34	7	34	41	116
Wounded		17	20	43	87	167
Missing		9	3	10	15+	37+
Total of Above		60	30	87	143+	320+
Attacks With No Reported Casualties		8	36	55	117	216
Attacks with No Casualty Data Reported		17	4	6	20	47

Patterns By Type of Ship Attacked

Type	1984	1985	1986	1987	Total	
Oil Tanker/Product Carrier		21	35	78	125	259
Cargo/Freighter/Combination		11	9	1	31	52
Supply/Support		3	3	0	4	10
Tug		0	3	3	6	12
Other/Not Specified		2	0	2	3	7
Total		37	50	84	169	340

Adapted from Bruce McCartan, "The Tanker War," Armed Forces Journal, November, 1987, pp. 74-76, reporting by Lloyd's and Exxon; and the Washington Post, October 13, 1987, p.1; Ronald O'Rourke, "The Tanker War," Proceedings, May, 1988, pp. 31-32; and information provided by the Center for Defense Information. Data sources are not consistent.

14.1.3 Probable improvements in Third World Threats to Commercial Shipping

In any case, it is unlikely that Third World states will suffer from the same technical limitations in the future as Iran did in the Iran-Iraq War. Third World navies and air forces seem likely to procure heavier anti-ship missiles with the larger warheads necessary kill large cargo ships and tankers. The lessons of Iran-Iraq War and Falklands conflict also are likely to lead them to more use of laser guided and bombs, and various arms exporters to design and purchase of cheap air and ship mounted stand-off weapons for such missions. Many Third World nations are very vulnerable to attacks on shipping to and from their ports, and it is easy to foresee cases where aircraft and small craft will be used to launch missiles or mines that are far more lethal against commercial vessels than the Exocet or the weapons on the vessels used by Iran's naval guards.

Many Third World states are already considering ways to improve their naval target acquisition and battle management capabilities. Both the second half of the "tanker war" and the Falklands conflict have led many Third World states to consider buying maritime patrol aircraft in a naval conflict to provide long periods of target coverage and complex battle management near a target area.

Recent wars have also shown the a need for "smarter" radars and better target identification systems in order to characterize naval vessels and targets, although such systems are not currently available. It is also interesting to speculate, however, whether the Iran-Iraq War will lead more advanced states like the USSR to consider combining cruise missiles and satellite imaging for long range kills against commercial ships. The most critical commercial targets in the Gulf would probably show up on modern satellites. While cruise missiles are comparatively slow flying, it might still be possible to use them against such large, slow moving, and undefended targets are very long ranges and without committing surface ships to combat.1

14.1.4 Protecting Commercial Shipping

It is unclear what commercial ships can do to improve their defenses against more sophisticated threats. It is difficult to see that commercial ships can do a great deal in defense. They can mount light anti-ship missiles of their own; use chaff, reflectors, and decoys; and mount light surface-to-air missiles. These measures might help against low level and unsophisticated attacks, but are unlikely to help against the far more sophisticated electronics on most combat

ships and aircraft.[5] The only defenses such ships have against mines are their size and ability to survive a hit -- a defense that may be even less effective against more sophisticated mines than the Soviet M-08. 1

It is clear, therefore, that the West will have to reconsider the way in which it plans to project naval power in the future. While Western navies will have a distinct technical and operational "edge" of most Third World navies, they also may find it far harder to take losses in political terms. There are also obvious problems in dealing with prolonged deployments in areas which divert forces from NATO or other commitments.

Further, the evolving air and missile threat in the Third World is such that only Britain, France, and the U.S., can really afford to protect their vessels. These three nations must be fully ready to equip their smaller ships and on-board aircraft and helicopters with enough defenses and countermeasures to

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5 Various companies made a small fortune selling tankers and cargo ships devices like simple jammers, reflecting paint, reflectors, chaff, and decoys. These may have provided a morale boost, but had little effectiveness against the missile systems used by Iraq and Iran. Most anti-ship missile systems can easily overcome such low grade countermeasures.

deal with Third World threats.[6] At the same time, consideration should be given to designing small frigates or hydrofoil specifically for such missions. This could greatly cut deployment costs.[7] Similarly, the West should do everything possible to suitably equip friendly Third World navies as a substitute for Western power projection forces.

The U.S. deployed two other systems to the Gulf in mid-1987 which may also provide important lessons for reducing the risk and cost of future naval power projection. One was an RPV with an endurance of five hours and a flight range of 110 miles. This aircraft was only 16 feet long and have day/night sensors. These RPVs cost about $400,000 each and are relatively expendable they can perform close scouting missions against enemy naval forces and along defended coasts with minimum risk.[8]

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6 The French and British both had to greatly improve the countermeasure defense of their naval helicopters against small surface-to-air missiles when they deployed to the Gulf. Jane's Defense Weekly, April 9, 1988, p. 694; February 6, 1988, p. 205, and February 13, 1988, p. 269.

7 For an interesting analysis of the hydrofoil option see Lt. Stephen Chapin, "Countering Guerrillas in the Gulf," Proceedings, January, 1988, pp. 66-69.

8 New York Times, December 20, 1987, p. 1.

The other U.S. system was the Tomahawk conventional cruise missile. The U.S. deployed these systems to the Gulf in early 1987. The Tomahawk is 21 feet long, 21 inches in diameter, has a wing span of 8 feet, seven inches, and uses a turbofan engine in the 600 pound thrust class. It has a cruise speed of about 550 miles per hour and a land attack range of 1,550 miles. It has an anti-ship range of 275 miles. It can be launched from armored box launchers or vertical launch systems. The system moves to its target with great accuracy by following an exact computer simulation of the terrain or water areas it must pass over to reach its target. It can be set to fly low and pop up to dive into a ship or to explode its warhead after penetrating.

The U.S. never used cruise missiles during the Gulf conflict, but it developed the necessary high resolution computerized mapping capability for strikes against Iran's fixed Silkworm sites, key oil facilities, and a wide range of other targets. They offered a high technology solution to getting precision kills at very long ranges with virtually no risk of combat losses.[9]

Finally, long range helicopters or new systems like the V-22 tilt-rotor aircraft also act as means of expanding the coverage of ships. The U.S., Britain, and France all deployed armed helicopters to the Gulf. They all equipped their helicopters with advanced countermeasures, and it is interesting to note that Britain also equipped its Lynx Helicopters to provide airborne jamming against the Silkworm and Stinger using AN/ALQ-167 (V) electronic jammers and IR countermeasures. The minimum attack altitude of the Sea Skua missile on the Lynx also had to be lowered to one meter to attack the Iranian Boghammars.[10]

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9 Washington Post, January 20, 1988, p. A-18.

10 Jane's Defense Weekly, April 9, 1988, p. 694; February 6, 1988, p. 205, and February 13, 1988, p. 269.

14.2 The Attack on the *USS Stark* and Lessons for Surface Warfare1 [11]

Most of the naval encounters in the Gulf were so one-sided that they do not provide major lessons, except for the fact that many new naval weapons systems worked as advertised, and that the U.S. reliance on advanced weapons and electronics and carrier task group oriented combined operations can have great effectiveness in war. The lessons of the attack on the *USS Stark* are interesting, however, for what they say about the impact of human error, the vulnerability of modern ships, and naval fire fighting.

14.2.1 The Conditions That Led To the Attack

At approximately 9:12 on the evening of May 17, an Iraqi Mirage F-1EQ attacked the U.S. radar frigate, the *USS Stark*, about 85 miles northeast of Bahrain and 60 miles south of the Iranian exclusion zone. It fired two Exocet missiles, both of which hit the ship, and one of which exploded. While the Iraqi attack was unintentional, it sparked a whole series of debates over the U.S. role in the Gulf, U.S. defense capabilities, and U.S. relations with Saudi Arabia.

The Stark had left Manama in Bahrain at 8:10 AM, after completing an eight day in-port upkeep period. It cleared restricted navigational waters at 12:30 PM and proceeded into its operating area west of the Iranian Declared Exclusion Zone. It was participating in a two-day exercise with the *USS Coontz* and *USS La Salle* -

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11 Unless otherwise specified, the analysis in this section is based upon unclassified materials furnished by the U.S. Navy. The key source is Rear Admiral Grant Sharp, "Formal Investigation into the Circumstances Surrounding the Attack on the USS Stark (FFG 31) on 17 May 1987," Miami, Florida, U.S. Navy Cruiser-Destroyer Group Two, Ser00/S-C487, June 12, 1987.

- which also were assigned to the Middle East Task Force -- and with the USAF E-3A AWACS detachment, or Elf-1 force, based in Saudi Arabia.[12]

Early that evening an Iraqi fighter took off from the Shaibah airfield near Baghdad. This was the third Iraqi sortie directed against shipping in a twelve hour period. This time, however, the Iraqi Mirage flew an unusual night attack mission -- one of only 10 or 12 night air attacks up to that date.

The Iraqi fighter was tracked during virtually all of this mission by a USAF E-3A AWACS flying out Dhahran in Saudi Arabia. The E-3A first detected the Iraqi fighter at roughly 7:55 PM.[13] It was subsequently identified as a Mirage F-1 by a joint U.S.-Saudi ground tracking station. It was then heading southeast on a course of about 155 degrees. The AWACS continued to report on the Mirage continuously from this time on.

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12 During the days following the attack rumors surfaced that there were two Mirages flying such close formation that they appeared as one radar blip; that the planes had French, Egyptian, or Indian pilots; that the *Stark* was attacked with a laser guided missile or bombs, and that the attack was a deliberate Iraqi effort to bring the U.S. into the war. There is no current evidence to support any of these rumors.

13 Aviation Week, June 22, 1987, pp. 32-33

About one hour later, the Mirage crossed the Late Detect Line, a line drawn at about 27 degrees, 30 minutes, across the middle of the Gulf. The Iraqi flight flew unusually close to the Saudi coast and then turned north towards Iran. This led to the Iraqi fighter being classified as a "critical class track" which is watched more carefully than usual. A "Force Tell" communication was issued to alert all U.S. ships in the Gulf and the commander of the Middle East Task Force on the *USS LaSalle*. The AWACS increased its reporting frequency, and these reports were sent directly through the Navy Tactical Data System (NTDS) to the nearest ship, the *USS Coontz*, and were relayed to the *USS Stark*.

By this time, the Iraqi Mirage was flying southeast at a speed of 200 MPH, and an altitude of 1,000-3,000 feet. It was also about 15 miles from Saudi Arabia, and close enough to allow the pilot to confirm his track using the lights on the shore. The pilot, however, was flying at an unusually slow speed and was coming far closer to Saudi Arabia than was normal. Saudi Arabia responded by sending up two Saudi Air Force F-15s, which remained near the AWACS throughout the rest of the Iraqi fighter's flight.[14]

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14 The times used here are taken from the report of the House Armed Services Committee on the Iraqi missile attack on the *USS Stark*, "Report on the Staff Investigation into the Iraqi Attack on the *USS Stark*", issued on June 14, 1987, and from a chronology issued by the Department of Defense and presented by Rear Admiral David N. Rogers, after going on a fact finding trip to the

The U.S. ships in the Gulf could not yet track the Iraqi Mirage. Although their AN/SPS-49 Air Search Radars have a maximum range of 200 miles, this range is highly dependent on weather conditions and target altitudes. The AWACS, however, was now providing an unedited real time downlink to the *Coontz*, which relayed the track to the *Stark* at 8:10 PM.

The *Stark's* Captain, G.R. Brindel, was advised of this track no later than 8:15 PM, -- roughly one hour before the *Stark* was attacked and when the aircraft was still 200 miles away. He instructed the Tactical Action Officer (TAO), the senior officer in command of the CIC, to keep a close watch on the aircraft's progress. He then left for the bridge and arrived on it at 8:31.

At this time, the *USS Stark* was operating in an area along the Iranian Exclusion Zone called Radar Picket Station-South. At 8:24 PM, it began a full power run in preparation for the exercise to be held in a few days. The ship's engines were raised to full power and the speed was increased to 30 knots. The ship's engines, however, began to produce abnormal temperature readings, and ship speed was reduced to 15 knots, and course was changed to 300 degrees (northwest).

These problems in preparing for the coming exercise may have contributed to some of the events that followed, although the *Stark* was kept in a state of Condition 3 readiness. This is the third of five different readiness states and requires all weapons and sensor stations to be manned and allows all weapons systems to be engaged in a short period of time. All consoles in its Combat

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Middle East for the Joint Chiefs of Staff. Because of changes in the time zones in the Gulf, some reports use times one hour earlier.

