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**Center for Strategic and International Studies  
1800 K Street N.W.  
Washington, DC 20006  
(202) 775-3270  
(To comment: [Acordesman@aol.com](mailto:Acordesman@aol.com))**

**Saudi Arabia Enters the 21<sup>st</sup> Century:  
The Military and Internal Security Dimension**

**VII. The Saudi Air Force**

*Final Review*

**Anthony H. Cordesman  
Arleigh A. Burke Chair for Strategy  
Center for Strategic and International Studies**

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## **Introduction**

**This analysis is being circulated for comment as part of the CSIS “Saudi Arabia Enters the 21<sup>st</sup> Century Project.” It will be extensively revised before final publication.**

**Those interested in commenting, or in participating in the project, should contact Anthony H. Cordesman at the address shown on the cover sheet at [Acordesman@aol.com](mailto:Acordesman@aol.com).**

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# **The CSIS “Saudi Arabia Enters the 21<sup>st</sup> Century Project”**

The CSIS is undertaking a new project to examine the trends shaping the future of Saudi Arabia and its impact on the stability of the Gulf. This project is supported by the Smith Richardson Foundation and builds on the work done for the CSIS Strategic Energy Initiative, the CSIS Net Assessment of the Middle East, and the Gulf in Transition Project. It is being conducted in conjunction with a separate – but closely related – study called the Middle East Energy and Security Project.

The project is being conducted by Anthony H. Cordesman, the Arleigh A. Burke Chair in Strategy. It uses a net assessment approach that looks at all of the major factors affecting Saudi Arabia’s strategic, political, economic, and military position and future implications of current trends. It is examining the internal stability and security of Saudi Arabia, social and demographic trends, and the problem of Islamic extremism. It also examines the changes taking place in the Saudi economy and petroleum industries, the problems of Saudisation, changes in export and trade patterns, and Saudi Arabia’s new emphasis on foreign investment.

The assessment of Saudi Arabia’s strategic position includes a full-scale analysis of Saudi military forces, defense expenditures, arms imports, military modernization, readiness, and war fighting capability. It also, however, looks beyond the military dimension and a narrowly definition of political stability, and examine the implications of the shifts in the pattern of Gulf, changes in Saudi external relations such changes in Saudi policy towards Iran and Iraq. It examines the cooperation and tensions between Saudi Arabia and the other Southern Gulf states. It examines the implications of the conventional military build-up and creeping proliferation of weapons of mass destruction in the Gulf, the resulting changes in Saudi Arabia’s security position. It also examines the security and strategic implications of the steady expansion of Saudi Arabia’s oil, gas, and petrochemical exports.

This project is examining the succession in the Royal Family, the immediate political probabilities, and the generational changes that are occurring in the royal family and Saudi Arabia’s technocrats. At the same time, it examines the future political, economic, and social trends in Saudi Arabia, and possible strategic futures for Saudi Arabia through the year 2010.

This examination of the strategic future of Saudi Arabia includes Saudi Arabia’s possible evolution in the face of different internal and external factors -- including changes in foreign and trade policies towards Saudi Arabia by the West, Japan, and the Gulf states. Key issues affecting Saudi Arabia’s future, including its economic development, relations with other states in the region, energy production and policies, and security relations with other states will be examined as well.

A central focus of this project is to examine the implications of change within Saudi Arabia, their probable mid and long-term impacts, and the most likely changes in the nature or behavior of

Saudi Arabia's current ruling elite, and to project the possible implications for both Gulf stability and the US position in the Gulf.

Work on the project will focus on the steady development of working documents that will be revised steadily during the coming months on the basis on outside comment. As a result, all of the material provided in this section of the CSIS web page should be regarded as working material that will change according to the comments received from policymakers and outside experts. To comment, provide suggestions, or provide corrections, please contact Anthony H. Cordesman at the CSIS at the address shown on each report, or e-mail him at [Acordesman@aol.com](mailto:Acordesman@aol.com).

Related material can be found in the "Gulf and Transition" and " Middle East Energy and Security" sections of the CSIS Web Page at [CSIS.ORG](http://CSIS.ORG).

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## VII. The Saudi Air Force

Saudi Arabia has given the modernization and expansion of the Royal Saudi Air Force (RSAF) a higher priority than that of the Army, Navy, and Air Defense Force. This reflects the fact that the RSAF is the only service that can cover Saudi Arabia's 2.3 million square kilometers of territory. It represents the investment most capable of cross-reinforcement with the other services. It also has had the most impact in terms of regional prestige, and the most credibility in terms of being able to support other GCC states or to operate with USCENTCOM forces in a major crisis, although its quality and real-world strength has declined significantly since the mid-1990s.<sup>1</sup>

The Saudi Air Force is headquartered at Riyadh. Like the Army and Navy, it has a modern headquarters staff with five major branches -- G1 Personnel, G2 Intelligence and Security, GS Operations and Training, G4 Logistics, and G5 Civil and Military Affairs. The RSAF also has a military academy and an extensive system of training schools and support facilities. Its operational command is structured around its Air Command and Operations Center, and base operations. The main Air Command and Operations Center is near Riyadh and there are Sector Operating Centers at Tabuk, Khamis Mushayt, Riyadh, Dhahran, and Al-Kharj. These centers control air defense operations by fighter aircraft, surface-to-air missiles, and air defense artillery.<sup>2</sup>

The RSAF has shifted from a command structure whose chain of command went from Air Force command to air base command to squadron, to a chain of command going from Air Force command to sector command to base command to wing or group command to squadron. This new command structure is designed to give certain sectors more freedom and flexibility at the local command level.