Information Center (CIC) were supposed to be fully manned and operational, although this does not seem to have been the case.[15]

The Iraqi fighter was first detected by the radars on the *USS Coontz* at 8:43 PM when it was about 120 nautical miles from the *Stark*, and on a bearing of 285 degrees. As a result, the Captain of the *Stark* became concerned because his ship was not tracking the aircraft. He sent an order to the CIC at roughly 8:55 PM to shift the AN/SPS-49 air search radar to the 80 mile mode to attempt to acquire the Mirage. This command shifted the antenna to focus on aircraft lower on the horizon and closer to the ship. The change in radar mode worked, and the *Stark's* radar detected the aircraft at a distance of about 70 NM and a bearing of 260 degrees.

14.2.2 The Events That Made the *Stark* Vulnerable

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15 Condition 1 is General Quarters with all crewmen manning battle stations and all non-combat activities such as mess operations halted. Condition 2 is when a ship has been operating at Condition 1 for an extended period and critical operations like mess and repairs must be carried out. Condition 3 puts one third of the crew at battle stations at all times. It is the normal wartime operating state. Condition 4 is used for routine sailing from port to assignment or in untroubled waters. Condition 5 is when a vessel is in port and only partly manned.

The sequence of events that followed was critical to making the *Stark* vulnerable. Shortly before 9:00, the USAF E-3A in the area and the USS Coontz reported the fighter was at 26-36N/050-51E, and on a new easterly course of 043 degrees and flying at 290 NMPH at an altitude of 3,000 feet. Moments later, the personnel on the CIC reported a surface contact which later turned to out to be a misreading. At 9:02, an Electronic Warfare Technician in the CIC detected an aircraft's radar emissions and correlated them to the Cyrano IV radar on the Mirage F-1. [16]

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16 Iraq claims the course was 061 degrees. Ironically, an Iraqi fighter had flown a similar flight profile towards the *USS Coontz* only three days earlier. The *Coontz*, however, transmitted a message asking the Iraqi fighter for its identification and intentions while it was still 39 miles away. The ship also changed course to bring it broadside to the Mirage, mounted a Standard surface-to-air missile, armed the chaff launcher, and unmasked its radars. It never locked on its fire control radar because the fighter's radar stayed in the surveillance mode. The Iraqi fighter came within 10 miles of the *Coontz*, but never turned on its fire control radar, and went on to attack a tanker.

At virtually the same time, the Watch Supervisor on the USS *Stark* advised the TAO that the aircraft was approximately 43 miles from the ship. The maximum range of the Exocet is about 40 miles, and the Watch Supervisor asked the TAO if he should radio a standard warning to the aircraft. At 9:03, the TAO instructed him to wait. About one minute later, the Watch Supervisor advised the TAO that the Mirage was now on a course that had a closest point of approach (CPA) within four miles of the *Stark*. The TAO replied that he expected the aircraft would soon turn away from the ship.

At 9:03, the *Coontz* reported to all U.S. ships and the E-3A that the Iraqi aircraft was flying at 310 NMPH at 3,000 feet, and was headed towards the *Stark*. At 9:04, at the request of the *LaSalle*, the *Stark* confirmed that it was monitoring the Iraqi flight, and that no other surface ships were within 25 NM.

At 9:05, the Mirage F-1 turned directly towards the *Stark*, and flew within 32.5 NM of the ship. This turn was not detected in the ship's CIC until 9:07, but the radar operator on the Stark detected the fact the ship was being illuminated by the fighter's Cyrano 4 radar in the search mode. At 9:06 PM, the operator confirmed he was tracking the aircraft in response to a query by the AWACS. He also temporarily turned on the audio signal from the SLQ-32 so everyone in the CIC could hear when the ship was being searched or tracked by the fighter. The Mirage F-1 then moved within 22.5 NM of the ship and fired its first Exocet missile.

At 9:07 PM, the Watch Supervisor advised the TAO that the CPA had increased to 11 miles but that the Mirage was now only 15 miles from the ship. The TAO first asked a specialist in the CIC to man the weapons control officer console around 9:07. This was briefly delayed because the Executive Officer was sitting at the console.

At 9:08, the TAO ordered that a radio warning be given, and ordered that the Captain be called to the bridge.1 The first warning was broadcast on 243.0 Mhz (a Guard frequency all aircraft in the Gulf were supposed to monitor). The warning said, "Unknown aircraft: This is the U.S. Navy warship on your 072 at 13 miles. Request you identify yourself, over." This wording departed radically from the orders governing the proper content of such messages and did not provide a formal warning to the aircraft.

The AN/SLQ-32 ESM radar on the *Stark* again detected that the ship was being illuminated by the Iraqi fighter's Cyrano 4 tracking radar at about 9:08 PM.1 The radar operator asked the Stark's TAO for permission to arm the ship's two SRBOC chaff launchers on its port and starboard sides. Permission was given.

The operator ran to the deck above, prepared the launchers, and returned some 30 seconds later.[17]

The Iraqi fighter made a sharp turn to the right and increased speed between 9:08 and 9:10 PM. At approximately 9:08 PM, the Stark issued a second warning, stating its position as being on a bearing of 076 degrees and at a distance of 11 NM. This message again did not follow the proper format for a warning. No reply came from the Iraqi fighter, and it is important to note that Iraqi tactics routinely involved firing at radar blips, rather than at targets confirmed by sight. Iraqi pilots also were not compelled to monitor international distress or Guard frequencies, and often did not so. Further, at least the second warning came after the launch of the first missile, and this may have been true of the first.

The Stark then detected a lock on by the fighter's radar which lasted 5-7 seconds.[18] Between 9:08 and 9:09, the TAO finally began to take more active

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17 Other reports indicate that the *Stark* detected illumination by the search radar at 9:06 PM, when the aircraft was 27NM away and on a bearing of 269 degrees, and the *Stark* was then at 26-47.4N/051.53.8E.

18 Radars have two primary modes of operation: Search and Track. The radar pictures are displayed on a cathode ray tube screen and search radars cover a wide circular area, with

displays somewhat similar to the weather patterns shown on TV. A tracking or fire control radar emits a concentrated signal that follows or "tracks" a given object. When a radar switches from search to track it is warning that the operator is considering firing his weapons. This is sometimes referred to as being "painted" or as "lock-on". Depending on the weapons system, its fire control computer may need either a continuous or temporary track to fire the system.

Most modern weapons have terminal guidance to reduce or eliminate the need for continuous tracking. The Exocet has variable modes that allow terminal homing at range of 2, 4, or 6 miles from the target. The SLQ-32 on the *Stark* was programmed to detect the tracking radar

defensive measures. He called General Quarters and switched the ship's Phalanx Close-in Weapons System (CIWS) to the Anti-air Warfare Mode. This made its radar active and allowed it to perform all functions except firing. It would now search automatically for incoming missiles and lock-on its tracking radar but could not fire without an order.

The TAO also ordered the ship's Mark 92 fire control system -- which guided its three inch guns, Standard missiles, and Harpoon missiles -- to lock on its tracking radar if it detected an incoming missile, and to notify the CIC it was ready to fire on order. The ship's radar operator could not comply, however, because the primary STIR radar was blocked by the ship's superstructure. The TAO then

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on the missile. In theory, the radar operator on the *Stark* should have had both an audible and visual alert that the Exocet missile was tracking the ship the moment its radar began terminal homing. In practice, he had turned off the audio alert because so many signal were coming in he could not concentrate on his duties. He denies he had visual warning, but this may have been ignored in the confusion caused by so many activities in a complex signal environment. Further, the Iraqi Exocet may have been modified to turn on its tracking radar only at the last minute.

ordered that the secondary CAS radar be utilized, but this was too late to be effective.[19]

At 9:09 PM, a lookout on the port side reported the first inbound missile.[20] Visibility was about 2,000 meters. The lockout did not originally recognize what he

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19 Re-positioning the ship was critical for both optimal radar operation and to allow its close-in defenses to function. The STIR (separate Track and Illumination Radar) has nearly twice the target track range of the CAS (Combined Antenna System). The CIWS cannot function if the superstructure of the ship is between it and the bridge. Failure to re-position the ship and take every alert measure as soon as possible creates far more activity in the CIS, which distracts all radar and EW crew.

was seeing, but seconds before impact he realized the flash and the bobbing blue fireball near the horizon that followed was a missile and started screaming "inbound missile". This warning came far too late to have any effect. The missile was closing at a speed of 600 miles per hour, and was coming from a direction 10 to 15 degrees off the port bow. This was within a 30 degree blind spot where the ship's structure obscures the radar coverage of the Phalanx.[21]

14.2.3 Damage, Damage Control, and Fire fighting

The *Stark* was hit about five seconds later.1 The first missile hit on the port side on the second deck. It did not explode, but broke in two parts, spewing some 300 pounds of flammable propellent through a sleeping area where sailors were just settling down and then tore through the barber shop and post office and came to rest against the opposite hull. Power to the CIC was lost only momentarily, and most of the crew did not realize the ship was hit.

The second missile, however, was spotted seconds later and detonated at 9:10 -- this was 20-30 seconds after the first hit, and just as the Captain entered the CIC for the first time. It hit in the same general area in the crew quarters near the ship's Combat Information Center, ripped a 15 foot hole in the side of the ship, and exploded about five feet into the hull. This blew five men in to the water, and 37 American sea men died, and 11 others were seriously wounded. It shut off all power to the CIC, caused serious structural damage, compromised watertight integrity, and cut the main port water main used for fire fighting.

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20 There are some differences in the reports because some ships had a nominal time one minute earlier or later than others. Accordingly to one report, the Iraqi fighter had fired one Exocet missile at 9:10:05 PM and a second at 9:10:30 PM.

21 New York Times, June 4, 1987, pp. A-9, and Wall Street Journal, p. 66.

The explosion set the remainder of the first missile on fire, and led to the burning of some 600 pounds of propellant from the two missiles in the berthing compartment. This caused a set of secondary fires which eventually forced the abandonment of the RICIR and CIC, sometimes reached temperatures of 1,400 degrees, and produced blinding smoke throughout much of the ship. All radio capability was lost, and PRC radios from the aircrew survival vests had to be used to establish communications. 1

The crew had only partial training in using its oxygen breathing apparatus (OBA), and even though the ship had nearly twice its normal stocks of some fire fighting equipment, insufficient gear proved to be available for fire fighting.1 Many of the emergency escape breathing devices seem to have only functioned for a limited period. Even the OBAs often gave only 22 minutes of air versus the hour they were supposed to and the need to change canisters in a smoke free environment meant they sometimes allowed only 10 to 12 minutes for fire fighting. The crew also rapidly found it lacked the proper clothing and power cutting devices for fire fighting, and suitable emergency pump capability.[22]

The *Stark* managed to restore fire main pressure at 9:38, but not in the ship's magazines. The crew could only remove the threat of ammunition explosions by throwing some supplies overboard and using hoses to cool the magazine. The ship maintained electrical power, but stopped the engines and went to a maximum list of 16 degrees. At 11:30, a salvage tug arrived. It provided water cannons and a hose to cool the ships magazine.

The ship suffered major additional damage because it was not prepared to use its fire fighting equipment. It was only able to limit casualties and go on fighting because supplies were brought in be helicopter and from other ships. It would almost certainly have sunk if it had not been for the aid of a commercial tugboat. The heat was so severe that radiation between bulkheads spread the fire, and it melted aluminum ladders and deformed the aluminum superstructure.1 Although the ship's power drive was not hit, the fires eventually forced it to halt. Even flooding the magazines was not enough because of the heat. If the water from the

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22 The ship had only 30 OBAs and 400 air canisters when the attack occurred. It eventually needed 1,400 more canisters during the 18 hours required to fight the fire.

tugboat had not kept the missile storage compartments in the path of the fire flooded, the ship might have exploded.1[23]

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23 U.S. Navy reports issued in October, 1987, valued the damage to the *Stark* at $142 million, with $77 million damage to the ship and $62 million in damage to government furnished equipment. It recommended that all new ships receive design changes to improve survival in missile attacks, but noted that new U.S. ships like the DDG-51 already incorporated most of the lessons of the *Stark* attack because of information provided by Britain on its lessons from the Falklands conflict. They also recommended that more fire insulation be added to the bulkheads and undersides of decks, reductions be made in combustible materials (particularly electric cables), the use of diesel fuel for pumps, more smaller pumps, and improved fire fighting

14.2.4 The Problem of Human Error

It is impossible to evaluate how well the ship might have done in different hands, but the *Stark's* defenses should have been formidable. The *USS Stark* was tracking the fighter when it fired on the ship, but it never turned on its fire control radars. The only major question is whether the ship's electronic warfare systems were able to detect the fact the ship was being illuminated by the tracking radar on the Iraqi Mirage F-1EQ, and whether the radars should have detected the actual firing or "separation" of the missile. The evidence cited by the U.S. Navy indicates

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equipment included protective clothing and equipment for cutting through decks. One of the basic problems the U.S. advisory team faced was that the greatest single problem was electrical cables and the solution required a conversion to next generation optical fibres which permitted both the use of fire resistant cabling and a major saving in cable weight. Jane's Defense Weekly, October 24, 1987, p. 935; Philadelphia Inquirer, September 6, 1987, p. A-1; Washington Post, October 16, 1987, p. A-1.

that if all the systems in the ship had been properly turned on and operated, it would have been able to defend itself.[24]

The *USS Stark's* defensive systems included Standard ship-to-air missiles, Phalanx automatic anti-missile radar-directed Gatling guns, automatic chaff

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24 The Captain of the *Stark* later charged that the SPS-49 air-search and SPS-55 surface-search radars on the ship could not reliably detect a missile as small as the Exocet. This might have been true, but the *Stark* probably would have detected the missile if the Mark-92 CAS search/fire radar had been in the fire control mode. He also charges that the SLQ-32 did not function. The SLQ-32 did have to be modified to improve its coverage of Exocet. Given the problems the operator had at the time, however, it seems just as likely that the operator did not notice, or react to, warning. Defense News, November 23, 1987, p. 1 and Navy Times, October 26, 1987, p. 1.

dispensers, and electronic warfare equipment.1[25] The ship also had turbine engines capable of rapidly accelerating it to 33 knots, and such maneuvers could

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25 The *Stark* did not, however, have the Block One version of the Phalanx. This uses an improved version of closed-loop spotting to simultaneously measure both target and bullet location and constantly update the fire control solution. It uses a six barrel M61A1 Gatling gun with electrical train and elevation controls, and its improved ammunition feed system overs 50% more capacity than then original model. The radar is integrated into the system by a digital computer which controls a servo/gun mount. The radar operates in a standby mode, and the improved Block 1 version can attack high elevation as well as low altitude targets. There are well over 400 of the older Phalanx systems in service in 52 different navies.

further confuse the missile's guidance system in combination with its other defenses.1[26]

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26 The long range SPS-49 radar on the ship provides up to 200 miles of warning of aircraft movement. The Standard missile is a General Dynamics system with ample range to have attacked the fighter but was not used because it was not believed to be hostile. The AN/SLQ-32 electronic warfare and surveillance system is designed to detect and identify incoming radar-guided anti-ship missiles, but does not seemed to have warned of the attack or identified the missile. The Mark Sperry Mark-92 fire control radar, which also directs the 76mm Oto Melara radar controlled gun, was supposed to detect the narrow beam radar used when missiles were fired, but may not have done so. The General Dynamic Phalanx gun system consists of a six-

In practice, the previous series of command changes meant that none of the *Stark's* defenses were used -- a fact which eventually led to a U.S. Navy report which blamed the incident on a collapse of command, and which resulted in the relief of the ship's Captain, executive officer, and tactical action officer (TAO).[27] The Captain and tactical action officer were reprimanded and allowed to resign from the navy. The executive officer was disciplined, but allowed to stay in the service.[28]

The Iraqi attack was never really challenged because of human error. Its commanders did not treat their duty as a combat situation and did not maintain or establish proper watch manning and standing or weapons readiness. While the ship had tracked the incoming Iraqi fighter, the *Stark* had delayed any warning of the Iraqi aircraft.

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barrel radar-guided 20mm Gatling gun that can fire 30,000 rounds per minute. Finally, the ship had a Tracor Super Rapid Blooming Chaff system with another automatic sensor and launch system, but this was not turned on. .

27 Washington Post, June 20, 1987, p. A-1.

28 Washington Times, July 29, 1987, p A-6; and Washington Post, July 20, 1987, p. A-1 and October 16, 1987, p. A-1.

Even though the *Stark's* Captain was first notified of the fact an Iraqi aircraft was operating in the area when the plane was still over 120 miles away, he did not continue to monitor its progress. He instead conducted a high speed run exercise, and then left the bridge at 10:00 PM.

Although the tactical weapons officer was asked if he should warn the Iraqi fighter it was closing on a U.S. ship when it was still 43 miles away, the TAO waited until the aircraft was within a range of 13 and then 11 miles to send a warning. The Captain was making a "head call" and was in his cabin when the missiles hit, and his two senior officers did not take measures to position the *Stark* to improve its defensive coverage or activate its defenses.[29]

The ship had never been turned in the proper direction towards the target. This meant the ship could not use its main fire control radar antenna effectively. An automatic audio alarm to warn of incoming missiles had been turned off because the crewman found it distracting, and the crewman who should have visually detected a radar blip at missile launch was later reported to have been occupied with other duties. This makes it impossible to know whether the radars and

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29 Ibid. Three days earlier, the *USS Coontz* had had a similar experience. It warned the Iraqi fighter at a range of 39 miles, turned the ship to improve its defensive position, and readied its chaff and terminal defense weapons.

electronic warfare systems on the ship detected the firing of the missile, but it seems likely that they did so.[30]

The *Stark* did not detect the fact the Iraqi Mirage had fired two Exocet missiles until a lookout on the deck saw one of the missiles coming. The ship then had only about five seconds of warning, and none of its automatic defenses were turned on. Further, the failure to re-position the ship blinded the radar on the Phalanx system, which is designed not to track in areas where it might lock on the ship's superstructure.[31]

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30 At least the ergonomics of the system are highly questionable. The system produces only a short visual blip during actual tracking by a missile. The operator not only had to watch the scope for this blip, but communicate orally with the TAO. The ship's radars do, however, have a relatively slow scan rate and are designed for optimal detection of ships and aircraft, rather than high speed missiles.

31 The system had had some intermittent failures in late April, but there is no reason to assume it was not fully operational at the time of attack.

This sequence of human error is partly excusable. Part of the reason for the *Stark's* failure to react was that U.S. Navy ships in the Gulf routinely experienced Iraqi strikes against shipping in their area of operations. Even so, the *USS Stark's* officers should clearly have taken precautionary measures much earlier.[32]

14.2.5 The Role of the Iraqi Pilot

The Iraqi pilot, was also clearly to blame. He had flown 15 previous missions in the Gulf, and knew of the risk he might strike at friendly ships. It is true that the attacking Mirage F-1EQ aircraft was flying an unusual night mission, and was carrying two Exocets, which were twice its rated capacity.

This represented a payload which would have produced constantly buffeting of the fighter from aerodynamic drag, raised fuel consumption, and created high pilot fatigue.[33] Nevertheless, the pilot was grossly negligent. He later claimed to have been monitoring both major distress frequencies on 243.0 Mhz and 121.5 Mhz. This, however, was not standard Iraqi practice and it is unlikely that he did so. He also claimed he never received any signal from the *Stark* -- which is absurd given his distance from the ship and the fact a radio log confirms the fact such messages were sent.

Most importantly, the Iraqi pilot claimed that his navigation gear indicated the ship was 5-10 nautical miles inside the Exclusion Zone, not 10-15 nautical miles outside it. Nevertheless, the Iraqi pilot seems to have preserved radio

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32 U.S. ships often were illuminated or painted by the radars of Iraqi aircraft. Washington Post, June 4, 1987; Jane's Defense Weekly, May 30, 1987, p. 1040; New York Times, June 4, 1987, p. A-9, June 1, 1987, p. A-1..

33 Washington Post, June 2, 1987, p. A-11.

silence and simply fired at the first target confirmed by his radar.[34] All the pilot's actions in flying both to and from his target indicate that he knew his position, and knew he was firing outside the Iranian exclusion zone. If he had not known his position, he could not have flown the precise return course he used to get back to base. Finally, the Iraqi pilot only turned on his tracking radar seconds before he fired. This was only justifiable in a combat environment where he faced hostile ships with air defenses, which he did not. The Iraqi pilot made no real attempt to identify his target even by radar.[35]

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34 Washington Post, May 25, p. A-1 and May 26, 1986, p. A-15; Aviation Week, May 25, 1987, pp. 23-25. One theory advanced immediately after the attack was that the "accident" was a deliberate Iraqi attempt to internationalize the war. Nothing about the Iraqi flight pattern or prior Iraqi activity supports this thesis.

35 Iraq did not allow the U.S. investigating team that visited Iraq to interview the pilot. It claimed that he had 1,300 hours of flying time, including 800 hours on Mirage fighters. The Iraqi

14.2.6 The Major Lessons of The *Stark* Incident

The major lessons from the attack on the *USS Stark* are familiar ones, and may be summarized as follows:

- No commander in a war zone can afford to take the risk of dealing with attacks or intrusions as routine matters. Every possible attack must be dealt with as an attack, and all officers on a ship must act accordingly.

- Rules of engagement must encourage military defense, not political restraint. Battle orders must be issued for the specific conditions under which a ship operates, and not simply in generic terms.

- Full combat readiness, and placing every man on his duty station, is as critical with modern ships as at any past time in naval combat. It is virtually impossible to defend a ship or deal with damage without having all men at their duty stations.

- IFF has become as important in the case of missile as in the case of aircraft.

- Given the world arms market, no system can be assumed to be friendly.

- Defense systems must be much more tightly integrated and be less subject to constant operator attention. The CIC of a ship must be able to take integrated and decisive action from several points.

- Regardless of the exact cause of damage to the *Stark*, all Western missile electronic warfare systems need extensive review to see if they can reliably detect all Western-designed missiles and not simply Soviet or communist designs. Far too many Western naval missile defense systems are over optimized towards a limited number of threat missiles.

- Special emphasis needs to be placed on short range defense. Many anti-ship missiles can only be detected at ranges of 22 miles or less. This requires the

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ambassador to the U.S. later conceded that the Iraqi plane might have made a navigation error.

Washington Times, July 17, 1987, p. A-1.

ability to quickly react and to use several defenses at the same time. Increasing emphasis is being placed on combined light missile and rapid fire gun defenses. Heavy emphasis is also being placed on new guidance systems which can deal with the IR and radar reflections or "clutter" inherent in tracking low flying missiles.[36]

- Fire fighting and damage control are as important in naval combat as active defense. The U.S. Navy had had the advantage of learning from earlier carrier fires and from the damage done to British ships in the Falklands, but immediately had to strengthen its fire fighting capability as a result of what it learning from the damage to the *Stark*.[37]

- Damage control training levels were high, and equipment had been added as a result of the British experience in the Falklands. Nevertheless, the U.S. Navy recommended a major increase in breathing aids, bulkhead cutting equipment, night vision devices with thermal sensors to detect small fires, added fire main jumping stations, emergency radios, larger deck scuttles to allow free movement of the crew, high capacity light smoke removal equipment, topside deck drains to remove fire fighting water, improved fire fighting uniforms, high volume fire suppression systems in critical electronics areas, and added pumps.

- While aluminum may not present a serious risk per se, many Western warships are designed with too much emphasis on defense and mission

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36 Robert M. Greeley, "Falklands, Gulf War Spur Navy to Upgrade Short-Range Ship Defenses," Aviation Week, April 4, 1988, pp. 17-18.

37 For an excellent analysis of the detailed fire fighting lessons involved, see James Kitfield, "Fire fighting: Have The Lessons Been Learned?," Military Forum, March, 1988, pp. 22-37.

capability and too little emphasis on survival. Packing the maximum amount of electronics in a ship like the *Stark* compromises survival, and the cost-effectiveness may only exist if the ship never fights a serious war. This is particularly true because of the West's acute limitations in military shipyard capability. Under many conditions, a war would be over before significant repairs could take place.1

14.3 The *Bridgeton* and the Mine War

The West feared an Iranian effort to mine the Gulf from the very start of the Iran Iraq War. At the same time, it tended to focus on the threat to close the mouth of the Gulf and to ignore any other threat except the occasional risk of free mines. Mining the Straits of Hormuz seemed to be beyond the military capabilities of a nation like Iran. Oman controlled the shallow passage and Coin Islands in the Straits, and the deep water channel between the Island of Jazye Larak in Iran and the rocks off Didamar in the South is nearly 20 miles wide and has an average of 60 meters deep and a maximum depth of 89 meters.

There were strong currents moving through the Straits, and the two types of mines which are hardest to clear--pressure and acoustic--cannot be used below 40 to 50 meters. Magnetic contact mines could be deployed in either bottom or moored forms, and horned-antenna contact mines could be bottom moored. These mines, however, weigh about a ton, roughly, and 2,000 to 3,000 would be needed to close the straits, and even limited mining activity would be quickly detected by the West. Mobile unanchored oscillating mines, drifting mines, and drag (chain) mines would also have to be laid in large numbers and be detected. While Iraq cannot defend the Straits against mining or naval action, the West can, and the technology ensures considerable warning.