It has operational command facilities at its air bases in Riyadh (King Faisal Air Academy), Dhahran (King Abdul Aziz), Tabuk, Jeddah, and Khamis Mushayt. There are additional major air bases at Al Jawf, Hafr al Batin, and Taif (King Fahd). There are major Air Defense Force facilities at Al-Kharj, Dhahran, and Khamis Mushayt. Most of Saudi Arabia's

fighters and strike aircraft are based at Dhahran, Taif, and Khamis Mushayt. In the past, the RASAF has limited its deployments in Tabuk to minimize vulnerability to Israeli attacks.

## **The Current Size and Capability of the Saudi Air Force**

The growth of the Saudi Air Force is summarized in Chart 7.1. While the build-up of the Saudi Air Force's combat strength shown in Chart 7.1 sometimes seems erratic, until recently the peaks generally represent periods where major new deliveries of combat aircraft took place while the older aircraft were still kept in service. Other peaks represent periods when lower quality and older aircraft were converted to trainers. In general, the modernization and expansion of the Saudi Air Forces proceeded relatively smoothly from the time it began to replace its Lightning fighters up to the mid-1990s. Unfortunately, the decline shown after 1995 does reflect a serious drop in force numbers that has been accompanied by a similar drop in war fighting capability.

The IISS estimates that the RSAF had about 20,000 men in 2002, not including another 16,000 men in the Air Defense Force. USCENTCOM estimates the Air Force's strength at a total of 16,500 men. According to one source, the RSAF's combat forces were organized into six wings with a total of 15 combat squadrons and about 259 operational first-line, fixed-wing combat aircraft, and 39 combat capable trainers. The IISS estimated that Saudi Arabia had a total inventory of about 432 combat aircraft with about 348 active combat aircraft. The Saudi Army operates an additional force of 12 AH-64 attack helicopters, and the Navy has 21 more armed helicopters. These armed naval helicopters include 19 AS-56 helicopters, of which four are equipped for the search and rescue mission and 15 has AS-15TT anti ship missiles, six AS-332B transports, and six AS-332Bs equipped with Exocet anti-ship missiles.<sup>3</sup>

Chart 7.2 shows how the size of the Saudi Air Force manpower compares with that of other Gulf states. Chart 7.3 provides similar data for comparative total fixed and rotary-wing combat aircraft strength. Chart 7.4 compares relative holdings of advanced types of combat aircraft, and Chart 7.5 compares holdings of low-quality combat aircraft. Chart 7.6 compares reconnaissance aircraft, Chart 7.7 compares sensor aircraft, and Chart 7.8 compares attack helicopter strength.

As these charts show, the Saudi Air Force has benefited from the fact that Iran has not had any major modernization since the fall of the Shah, other than for limited deliveries of MiG-29s and Su-24s, and Iraq has faced an arms embargo since the summer of 1990. As a result, the Iranian air force is worn and aging, and the Iraqi air force is now at least a decade old and has never had major weapons deliveries to allow it to react to the lessons of its massive defeat during the Gulf War.

This force strength and equipment mix has made the Saudi Air Force the most advanced air force in the Gulf in terms of modern aircraft and weapons, but it still has major defects. These defects include:

- An over-emphasis on air defense at the expense of offensive air capabilities, and particularly capabilities designed to deal with advancing Iraqi armor or the naval threat from Iran.
- A failure to develop effective joint warfare capabilities, realistic joint warfare training capabilities, and transform joint warfare doctrine into effective war fighting plans to support the Army, National Guard, and Navy.
- A failure to develop a truly integrated air defense and war fighting capability with other Southern Gulf states.
- A failure to rapidly modernize the RSAF C<sup>4</sup>I/SR and battle management system and to develop high capacity secure communications, and to expand the role of sensor, electronic warfare, and intelligence aircraft to support offensive and joint warfare missions.
- A lack of overall readiness, and poor aircrew and maintenance to aircraft ratios, which has forced the near-grounding of its F5s, and has severely reduced the effectiveness of its F-15s and Tornados. Since 1994, the poor leadership of the air force, the mishandling of overall training and readiness, underfunding, and poorly managed Saudisation, have brought readiness to the point of near-crisis and led to a severe increase in the Air Force's accident rate.
- A failure to modernize training to support realistic offensive and joint warfare missions.
- A decline in leadership since the Gulf War, and particularly in focusing the modernization of the RSAF on key missions. Slow promotion and turnover, and corruption in the highest ranks, have compounded these problems.