The U.S. in particular, however, forgot that a bottle can be broken in more places than its neck. As a result, it learned important lessons about mine warfare from its naval deployments in the Gulf, many of which were far from than pleasant.

14.3.1 The Background to the Attack

The *Bridgeton* incident was the key to these lessons. If the Iraqi attack on the *USS Stark* challenged both the quality of U.S. anti-air and anti-missile defenses, the mining of the Bridgeton raised other issues. It again raised questions about the quality of American military planning, and about the U.S. Navy's ability to fight low level wars. Further, it exposed the weaknesses in the U.S. mine warfare program and the potential dangers the U.S. faces in relying on its allies to perform specialized roles and missions.

It is clear that the U.S. should have been far more alert to the risk of mine warfare than it was before the *Bridgeton* was hit. Soviet ships had already hit mines on their way back and forth to Kuwait. U.S. defense spokesmen had stated early in the U.S. effort to reflag eleven Kuwaiti tankers that mines were one of the two greatest risks the U.S. faced. Further, the U.S. had been remained of the reality of the threat only days before the *Bridgeton* hit a mine.

The U.S. announced on July 14, 1986, that it would begin to escort the reflagged Kuwaiti ships in one week. That same day, the U.S. indicated it had delayed its convoy activity because clearing the Iranian mines from Kuwait's main shipping channel was taking longer than had originally been anticipated, and the other channel was too close to Iranian waters to be safe. The U.S. announced at the same press conference that the U.S. *Bridgeton* (Al Rekkah) would be one of the first tankers to be escorted by the time the mines were cleared.[38] In response

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38 Ironically, the reflagging made a significant increase in the U.S. cargo fleet. The U.S. merchant marine was now half the size of the Soviet one. Although the U.S. calculated it would need some 373 vessels in a national emergency, with a deadweight tonnage of 19.4 million, it had less than 200 vessels with a capacity of 13.2 DWT and less than one half of the tankers it required. U.S. shipyards were building less than 1% of world shipping, and the number of yards was expected to drop from 116 in 1982 to 65 in 1990. Further 45 of the tankers that did remain in

to follow-up questions, a U.S. official noted that none of the nine U.S. warships in the Gulf was a minesweeper and that the U.S. had no MH-53 Sea Dragon minesweeping helicopters in the region -- although five were ready to deploy.[39]

The U.S. stated later that a plan to send a 200 man detachment and mine warfare helicopters to the Gulf was deferred because Kuwait planned to lease Dutch minesweepers and obtain Dutch technical assistance. This mine clearing effort in Kuwait had a peculiarly international character. Some of the work was done by Soviet and Dutch experts, and other work by Saudi minesweepers and an

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U.S. service only did so because foreign flags were forbidden to move oil between Alaska and the

U.S. This had some interesting implications for any war in the Gulf because U.S. ships had

carried 80% of the military cargos in the Korean conflict and 16 million long tons of POL and 65%

of other cargo during the Vietnam conflict. Tankers were 30% of the ships Britain deployed to the

Falklands.

39 This was not accurate. The force was not ready to deploy and was not airlifted to the Gulf until

August 1, 1987.

18 man U.S. Navy Explosive Ordnance Disposal detachment. The mines turned out to be old Soviet MO-8 mines which Iran had bought from North Korea could be planted to a depth of 350 feet and which had 250 pounds of explosive.[40]

14.3.2 The Strengths in the U.S. Convoy Effort

Part of the reason for the U.S. failure to plan for mine warfare seems to have lain in the way the U.S. Navy focused on the Iranian threat, and the resulting balance of strengths and weaknesses in the forces it deployed to protect its first convoy.

The main strength of the U.S. force that accompanied the first convoys was that it consisted of a relatively large force to convoy only two tankers. The U.S. had four frigates, three cruisers, and a destroyer in the area around the Gulf and the Straits of Hormuz. These ships had gone through three rehearsals since the last elements of the escort force had arrived in early July, and the escort plan had reached the size of an 80 page document. The U.S. also had a carrier task force, including the carrier *Constellation*, in the Indian Ocean. The battleship *Missouri*, two more cruisers, and a helicopter carrier were in transit to the region.

The convoy plan called for three to four U.S. ships to escort each of the two tanker convoys while the cruisers stood buy to provide a defense against air attack. U.S. A-6 and F/A-18 attack aircraft. EA-6B jamming aircraft, and F-14 fighter planes were to provide support from the U.S. carrier Constellation in the Arabian

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40 Some of these mines later turned out to date back to 1908. Washington Times, July 2, 1987, p. A-1, and July 15, 1987; Washington Post, July 2, 1987, P. A-26. . Baltimore Sun, June 27, 1987, p. 2A, Christian Science Monitor, July 2, 1987, p. 11; New York Times, July 2, 1987, p. A-2.

sea. The tankers were to have at least three escorts once they passed beyond the Straits, with USAF E-3A AWACS providing airborne surveillance.

The U.S. planned to provide convoys once every two weeks during July and August. This interval was intended to allow the task force concept to be tested, and to find out Iranian reactions. It also eased the burden of being on constant alert against suicide attacks or other means of irregular warfare. The destroyer *Fox* and cruiser *Kidd* were selected in part because their 76mm guns provided considerable firepower against sudden raids by the Iranian Navy or shore targets. All of the U.S. combat ships were equipped with long radar radars, data nets, and Phalanx terminal defense guns.

14.3.3 The Inherent Weaknesses in U.S. Mine Warfare Forces

The U.S. force also, however, had several weaknesses. These included the lack of local naval and air bases in the Gulf, its inability to provide a cross-reinforcing defense of single ships operating outside the convoy to minimize the success of a saturation attack, and its lack of mine warfare defenses. It was the latter weakness that Iran chose to exploit.

The U.S. lack of mine warfare defenses was partly a matter of inadequate planning. The initial operational plan the Joint Chiefs and USCENTCOM developed for the convoy made no provision for mine forces in spite of warnings from U.S. intelligence officials and the U.S. Navy.[41] The U.S. Navy, however, was not ready to carry out the mine warfare mission. It relied on its European allies for most mine warfare missions since the early, and the U.S. had made little initial effort to get direct allied military support. The U.S. had only 21 30-year old minesweepers (MSOs) in service.[42] All but three of these minesweepers were in the Naval Reserve Force. The three active ships were assigned research duty and were not

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41 The Pentagon released an unclassified version of the plan on June 16, 1987. It makes no reference to planning for the mine war fare threat. Baltimore Sun, August 23, 1987, p. 2A.

42 Washington Times, August 3, 1987. P. 1.

ready to perform their mission. They were augmented only by seven active-duty 57 foot minesweeping boats (MSBs), and 23 Sea Stallion RH-53D helicopters, four of which were also allocated to the naval reserves.[43]

The MSOs were 830 ton vessels with a maximum speed of 14 knots. They had sonars with mine hunting capability, but lacked the ability to simulate the magnetic or acoustic image of larger tankers to detonate modern influence mines. The MSBs were only 30 ton vessels which could often make only seven knots in the open sea. Only one of the MSBs had a sonar to prevent hunting before sweeping. None of the vessels had the electronics and sweeping equipment to be fully effective against modern acoustic and magnetic influence mines or sophisticated mines like the Soviet 99501 combination bottom and influence mines that Libya had used in mining the Read Sea approaches to the Suez Canal.[44]

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43 To put these numbers in perspective, classified studies have indicated that it would take a minimum of 25 modern minesweepers to keep the Gulf ports open, assuming a 1,200 meter wide channel is explored every 48 hours. Jane's, August 22, 1987, p. 296.

44 Department of Defense sources indicate that the USSR only has three ships designed specifically for mine laying operations, but has 125 vessels which can lay mines, as well as aircraft and submarines. U.S. experts estimate that it has stocks of some 100,000 moored contact mines,

The U.S. had begun a $1.5 billion program in the early 1980s to replace its 1950s-vintage minesweepers, and to build 14 large wooden-hulled Avenger-class minesweepers, and 17 small high technology fiber glass coastal minesweepers. The Avenger-class ships were designed as fully modern 224-foot mine vessels with a size of 1,040 tons and SQQ-30 variable depth mine detection/classification sonars, a Honeywell mine neutralization vehicles, and acoustic and magnetic sweeps. The program ran into major coast overruns , however, and the cost rose from $100 million to $153 million. The ship also experienced degaussing, engine, and transmission problems and the Peterson Builder construction effort also slipped two years in delivery -- with the first ships scheduled to enter active service in 1988.[45]

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and 200,000 magnetic/acoustic fuzed mines. The Tango-class submarines, the oldest Soviet type in service, can carry 30 mines. The USSR has some 300 submarines with at least limited minelaying capability.

45 The Avenger program was funded in FY1986 at a cost of $256.6 million, with $297.3 million requested in FY1988. Ships are also being built by Marinette Marine. The MHC program was funded at $120.1 million in FY1986, but not money was requested in FY1987, and the House

The initial order of coastal minesweepers had to be canceled in 1986 -- in part because the fiberglass hulls peeled under the simulated shock of nearby mine explosions. The U.S. then had to order a new type of ship from Italy's Intermarine and Hercules Powder at a cost of $120 million. Work on the first of these MCC-51s was scheduled to begin in November, 1987.[46]

The U.S. could use the SH-2 ASW helicopters on its frigates to spot mines and visually, and these helped contribute to spotting and destroying 10 of the mines found off Kuwait. They were not, however, capable of detecting deep mines or of mine sweeping. The Navy's only heliborne minesweeping assets were three squadrons with a total of 23 RH-53D Sea Dragon helicopters, which were based at Norfolk. These helicopters had serious structural reliability problems, were only usable in daylight and shallow water, and had relatively limited endurance.

New Sikorsky MH-53E AMCM minesweeping helicopters that were supposed to replace them. These were designed to provide night operations capability, a major increase in range payload, a 50% increasing in towing capability, improved hot day performance, an on station mission time of more than four hours, improved coverage for the AQS-14 towed sonar, and more effective use of dual acoustic and magnetic minesweeping sleds. They were lagging badly in delivery, however, and Sikorsky had been penalized for slow progress. Only 15

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vetoed a request of $297.3 million in FY1988. The Administration plans to request $199 million in

FY1989. New York Times, August 18, 1987, p. 6

46 New York Times, July 29, 1987, p. A-1 and Defense Technology Viewpoint, August 31, 1987,

p. 8.,

of 32 aircraft were actually on order, and those which had been delivered were still in a training or shake down role and could not be deployed.[47]

In any case, helicopters have important limitations. To sweep mines, the helicopters either had to drag a V-shaped device with explosive cutters to break the mine's cable and let it rise to the surface, or tow a sled along the surface and

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47 The U.S. had an active strength of 21 RH-53D Sea Stallions. It took delivery on the first squadron of 12 on June 26, 1987, and had obtained three more by July 1, 1987. It plans then called 35 MH-53E Sea Dragons to be in service by 1990. See Scott Truver, "Airborne Mine Countermeasures in the U.S. Navy's Front Line", International Defense Review, 10/1987, pp. 1353-1359.

generate a strong electromagnetic current to detonate magnetic mines while giving off the sound of a ship's propeller to detonate acoustic mines.[48]

The Mark 104 sled uses a cavitating disk in a venturi tube to simulate the acoustic sound of a ship. The Mark 105 is a hydrofoil sled towed at about 25 knots about 135 meters behind the helicopter. It has a generator which supplies current to a twin electrode magnetic tail with creates a magnetic field like that of a ship. It can be refueled by the helicopter. The Mark 104 can be attached to one of the tails of the Mark 105 to sweep both magnetic and acoustic mines. The combined system is called the Mark 106 and was used with some success in the Gulf of Suez minesweeping effort in 1984. A system called the magnetic orange pipe is a magnetized pipe filled with styrofoam and up to three can be used to sweep magnetic influence mines in shallow waters.[49]

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48 Helicopters are sometimes given credit for helping to sweep the mines from Haiphong Harbor in Vietnam. In fact, the U.S. sweeping operation only found one mine. The rest were rendered harmless by internal timing devices.

49 A new system called the AN/ALQ-166 will be deployed in the late 1980s combining advanced features for both acoustic and magnetic minesweeping and allowing multiple refueling and use by multiple helicopters without being returned to base.

The speed of sweep for mechanical mines is 10-12 knots and the speed for acoustic magnetic mines is 22-25 knots. This means the helicopters were forced to chose between the kinds of mines to be swept, although mine operations often use a mix of mines. While helicopters are faster than ships, the weight of the sleds and deployment time considerations reduces the helicopters mission time to two hours.[50]

14.3.4 Planning for Only Part of the Iranian Threat

The U.S. thus faced a wide range of threats, only part of which it was prepared to deal with. Iran had had access to a wide range of sources for its mines. It had both surface mines and bottom mines, and at least some timed or interval mines that only became active after a fixed time period or after several ships or minesweepers passed by. While Iran's full mine assets were uncertain, it may have had contact, magnetic, acoustic, bow wave, pressure, and temperature mines, and possibly remote controlled mines. Some were large metal mines and could easily be detected by sonar, but many were too small for easy detection and others were non-magnetic.

Another problem consisted of the distance the convoy had to move, and the fact it was continuously vulnerable from the time it approached the Straits to the moment it entered port in Kuwait. The convey had to follow a route that included an 60 mile voyage from Dibba, outside the Gulf, to the Straits. With a convoy speed of 16 knots, this would take eight hours. For the next 50 miles, the convoy passed through the Straits, and near Iran's 20 mile exclusion zone and its Silkworm missiles. It then sailed for another 90 miles to a point near Abu Nuayr off the coast of Abu Dhabi. This meant passing by Abu Musa and the Tunbs.

There was then a 60 mile stretch to the UAE's Zaqqum oil channel, followed by a 60 mile voyage to Qatar's Halul Island. The convoy then had to sail 90 miles to the Shah Allum shoals and a point only a mile from Iranian waters. At this point the convoy had about 285 miles more of relatively open sailing from a position off

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50 Washington Post, August 2, 1987, p. A22; Aviation Week, August 3, 1987, pp. 25-26

the Ras Tanura beacon ship to Kuwait. During all of this time, Iran could chose its point and means of attack.[51]

Finally, the U.S. faced the problem that -- in spite of efforts to keep the convoy's composition and schedule, and the details of its strengths and weaknesses secret -- it received a relentless exposure in the media. Its weaknesses, in regard to mine warfare, were fully communicated to Iran. Iran could predict the path of the convoy and its timing, and meant that small craft

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51 U.S. News and World Report, July 13, 1987, p. 39; Washington Times, July 2, 1987, p. A-1, and July 15, 1987; Washington Post, June 27, 1987, p. A-23, 20, 1987, P. A-21, July 21, 1987, P A-1;, Christian Science Monitor, July 2, 1987, p. 11; New York Times, July 19, 1987, p. 12; July 21, 1987, p. A-8 and July 22, p. A-10; Baltimore Sun, July 1, 1987, p. 1A and 2A, July 24, 1987, p. 2A; Wall Street Journal, July 1, 1987, p. 2, July 19, 1987, p. 12.

might succeed in hitting a ship even if they did nothing more than drop a few contact mines at night.[52]

14.3.5 Using Tankers to Protect the U.S. Navy

The first convoy sailed on schedule on July 22, 1987. The U.S. sent in four combat ships, including a guided missile cruiser. The reflagged ships included the 414,266 ton supertanker *Bridgeton* and the 48,233 ton gas tanker *Gas Prince*. It transited the Straits safely, amid wide speculation that a week long lull in the tanker war somehow meant Iran had decided not to attack. In fact, the most Iran did publicly was to send four of its F-4s near the convoy when it entered the Gulf, and to announce new naval maneuvers which were code-named Operation Martyrdom.[53] The convoy reached the half-way point on July 23, when Iran declared it had a cargo of "prohibited goods".[54]

Unfortunately, the U.S. concentrated far too much on the missile threat near the Straits, and far too little on the risk of other forms and areas of attack. This became brutally clear about 6:30 AM on July 24. The *Bridgeton* struck a mine at a position of 27°58' north and 49°50' east. This was a position roughly 18 miles from

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52 Free floating or moored contact mines can be planted by dropping them over the side of any small ship with a crane. They are difficult to destroy since a direct hit on the tip of one of the mine's spiked contacts is necessary to make it explode.

53 Chicago Tribune, July 24, 1987, p. I-1.

54 Washington Post, July 24, 1987, p. A-16.

the Iranian naval Guards base on Farsi Island. It was about 80 miles southeast of the four mine hits reported between May 16 and June 19 in the approach channel to Mina al Ahmadi, and about 50 miles north of the Juaymah departure channel. The *Bridgeton* was hit in its number 1 port cargo tank, and the mine blew a large hole in her hull and flooded four of her 31 compartments.

The convoy was force to slow from a speed of 16 knots to 5, and its warships were forced to follow the damaged *Bridgeton*, which was the only ship large enough to survive another mine hit. The only action the warships could take was to turn on their sonars and put riflemen on the bow to try to shoot a mine if they saw it.

14.3.6 The Lessons of the Bridgeton Incident

In the months that followed the Bridgeton incident, the U.S. deployed its mine warfare forces to the Gulf, and acquired the aid of the Belgian, British, French, Italian, and Netherland's navies. The U.S. showed it can seek out and destroy Iranian mine vessels, and Iran dissipated any political advantages it gained by acts which catalyzed American public opinion to support the U.S. presence in the Gulf and alienated much of Western Europe.

At the same time, the Bridgeton incident was costly to the U.S. in political terms, and this cost could have been far higher if Iran had not made compensating mistakes. Like several other recent incidents when Western forces have engaged Third World states, the Bridgeton incident offers some important lessons and warnings:

- Virtually all of the European mine vessels sent to the Gulf ran into endurance and maintenance problems or required extensive preparation. The mine warfare effort in the Gulf raised broad questions about the normal readiness of NATO mine forces that need to be addressed.

- Mine vessels operating in Third World contingencies may lack air and missile defense support, and will need defenses of their own. For example, the U.K. had to provide extensive preparation for its four Hunt-class mine countermeasure vessels (MCMVs) and the mine support ship Abdiel. It added its Replica DLF-2 anti-missile decoy system to provide deck-launched passive broad band decoy capability. It added the MEL Matilda electronic support measure (ESM) system. This system provides generic warning of attack. The U.K. also added two additional Oerlikon-BMARC 20mm cannon, the Barricade anti-missile decoy, and Marconi SCOT satellite communications systems. The mine hunting systems included the EDO Almondbury 2059 acoustic tracking sonar, which is combined with the Standard Type 193M mine hunting sonar and PAP type remotely operated

vehicle. The EDO precisely tracks the location of the PAP, and other data from a hull mounted sensor.[55]

- Both the U.S. and U.K. soon realized that they needed visual inspection systems to determine the exact nature of mines. Britain deployed a small remotely guided surface vessel called SACRAB for this purpose, and the U.S. acquired a small remotely guided submersible called the Super Sea Rover, carrying camera and sonars. These "robotic" systems offer a way of dealing with mines at minimum risk to personnel and ships.[56]

- By the time of the ceasefire, the Western minesweeping effort in the Gulf had found a total of 89 mines in seven different minefields.[57] These included 79 M-08 Soviet mines and 10 Iranian-made Myam mines which were smaller contact mines. In addition, there were large numbers of floating mines. The total number of mines neutralized was 176, including 89 moored and 87 floating, and a total of 83 M-08s and 95 Myams.

- These figures clearly demonstrate that Third world states can and will take the risk of challenging Western powers, even superpowers. This is particularly true when the West either lacks any effective way of striking directly at their leadership elites, or when those leadership elites have a deep anti-Western political or ideological commitment.

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55 Jane's Defense Week, September 18, 1987, p. 586.

56 New York Times, December 10, 1987, p. A-11; Defense News, April 4, 1988, p. 8.

57 Two fields were in the lower Gulf, with the rest strong out over the convoy routes. The mines were often poorly moored and had no safety devices.

- None of the minesweepers that deployed to the Gulf would have been able to quickly and reliably sweep more modern non-magnetic or influence mines, particularly ones which could be set to operate at fixed intervals or become active only when approached by given sizes of ship.[58] If Iran had used the more sophisticated mines it was rumored to have bought from Libya, it might well have created a far more serious problem, and one that would have required weeks of additional sweeping and the virtually interdiction of all naval traffic out of Iran. In 1982, for example, when mines were discovered in the Red Sea, it took a British minesweeper six days to identify, disarm, and neutralize a sophisticated 1,500 lbs. mine.[59] Far more sophisticated mine warfare threats are likely to occur in the future.

- No Western power can ever afford to dismiss the ability of Third World states to use every available weapon and technology. In fact, Third World states are forced to use unconventional means and weapons to challenge the broad Western superiority in military technology. Any force which is not tailored to respond to all known low level threats from a given country is poorly planned and improperly equipped.

- Third world countries are fully aware of the major political vulnerabilities inherent in Western power projection and will make every effort to exploit them. This is particularly true when they feel Western political leaders are in a

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58 The U.S. and U.K. are working on improve methods and software to detect influence mines. The State of current progress is classified.

59 James D. Hessman, "Mine Warfare: The Lessons Not Learned", Sea Power, October, 1988, pp. 37-45

weak political position may not be able to take casualties, or cannot take embarrassing loses.

- U.S. power projection forces must be capable of dealing with every threat. The U.S. may be able to leave the bulk of some every threat. The U.S. may be able to leave the bulk of some military mission to its allies, but in cannot ever leave an entire mission in allied hands or disregard it in its focus on other kinds of war.

- Western task force commanders cannot rely on mass or technology as a substitute for military flexibility. As the British experience in the Falklands also demonstrates, any commander dealing with out of area operations must be fully prepared to use tactics and innovation, and must be fully responsive to intelligence warnings.

In a broader sense, the West cannot afford to ignore the mine warfare threat from Soviet forces, or assume it will be limited to certain European waters, simply because the USSR is more likely to conduct missile, air, or submarine warfare. The USSR has just as much incentive to be "unconventional" as Iran.

The West also needs to consider the fact that the Third World is rapidly changing its military capabilities, and "gun boating" in any form is not a substitute for combined arms. In the last five years alone, Third World states have acquired 154 major surface combatants, 482 minor surface combatants, 26 submarines, and 99 missile attack boats. They have acquired some 2,844 supersonic combat aircraft, 597 subsonic combat aircraft, 1,656 military helicopters, and 24,684 surface-to-air missiles. Their armies have acquired some 13,800 main battle tanks, 16,700 major field artillery weapons, and 18,680 other armored vehicles.

The U.S. may have been exceptionally lucky in the fact that most of Iran's air force is not operational, and most of its ships lack operational missile systems and fully operational electronics. No Western force can count on such weaknesses in Third World opponents in the 1990s. In fact, the process of technology transfer and arms sales is now beginning to transfer some weapons to the Third World before they are fully deployed in the forces of the Western nations that make them.

14.4 The Lessons of the Convoy Effort

Experts are likely to debate for decades whether the U.S. convoy effort was entirely necessary. It can be argued that the Iranian and Iraqi threat to Gulf shipping was never serious enough to merit the U.S. commitment to the region. It can also be argued that be agreeing to reflagging the ships of Kuwait, the Gulf state most friendly to Iraq, the U.S. forced a confrontation with Iran that it might have avoided by simply declaring it would protect all ship outside the declared war zones.[60]

If one only looks at the pattern of Iranian attacks, the statistics on the U.S. presence do seem to imply that the U.S. provoked Iran. From July 22, 1986 to July 1987 -- the year before the U.S. started the reflagging effort -- Iran attacked 54 commercial vessels, and Iraq attacked 63, for a total of 117. In the year between July 23, 1987 and July 22, 1988, Iran hit 105 ships and Iraq hit 82. Accordingly, the Iranian strikes nearly doubled during the reflagging period.

This focus on the number of Iranian attacks on shipping, however, ignores the overall pattern of military events in the region. While there is no question that the reflagging effort did coincide with an increase in Iranian attacks, it is important to understand that the Iranian's formally created the naval branch of the Guards in May, 1986 and built them up to a force of 20,000 men and several hundred boats before the reflagging effort. They also gave the naval Guards Silkworm missiles. It is almost certain that Iran would have made even greater increases in the number of its ship attacks without the reflagging effort, and would have been far more effective. It also is uncertain as to whether it would have ever have agreed to a ceasefire in 1988, if it had not been for the U.S. presence in the Gulf.

Experts can also argue whether the U.S. really faced any serious threat the USSR would expand its influence in the Gulf if the U.S. did not take action, and whether the eventual U.S. confrontation with Iran did have a major impact in bringing the war to a close and in forcing Iran to accept a ceasefire.

The previous chapters have strongly suggested that Iran was acquiring sufficient naval capability to bring strong pressure on Kuwait and Saudi Arabia to halt their support of Iraq and would have used this capability. They suggest that while reflagging probably was not the best approach, it was a reasonable political risk. They suggest that the U.S. covert arms sales to Iran and withdrawal from Lebanon had left the U.S. in far too weak a position not to take action in the Gulf,

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60 These statistics are based on work by the Center for Defense Information.

and they suggest that the U.S. presence in the Gulf did have a major impact in forcing Iran to accept a ceasefire. It also is possible to support these points with countless quotes by Iranian leaders and many of the leaders in the Southern Gulf. No one will ever be certain whether the Western presence in the Gulf was necessary in a purely game-theoretical sense, but it was certainly perceived as a major success by virtually every friendly leader in the region after the 1988 ceasefire.[61]

14.4.1 The Overall Performance of the U.S. Convoy Effort

Regardless of the broader policy issues, it is clear that the U.S. convoy effort was successful in protecting the ships it was deployed to protect. Iranian strikes against ships in the Gulf, including mines and Silkworm missiles, increased from 17 in 1984, to 14 in 1985, 41 in 1986, 89 in 1987, and 39 in 1988. During this time, Iranian strikes against Kuwaiti ships shifted from 4 in 1984, to 2 in 1985, 2 in 1986, 4 in 1987, and none in 1988.[62] The only U.S. escorted ship hit during the convoy effort was the *Bridgeton*, although the U.S. escorted or accompanied 252 ships during the period from the sailing of the *Bridgeton* and *Gas Prince* on July 22-24, 1987 and the time the U.S. halted

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61 The author talked at length with senior officials of Bahrain, Kuwait, and Saudi Arabia during a November, 1988, trip to the Gulf. All felt the U.S. intervention was both necessary and successful. The same points were made in very different ways by senior Iraqi and Iranian officials.

62 The data involved were provided by the U.S. Navy and differ slightly from the statistical summary prepared using commercial data bases presented earlier.

accompanying or escorting ships with the accompanying of the *Courier, Ranger*, and *USS Mars* on 13-15 December, 1988. If one looks only at the direct impact of the U.S. convoy effort as part of Operation Ernest Will, the U.S. covered 177 ship transits by reflagged tankers, 57 by MSC ships, 14 by other U.S. flagged ships, and 4 by foreign flag ships.

The broader impact, however, was far greater. As the previous chapters have shown, the U.S. presence catalyzed a general effort by Western European and Southern Gulf states to protect the flow of shipping through the Gulf. Regardless of the increase in the number of Iranian attacks, Iran had a negligible impact on the flow of shipping and only a minor impact on insurance rates. It is unlikely that any of these efforts, by either European states or Southern Gulf states would have taken place without Operation Ernest Will.

If there is any lesson that can be drawn from this experience, it is that there are unlikely to ever be cases in low intensity combat where the conditions involved are so unambiguous that it is possible to prove the need for American intervention, avoid major uncertainties and problems, and avoid having to intervene under less than ideal conditions. Crises only tend to become unambiguous at the point they cease to be manageable with limited amounts of force, and national interests only become totally clear when they are threatened to the point where they may be seriously damaged. Regardless of the faults in the precise way the U.S. entered the Gulf, and conducted its military operation, it is virtually certain that the U.S. was far more successful that it would have been if (a) it had waited long enough to see if Iran's actions in the Gulf would seriously threaten the flow of oil and Southern Gulf support of Iraq, (b) let its influence and credibility continue to decline, and (c) failed to exert reasonable pressure to end the war on terms that left Iraq independent.

14.4.2 The Military Clashes During the U.S. Convoy Effort

There were six military clashes between U.S. and Iranian forces during the convoy effort. None of these efforts involved a serious test of U.S. military capabilities or weapons. The key message from a short chronology of the events involved does indicate, however, that the the pattern of events followed an almost inevitable process of escalation, which only culminated when it became clear that no amount of pressure could force the U.S. to withdraw from the Gulf, and when the U.S. had inflicted sufficient Iranian losses to force Iran to halt naval operations:

- September 21, 1987: U.S. helicopters on a night surveillance patrol observe the Iranian ship *Iran Ajr* laying mines in international waters near the Bahrain Bell. U.S. helicopters engage the *Iran Ajr* until the minelaying ceases. At daylight, U.S. forces board the ship, which has been abandoned by its crew. Nine operational mines are discovered, as well as evidence of the previous

night's minelaying activity. The Iranian crew is rescued from life boats and is repatriated through a third country. There are no U.S. casualties or losses; the *Iran Ajr* is captured and scuttled.

- October 8, 1987: U.S. helicopters on patrol near Farsi Island are fired upon by Iranian patrol boats. U.S. helicopters return the fire. There are no U.S. losses or casualties. One Iranian Boghammer is sunk. Several Iranian Boston Whalers are damaged.

- October 19, 1987: U.S. forces attack Iran's Rashadat oil platforms, which are armed surveillance and patrol boat centers for the Iranian naval Guards, in response to a October 16, 1987 Iranian Silkworm attack against the U.S. flag tanker *Sea Isle City*. The U.S. uses gunfire and demolition charges. The Iranian personnel abandon the platforms in response to a prior U.S. warning. There are no U.S. casualties, The platforms are destroyed or neutralized.

- April 14, 1988: *U.S.S. Samuel Roberts* strikes Iranian mine in central Gulf: The *Roberts* is severely damaged, and is transported to the U.S. by heavy lift ship for a major overhaul. There is no damage to Iranian units.

- April 18, 1988: U.S. forces attack several Iranian oil platforms, known to be used as surveillance and attack boat support bases, in response to the mining of the *USS Roberts*. Iranian naval and air units respond against U.S. forces and strike at third country oil platforms. The U.S. lost one AH-1 Cobra. Iran lost the Saan and Siri oil platforms. It lost the guided missile frigate *Sahan* to U.S. air and surface attack, and the guided missile patrol boat *Joshan* was lost to a surface action group. The guided missile frigate *Sabalan* was severely damaged. A Boghammer was lost and another damaged by U.S. air attack and an Iranian F-4 was damaged by a U.S. surface-to-air missile.

- July 3, 1988: Iranian small boats fire on a U.S. helicopters while on routine patrol. The *USS Vincennes* and *USS Montgomery* investigate and engage Iranian forces when they continue to close at high speed. The USS Vincennes shoots down an unidentified aircraft while simultaneously engaging an Iranian ship. U.S. forces suffer no losses. Iran loses two small boats and another is damaged. The aircraft later turns out to be Iran Air Flight 655, and 290 Iranian civilians are killed.

If there are lessons that can be drawn from this process of escalation, it is the U.S. efforts to deal with Iranian pressure by "measure response" did generally contain Iran's ability to act without leading to broader conflict. It is important to note, however, that the U.S. operated under exceptionally favorable conditions. While Iran dictated the actual steps involved in escalating the conflict,

it had few air assets and its naval forces were largely ineffective. Iran was extremely vulnerable to attacks on its oil facilities, and could not protect its military forces. It is uncertain that future contingencies will be as favorable to Western power projection, particularly given the quality and quantity of aircraft and missiles being sold to the Third World. In future cases, therefore, the West may have to respond with much more decisive levels of force to avoid becoming trapped into a similar process of escalation under far more dangerous conditions.

14.4.3 The Need for Allies

Although the previous history of the war has repeatedly made the point, it is also important to note that one of the key lessons of the convoy effort was that the U.S. could never have been successful without help from its local and West European allies. At the peak of the Western intervention in the Gulf there were 40 Belgian, British, French, Italian, and Netherlands ships present, and even in November, 1988, there were still 21 West European warships in the area. The British Armilla Patrol alone participated in a total of 1,026 transits after it started actively protecting ships in the Gulf in 1987, with 405 transits in 1987 and 621 between January and August, 1988.[63]

Large as the U.S. military effort in the region was, the U.S. was also heavily dependent on Kuwait and Saudi Arabia for fuel, the use of air and naval facilities, the ability to base E-3A and P-3C aircraft, and staging the naval, marine, and army forces it deployed in the area.

Kuwait paid for the leasing charges on the barges the U.S. used in the Gulf, and some nine million gallons of fuel a month. It permitted port calls, and provide cooperation at a number of other levels. Saudi Arabia permitted the U.S. to base P-3s on Saudi territory, and U.S. minesweepers to occasionally use Jubail. It provided E-3A and tanker support for the U.S. presence. The E-3As in the northern part of the AWACS orbit were Saudi E-3As with U.S. crews; the aircraft covering the southern part of the orbit were Saudi E-3As with Saudi crews. Saudi Arabia allowed U.S. barges to deploy in Saudi waters and U.S.

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63 Washington Times, January 16, 1989, p. A-5, and Philadelphia Inquirer, February 12, 1989, p.

21A..

carrier aircraft to refuel. Similarly, Bahrain provided vital medevac and fire fighting services in dealing with the attack on the *USS Stark*, and repair services after it was hit.. U.S. helicopter forces routinely staged out of Bahrain, and Bahrain allowed frequent port calls. At the peak of the U.S. build-up one supply ship and week and five USAF C-141, DC-8, and DC-10 flights at day were off-loading in Bahrain.

The UAE allowed U.S. E-2s to refuel, allowed port visits, and allow E-3As to overfly UAE territory. Dubai provided major repair services for the USS Roberts. Oman allowed the U.S. to base P-3s at Masirah and served as the "home port" for the carrier battle groups. It also allowed U.S. logistic support flights to used Muscat airport and the air field at Masirah .

While the exact extent of local cooperation with the U.S. is still secret, the U.S. commanders involved regarding such cooperation as being extraordinarily forthcoming, and as absolutely vital to the success of their operations.

Similarly, the West European presence in the Gulf not only helped compensate for the lack of U.S. mine warfare capability, it acted as a power influence in marshalling broad international support for the U.S. effort, and in convincing Iran that no amount of escalation could drive the West from the Gulf. The issue was not simply one of ships -- although the European contribution reduced U.S. force requirements by at least one-third in terms of ship numbers -- it was one of political and strategic impact.

14.4.4 The Need for Innovation

Finally, it is worth pointing out that the U.S. faced much the same need for innovation that Britain did in projecting naval forces to the Falklands. Fleets designed for open war at sea or classic exercises in power projection are not ideal tools for every possible contingency in low level war. This is particularly true in an area like the Gulf, where the U.S. was forced to operate in a very narrow area where Iran could strike with small craft and aircraft with very little warning, and where so many complex political constraints applied to the operation.

While the U.S. was able to establish six different convoy routes through the Gulf, the waters in which it could operate were often very narrow, particularly in the area around Farsi Island. Iran's exclusion zone technically covered the main channel through the upper Gulf, and the 12 mile wide channel near Abu Musa in the Straits of Hormuz presented a similar challenge, plus the risk of Silkworm attacks. The U.S. was forced to divided the Gulf into seven different zones, and create a different mix of air and naval assets, strike systems, and countermeasures for each zone. The area also placed special demands on men and equipment. Temperatures outside the ships often reached 100-115 degrees

and temperatures in side often averaged 117 degrees. Sand was a constant problem, and the fine particles required special filters.

Defeating the Silkworm required the creation of a new mix of electronic warfare capabilities. The previous chapters have already described how the U.S. was forced to improvise to deal with the threat of the Iranian naval Guards, and with the Silkworm. They have pointed out that the U.S. was forced to lease large oil barges from Brown and Root and use them as bases for its helicopters, sensors, and special forces. These two barges were called the *Winbrown 7* and *Hercules*, and were stationed in international waters, some 40 miles from Farsi island. Each held about 200 U.S. Army, U.S. Marine, and U.S. Navy personnel, including SEAL teams. They were commanded by a U.S. Navy officer, with a U.S. Army Lieutenant Colonel in charge of the helicopter force. The barges both flew the Panamanian flag, and were surrounded by floating reflectors to help defend against enemy radars and missiles. While they were used as forward sensor posts and force special operations, they were routinely used to stage AH-58D Warrior helicopters for night surveillance and attack missions and SEAL Mark III 20 meter patrol boats for day operations.[64]

The U.S. was also forced to improvise floating barges with radar reflectors to help protect Kuwait against Iranian Silkworm attacks. This project involved mounting specially shaped metal sheets designed by U.S. navy research laboratories on 20 barrages, and effectively protected Kuwait against Silkworm attacks. In other efforts, the U.S. had to modify its jammers for the EA-6Bs used to help protect its ships against air and missile attacks, and its LAMPS III SH-

64 Jane's Defense Weekly, August 13, 1988, p. 243.

60B Sea Hawk helicopters to tailor their sensor mix and software to the missions required in the area.[65]

The U.S. also was forced to rapidly build up from a force in the Gulf of a command ship and four destroyers and frigates, to a force of over 14 ships in the Gulf and 25 ships in the region, plus extensive additional special forces and air assets. While the full details of all the many innovations the U.S. was forced to go to remain secret, but some indication is provided simply by reviewing **Figure 14.4,** which shows the changes the U.S. had to make in its forces during Operation Ernest Will. The obvious lesson inherent in the constant stream of changes in the U.S. force between June 1987 and May 1988 is that when one cannot predict the nature of combat, it is the ability to adapt to new conditions that will determine success.

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65 See David Harvey, Lamps III, Defense Science, August, 1988, pp. 28-30; and Bruce Henderson, "Interim Jammer Helps Make Prowler Effective in Persian Gulf," Aviation Week, October 24, 1988, pp. 48-57.

Figure 14.4

Changes in U.S. Forces Committed to Operation Ernest Will: June 1987 -May 1988 - Part One

Date	Shift in Force Structure
1987	
2 June	Joint Chiefs of Staff (JCS) message to augment force in Gulf from 5 to 8 combatants.
1 July	Augmentation of combatants complete.
1 August	JCS messages to deploy additional army helicopters, *USS Guadalcanal* amphibious assault ship, and AMCM. Four KC-10 tankers deployed to Diego Carcia.
5 August	Six army helicopters arrive.
8 August	Two ocean-going tugs from Kuwaiti oil company rigged for mine sweeping.
10 August	Four PBRs arrive by C-5A.
14 August	*Guadalcanal* with AMCM and Marine Aviation Detachment plus two SEAL platoons, Contingency Marine Air Ground Task Force (CM) 2-88, and Marine special purpose raid force arrives.
25 August	*Constellation* and *Ranger* carrier battle groups rotate in and out of region.
27 August	*USS St. Louis* arrives with two Mark III patrol boats and two Seafoxes.
30 August	*USS Missouri* battleship battle group arrives.
31 August	*USS Raleigh* arrives with four MSBs, four Mark III patrol boats, and two Seafoxes.
6 September	*USS St Louis* departs.
2 October	Four additional Army helicopters arrive in Bahrain.
3 October	P-3C surveillance aircraft deploy to Saudi Arabia.

Figure 14.4

Changes in U.S. Forces Committed to Operation Ernest Will: June 1987 -May 1988 - Part Two

Date	Shift in Force Structure
7 October	First of two Kuwaiti chartered barges commences operations under U.S. control.
9 October	*USS Mount Vernon* arrives with two Mark III patrol boats.
11 October	Mark II anti-swimmer system arrives in Bahrain for port security.
24 October	*USS Raleigh* departs with four coastal minesweepers.
30 October	Two ocean-going minesweepers (MSOs), *USS Esteem* and *USS Enhance*, arrive at Bahrain.
1 November	Two UH-60B helicopters arrive to augment Army helicopters.
2 November	Two additional PBRs arrive by C-5A.
5 November	Three MSOs -- *USS Fearless*, *USS Inflict*, and *USS Illusive* -- arrive at Bahrain.
15 November	*USS Guadalcanal* and *USS Okinawa* rotate in Gulf of Oman. *Guadalcanal* takes three RH-53 minesweeping helicopters with it when it returns to U.S.
18 November	*Ranger* and *Midway* carrier battle groups rotate in the Bay of Bengal.
25 November	*USS Missouri* battle group leaves area.
28 November	*Reef Point* deployed back to U.S. Pacific Command (PACOM).
7 December	The second of two Kuwaiti-chartered barges.
12 December	*USS Iowa* battleship battle group arrives in area.
1988	
27 January	USS Mount Vernon (LSD) rotates with USS Portland (LSD). Three PBRs leave the area and two Mark III patrol boats are deployed.
12 February	USS Iowa battle group departs the area and is not replaced.

Figure 14.4

Changes in U.S. Forces Committed to Operation Ernest Will: June 1987 -May 1988 - Part Three

Date	Shift in Force Structure
16 February	*USS Enterprise* carrier battle group rotates with *USS Midway* battle group.
23 February	*USS Trenton* (LPD-14) replaces the *USS Okinawa* (LPH-3) in the Gulf.
24 February	First two of eight OH-58D helicopters arrive in the Gulf to replace TF-160 helicopters. Two AH-6 and one MH-6 helicopters leave the Gulf the next day.
28 February	*USS Coronado* (AGF-11) replaces the *USS LaSalle* (AGF-3) in the Gulf and becomes the command ship of the Commander, Joint Task Force Middle East (CJTFME). Two Sea Fox boats redeploy with the USS LaSalle.
1 March	*USS Portland* (LSD 37), with two Sea Foxes, departs the Gulf and the vessels are not replaced.
26 March	Second two of eight OH-58D helicopters arrive in the Gulf to replace TF-160 helicopters. Two AH-6 and one MH-6 helicopters leave the Gulf the next day.
16 April	*USS Roberts* hits mine.
4 May	*USS Stump* replaces the *USS Roberts*.
18 May	Two additional P-3Cs ordered to deploy to Daharan, Saudi Arabia.
20 May	*USS Forrestal* carrier battle group rotates with *USS Enterprise* battle group.
22 May	First AEGIS cruiser, *USS Vincennes*, arrives in Gulf.
25 May	Two additional P-3Cs arrive in Daharan, Saudi Arabia.
31 May	One additional PBR arrives in the Gulf.

Source: Adapted from material provided by the U.S. Navy in February, 1989

14.5 The *USS Vincennes* and the Destruction of Iran Air Flight 655

The loss of Iran Air Flight 655 as part of the July 3, 1988 clash between U.S. and Iranian forces was a major tragedy even in a war filled with so many similar tragedies. It killed nearly 300 innocent people and occurred largely because of human error. The operators of the ship-to-air missile defenses on the *USS Vincennes* interpreted radar data incorrectly and concluded that the air liner was actually a hostile fighter that was attacking the ship. The causes of these errors provide important lessons regarding the need to tailor any forces that are used in low-level conflicts to the particular conditions in the region and to political and civil, as well as military risks.[66]

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66 Most of the analysis of the shooting down of Iran Air Flight 655 is based upon the Investigation Report by Rear Admiral William M. Fogarty, USN, which was submitted to the Department of Defense on July 28, 1988. Use is also made of extensive supporting material provided by the U.S. Navy. Other sources include "A300 Downing Clouds Aegis Capabilities," Aviation Week, July 11, 1988, pp. 16-22, 1988, Julian S. Lake, "The Recurring Nightmare," Defense Science, September, 1988, pp. 13-17; Time, August 29, 1988, p. 30; the Economist July 9, 1988, pp. 9, 23, and 35; and

14.5.1 The Events That Led to Shooting Down of Iran Air Flight 655

The sequence of events that led to the shooting down of Iran Air 655 is a case study in the complexity of modern combat, even in "low level" conflicts. On the morning of July 3, 1988, the *USS Elmer Montgomery* was patrolling the northern portion of the Straits of Hormuz. At 0330 Zulu time, the *Montgomery* observed seven small Iranian gunboats approaching a Pakistani merchant vessel.[67] The small boats had manned machine gun mounts and rocket launchers. Shortly thereafter, the *Montgomery* observed 13 Iranian gun boats breaking up in to three groups. Each group had 3 to 4 gunboats, and they took position off the *Montgomery's* port quarter.

At O411Z, the *Montgomery* heard the gun boats challenging merchant ships in the area, It then heard 5 to 7 explosions coming from the north. At O412Z, the AEGIS cruiser *USS Vincennes* was directed to proceed north to the area of the *Montgomery* and investigate. The *Vincennes's* Lamps Mark III helicopter, which was already on patrol, was directed to observe the gunboat activity. Meanwhile, the *Vincennes* continued to observe an Iranian P-3 patrolling to the north.

At approximately 0615Z, the *Vincennes's* helicopter was fired upon by one of the small boats. The *Vincennes* then took tactical command of the *Montgomery* and both ships closed on the location of the firing at high speed. As the two U.S. ships closed on the area, two Iranian gunboats turned towards the

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Paul R. Jazka "AEGIS System Still Gets High Marks", Defense Electronics, October, 1988, pp. 48-60. Use was also made of reporting during the period by the Washington Post and New York Times. See the account of the incident in Chapter 10 for further details.

67 Local time was three hours ahead.

U.S. ships. They continued to close and the *Vincennes* was given permission to fire. This surface action continued during the entire time between the take off of Iran Air 655 and its downing. Another U.S. ship, the USS Side was transiting from east to west through the Straits of Hormuz and was about 18 miles to the east at this time.

The *Vincennes* was now about one mile west of the centerline of the civilian air path from the joint civil-military airport at Bandar Abbas to Dubai. Iran Air 655 took off at 0647Z as part of a routinely scheduled international airline flight to Dubai. It began a normal climb out to 14,000 feet. It reached the Amber 59 air corridor, which was 20 miles wide (10 miles on either side of the centerline) and made a routine position report to Bandar Abbas at 0654Z. It was ascending through 12,000 feet at the time, with a speed of 380 knots. It was only about four miles off the centerline down the air corridor, but this was unusual because more aircraft flew the center line exactly. The Iran Air 655 never communicated with the air traffic control center at Dubai, and the center never picked it up on its radar. There was no readily detectable commercial air control traffic, and although there were no military electronic emissions, Iranian F-14s some times fly "cold nose", or without using military radars or avionics.

At approximately 0647Z, and while still engaged with Iranian gunboats, the *Vincennes's* AN/SPY1A radar detected Iran Air 655 at a bearing of 025 degrees, 47 nautical missiles. The size of the aircraft could not be identified by the digital radar processing on the *Vincennes*, which does not show a "blip" in proportion to target size. It was simply assigned the digital identification code TN 4131.

At 0648Z, the *USS Sides* detected Iran Air 655, at a bearing of 355 degrees and a range of 32 miles. The aircraft continued to close on the *Vincennes*, which was right on the flight path, with a constant bearing and decreasing range. It was at this point that the IDS or identification supervisor on the *Vincennes* checked the airline guide to see if the aircraft could be commercial. Iran Air 655 was 27 minutes late, however, and the IDS incorrectly concluded that the aircraft could not be flight 655. At 0649Z, the *Vincennes* issued warnings of the Military Air Distress (MAD) frequency of 243 mhz. At 0650 it began warnings of the International Air Distress Frequency (IAD) of 121.5 mhz. The airliner was them about 40 nautical miles from the *Vincenne*s.

At 0650Z, several people in the *Vincennes* combat information center (CIC) heard a report of F-14 activity on internal voice circuits. The IDS also thought he had momentary indication of a Mode II-1100 IFF signal was detected, which he correlated with an F-14, although no such indication was later found in the data tapes. This identification as an F-14 was reported throughout the CIC on internal voice circuits, and the own ship display assistant, hearing the

identification, tagged the display signal with an F-14 symbol on the screens of the commanding officer, tactical action officer, and guided weapons officer.

The *Vincennes* began to issue continuous MAD and IAD warnings when the airliner closed to within 30 miles of the *Vincennes*. The ship issued a total of five warnings on MAD and four on IAD. At this point, the ship experienced a foul bore in mount 51, and full rudder was applied to unmask the after gun mount in the midst of an ongoing surface action. This further increased tension in the CIC.

At 651Z, with the airliner as close as 28 nautical miles, the *Vincennes* informed the commander of the Joint Task Force Middle East (JTFME) that it had detected a closing Iranian F-14 and intended to engage at a range of 20 miles if the aircraft did not turn away. The commander concurred, but told the *Vincennes* to warn the airliner first. The combat information officer also warned the commanding officer that the aircraft could be a commercial airliner.

The *Vincennes's* warnings to Iran Air 655 continued, but there was no response. Although the aircraft reached the 20 mile point, the commanding officer of the *Vincennes* decided not to engage. The order was given to use the fire control radar to illuminate the target, but there were no ESM indications. Due to an error in procedure, the illumination also did not occur until firing, although the impact was meaningless since the Iran Air flight had no military radar to detect the fact it was being illuminated.

At this point, the aircraft was ascending through 10,000 feet. Nevertheless, false report also was circulated through the CIC that the aircraft was descending, although the aircraft continued to ascend until it was shot down. The individual responsible for this error could not be identified.

At 0653Z, with the aircraft at a range of 15 to 16 nautical miles from the *Vincennes*, and 3.35 nautical miles to the west of the centerline of the air corridor, the *USS Sides* gave the last IAD warning to the aircraft. The aircraft was now climbing through 12,000 feet and had a speed of 382 knots.

At 0654Z, the commanding officer turned the firing key. The launch sequence took 14 seconds, and four seconds later two SM-2 Block II missiles left the firing rails. The missile intercepted Iran Air 655 at a range of eight miles from the *Vincennes*, an altitude of 13,500 feet, and a flight speed of 383 knots. The aircraft crashed about 6.5 miles east of Hengham Island. Some 290 people from six different nations died in the crash. At approximately the same time the aircraft was hit, an Iranian military aircraft took off from Bandar Abbas. Iranian F-4s were observed in the area some 30 minutes later.

The tragedy was compounded by several factors, including false reporting from the *Vincennes*, based on the false beliefs of the officers inside its combat

information center that had been generated by their interaction and tensions during the intercept. The personnel inside the CIC translated various oral reports to believe that they had a firm indication that the aircraft had an F-14 IFF signal, that it was descending rather than climbing, and that it was off the standard flight path. In practice, this information was not provided by the ships' sensors, and the data from the tapes of the Vincennes's combat operations, as corroborated by the information of the USS Sides and independent intelligence sources, showed that the aircraft was on a normal commercial air flight plan profile, was squawking in the 6760 Mode III IFF common to such air flights, and was in continuous ascent from takeoff at Bandar Abbas to shoot down.

14.5.2 The Combat Environment

The shooting down of a civilian airliner would have led to a storm of controversy under any circumstances, but the initial reports from the *Vincennes* and Iran were so contradictory that the end result was a host of conflicting media reports, defending or attacking the American position. These were rapidly followed by a host of equally misleading criticisms of the weapons systems, sensors, and battle management capabilities of the *Vincennes*, many of which failed to understand the digital nature of the radar on the Vincennes or which claimed the ship had IFF capabilities which simply did not exist.

These reports lost sight of the combat environment in which the *Vincennes* operated. They ignored the limited reaction times involved, the fact that the *Vincennes* was engaged in surface combat at the same time, and that another Captain and ship were severely criticized when the *USS Stark* did not fire on an fighter on May 17, 1987, and that the sensors and battle management systems on the Vincennes were designed to deal with complex air threats in a combat environment, and not to detect or identify civilian aircraft.

Little media attention also was paid to the overall pattern of combat activity in the area. The U.S. ships not only were shooting at Iranian gunboats, there were other gunboats in the area. They also were aware of patterns in Iran's behavior that led them to think the ship was at risk. Iran had conducted some 88 ship attacks in 1987, and 72% of these occurred in the shipping routes between the UAE and Abu Musa. All Iranian ship attacks from November 1987 to April 1988 with conducted in the southern Gulf and nearly 50% were conducted at night. During the U.S. clash with Iran in April, the *USS Wainwright* had also encountered an aircraft that failed to respond to repeated warnings. The missile hit and damaged the aircraft which turned out to be an Iranian F-4.

Although the F-14 is not normally used to deliver ordnance against ships, it can do so if it closes to a range of about two miles. The use of the F-14 was credible because of intelligence warnings that such modifications might take place and the fact Iran had had to conserve other air assets since August 1986,

although most of the 187 attacks Iran had made of shipping between March 1984 and October 1986 were made by aircraft using iron bombs and Maverick missiles.[68]

The situation was further complicated by the fact that F-14s had been permanently transferred to Bandar Abbas, and Iranian Air Force had changed it operating patterns at Bandar Abbas significantly during the month prior to July 3, 1988. Iraq F-14s had flown six patrol missions out of Bandar Abbas in June and have already flown two in July. Iranian F-14s were observed flying at air speeds of 250 to 400 knots while climbing to station, and at 500-550 knots during air intercepts. Warnings were issued about more "aggressive behavior" on June 18, and the Vincennes had been warned specifically about the transfer of the F-14s, and then on June 30 and July 1 that it should anticipate more aggressive Iranian attacks on ships because of Iraq's gains on the ground and Iraqi air attacks on shuttle tankers. These warnings were accurate. A commercial ships -- the *Karama Maersk* -- had been attacked in the area by Iranian gunboats the day before.

The problem of tracking the commercial air liners in the area was also extremely complex. There are 18 air corridors across the Gulf, covering 50% of its navigable waters. A total of 12 of these routes cross the southern Gulf and Straits of Hormuz area. Seven go to the Dubai/Sharjah terminal control area and five to the Abud Dhabi terminal control area. At least 1,775 commercial air line flights passed through the Oman control center area during the week ending July 13, 1988.

While commercial aircraft did normally use the standard commercial IFF signals, Iranian combat aircraft used a variety of Mode I, II, and III IFF signals and often flew commercial air corridors. Iranian fighters also sometimes flew these corridors in carrying out attacks on ships, as did Iraq. Departures from commercial flight schedules were also common. Iran Air 655 was due to take off at 0620Z, but actually took off AT 0647Z.

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68 The Maverick has a range of 0.5 to 13 nautical miles. It is TV-guided and the pilot must track the missile and control it until it hits the target. The F-14 cannot deliver the Maverick.

This made it almost impossible to track all of the civil air flights going over the combat area, and forced commanders to rely on radio warnings. These, however, presented problems because they interfered with air traffic control. For example, when the USS Halyburton warned away British Airways flight 147 on June 8, 1988, the airliner immediately came into a near miss situation with another airliner and Dubai's air traffic control filed a formal protest.

The US Navy concluded after the incident that the *Vincennes* and other ships in the JTFME did not receive sufficient data on civil IFF procedures or air line schedules. The military naturally concentrated on the military threat. Even so, the *Vincennes* had no prior reason to worrying about the problem. The U.S. force had issued 150 challenges during the month from June 2 to July 2, and only two affected civil airliners. The other 148 affected military aircraft, and 125 or 83% went to Iranian military aircraft. Seven were challenges to Iranian F-14s.

14.5.3 The Results of the Navy Inquiry

The shooting down of Iran Air 655 led to a rush to judgment that led to a flood of reports about technical malfunctions in the AEGIS air and missile defense system on the Vincennes. These charges were generally based on early tests of the AEGIS system or mistakes based on press reports. None of the charges proved to be true when the tapes giving the exact history of the ship's sensors and data systems were examined in detail by a Navy inquiry.

For example, some reports claimed that the ship's crew should have known the size of the aircraft from the size of the radar blip. "Blips" or signals based on radar cross section amplitude are not a reliable indication of aircraft size in analogue radars and there are no "blips" in digital radar, only digitally processed readouts which are constant in size. Other reports claimed that the *Vincennes* had an operational system that could identify aircraft type and size from the radar readout. The actual technology involved refers to a secret airborne system still in early development, and has never been deployed.

Charges were also made that the subsystems on the Vincennes were only suited for open ocean operations. In fact, the subsystems were fully programmable and had been specially adjusted to deal with the short reaction times inherent in operating so close to the land. The AEGIS system is the only system in the world capable of such adjustment. Charges were also made that the system was so automated that it led to the mistaken identification and firing. In fact, there were men in the loop in every critical function and it was their reaction under stress that led to errors in identifying the target. Finally, charges were made that Iran Air 655 should have been identified by an AWACs aircraft. The E-3As in the region were flying a northern orbit and could not cover the region with their sensors. An F-14 was dispatched from a U.S. carrier but could not reach the area in time to make any identification.

The U.S. Navy inquiry into the shooting down of Iran Air 655 produced very different findings. It found that the Vincennes had had good overall training and readiness and extensive special training for its mission in the Gulf. It found that its weapons sensors, battle management systems and weapons were functional. The anti-aircraft watch organization was properly manned and trained, and no anomalies were found in the operation of the AEGIS system or operator statements. One console was not operational and one mount of the close in weapons system (CIWS) were down, but neither affected any aspect of the operation relating to Iran Air 655. There were difficulties in some aspects of internal communications and these may have contributed to the misinformation that resulted from human stress.

A detailed examination of the tapes recording all the data registered by the ships sensors and consoles clearly showed that the operators misread the speed and altitude provided to them and showed the aircraft descending from 7,800 feet and flying at 445 knots. At least four members of the CIC crew had this impression, although it was not justified from the data provided. Similarly, the Identification Supervisor (IDS) made an error in reading IFF data that was not a result of sensor information.

The end result was that a mix of the pressures of immediate combat and human error confronted the commanding officer, who had only three and forty seconds of time from identification of the aircraft to the point he had to fire, with the following indicators:

- F-14s had recently been moved to Bandar Abbas
- Iranian fighters had flown at the same time as the naval engagement on April 18.
- Any aircraft could be used in a suicide mission.
- The aircraft was not responding to verbal warnings over IAD or MAD.
- There had been warnings of an increased threat over the July 4th weekend.
- Increased hostile activity had been predicted for the 48 hours following a recent Iraqi victory.
- Iran Air 655 was not following the air corridor in the same manner as other commercial aircraft consistently followed: exactly on the centerline.
- The aircraft was reported to be flying at a lower altitude than COMAIR was reported to fly in the past. It was reported to be descending and increasing in speed. The aircraft appeared to be maneuvering into an attack position.

- The aircraft was reported to have sent an IFF signal squawking in the Mode II common to the F-14.

- The F-14s were reported to have an anti-surface capability with Maverick and modified Sea Eagle missiles.

The end result was a mix of coincidence and human error that cost 260 lives. At the same time, however, Iran must also bear a considerable amount of blame. Even given the pilot workload during take-off, the Iranian pilot should have monitored the IAD warning frequencies. Similarly, Bandar Abbas, Approach Control, and Tehran Center either did not monitor or ignored the IAD warnings. Iran also allowed an airliner to fly at low altitude in close proximity to hostilities that had been underway for several hours. While it is unclear that the IRGC gunboats were in communication all of the time, they were certainly in communication with the military base at Bandar Abbas, and had ample time to warn Iranian civil aircraft.

14.5.4 The Lessons of the Shooting Down of Iran Air 655

The key lessons of the shooting down of Iran Air 655 had nothing to do with military technology. The first lesson is that no mix of technology can control the risks and uncertainties of combat. This is particularly true in "low level" conflicts which are highly political in nature and which involve opposing forces where there are no fixed patterns of conflict. Mistakes and problems are simply inevitable on both sides, and some will always involve innocent lives. It is clear that both the U.S. and Iran concentrated too much on the military situation and did not examine all of the risks to civilians in the proper depth. At the same time, the conflict in the Gulf involved so many possibilities that it is unclear any amount of prior thought or planning could have focused enough resources on this particular contingency to prevent it.

The second lesson, and one that has been driven grimly home by virtually all recent low level wars, is that war cannot be managed to the point where it can avoid civilian losses or unpredictable tragedy. There is an acute danger in assuming that modern technology and communications can somehow create either perfect war or perfect conflict management. It is obvious from the Iran-Iraq War, the Falklands conflict, Israel's 1982 invasion of Lebanon, and the Soviet invasion of Afghanistan that such expectations are false to the point of absurdity. War kills and it does not kill wisely or fairly. Nothing is ultimately more predictable than the fact that war will produce unpredictable losses. Any realistic intervention in a military situation must be based upon this reality.

Third, at a more technical level, the shooting down of Iran Air 655 showed that far more attention is needed to training under stress, and to going beyond technical excellence to training crews to accept the actual stress of combat.

Nothing is more human than to react to stress by imposing preconceptions or sudden misinterpretations on the actual evidence. This was a major recommendation of the U.S. Navy inquiry and one that has broad application to virtually every aspect of complex weapons system training.

Fourth, wherever possible, nations should attempt to work out rules of engagement that offer the maximum possible protection to civilians. Little real effort was made to restructure flight paths and handle the problem of protecting civilian airliners until Iran Air 655 was shot down. The warning procedures, notification procedures, air control procedures, and flight patterns all increased the risk of such an event. While war may have no rules, particularly in highly politicized conflicts, it should be possible to negotiate a wide range of agreements, and special attention should be given to such negotiations the moment a conflict begins or seems likely.

Fifth, more attention needs to be given to the command and control and related subsystems at every level of military organization and technology to take account of the fact that low level wars often do not involve an easy ability to identify friend or force and may be subject to major political constraints. In the case of the Vincennes, for example, the displays and command and communication procedures were heavily overoptimized for total war. A number of displays and command procedures have to be changed to establish better controls and checks to avoid shooting down an aircraft that blundered into a combat zone. It also would have been desirable to have computerized the civil air patterns in the area and to have added more radios to improve civil communications. The *Vincennes* had insufficient VHF radio capability to both issue warnings to an aircraft and constant the civil air traffic control facilities in the area at the same time. These radios were provided to U.S. warships in September, 1988, but by this time the war had already ended in a ceasefire.[69]

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69 New York Times, September 9, 1988, p. A-6.