Saudi Arabia's mix of aircraft also has its disadvantages as well as its strengths. In 2002, Saudi Arabia's total inventory of major combat aircraft included 72 F-15Ss, 67 F-15Cs, 20 F-15Ds, 85 Tornado IDSs (10 Tornado GR.1 recce-attack equipped), 22 Tornado ADVs, and 5 E-

3A AWACS. Until recently, the RASF also had 56 F-5Es, 21 F-5Fs, 10 RF-5Es, and 14 F-5Bs. By early 2001, however, most of the F-5s were grounded and in storage. Only 14 F-5B still seem to be operational in a combat-capable training unit.<sup>4</sup>

The combat strength RSAF aircraft strength included four fighter-attack squadrons. Three with 85 Tornado IDS, and one with 14 F-15B/F/RFs. In theory, there were still three squadrons with 53 F-5Es, but virtually all of these aircraft were grounded. The IDS squadrons had dual-capable trainer aircraft, and 10 had a dual-mission in the reconnaissance role. These squadrons were equipped with a wide range of attack munitions, including AS-15, AS-30, AGM-45 Shrike, and AGM-65 Maverick air-to-surface missiles and the Rockeye, Sea Eagle, and Alarm air-to-ground weapons. Saudi Arabia had MQM-74C Chukar II and Banshee remotely piloted vehicles for reconnaissance and target acquisition.

The Tornado squadrons provided much of the offensive strength of the Saudi Air Force, but were configured more for bombing against fixed targets than joint warfare or operations against armor. The Tornado does, however, have superior low altitude flight performance in attack missions to the F-15S, and was specifically designed to fly nap of the earth missions, while the F-15S is subject to buffeting because of its large wing area. The Tornado also has superior air-to-surface missile armament. It can deliver the ALARM anti-radiation missile and Sea Eagle anti-ship missile and the Saudi F-15S is currently limited to the Maverick, which only has a strike range of around 10 miles. Both aircraft can deliver laser-guided bombs and self-illuminate their targets.

The RSAF had nine interceptor squadrons for defensive missions. There were five squadrons with a total of 87 F-15C/Ds (67 F-15C and 20 F-15Ds), and more squadrons with 72 F-15Ss. F-15Ds were deployed to each F-15 squadron to perform both training and operational missions. There was one Tornado ADV squadron with 22 aircraft, which also included dual-capable trainer aircraft. Saudi fighters were equipped with modern air-to-air missiles, including AIM-9L and AIM-9P infrared guided missiles, AIM-7F Sparrow and Skyflash radar guided missiles. The RSAF is acquiring the AMRAAM air-to-air missile, which will give it substantial beyond visual range (BVR) all-weather air combat capability. Saudi F-15 fighter units are capable in the air defense role, but most aircrews now lack adequate advanced fighter combat training. The Tornado ADS has not proved to be an effective fighter except in a stand-off missile defense role and is being shifted to other missions.

What the Tornado and F-15 squadrons have had in common since the mid-1990s is a lack of adequate pilot training and flight hours which has led to numerous fatal accidents—all of which have said to be the result of “pilot error.” The truth is a combination and a lack of effective top level leadership. While far too many Saudi pilots have been allowed to qualify that lacked that lacked the necessary skills and language abilities, readiness and training has been underfunded and responsibility lies with the high command of the RSAF, and not with the pilots.

Saudi Arabia has been the only Southern Gulf air force with meaningful numbers of reconnaissance aircraft. Until recently, the RSAF had two aging reconnaissance squadrons with a total of 10 RF-5Es. These aircraft have reached obsolescence in terms of their sensors and survivability, however, and most are now deadlined or in storage. The 10 Tornado IDS-Rs in the fighter-ground attack force could probably perform most missions, and Saudi Arabia is acquiring reconnaissance and electronic warfare pods for its F-15s and has deployed some of this equipment.

The RSAF had an airborne early warning squadron with five E-3As I early in 2002. These aircraft now have Saudi crews, but the crews have shown only limited capability to manage complex air battles and the RSAF must rely on the USAF for help in such missions. The Saudi E-3As also lack adequate secure communications and data links, and need an upgrading of their software and improved electronic support measures. The remaining multipurpose squadron with 14 F-5Bs has both a training and a combat mission, but had little real operational capability. Most aircraft were “parked” and without real operational capability.

The RSAF also had 25 armed Hawk Mark 65 jet trainers, and 20 armed Hawk Mark 65A jet trainers. Saudi holdings of 36 BAC-167 turboprop COIN and training aircraft were phased out of service in the late 1990s. The Hawk units were technically capable of performing COIN and light attack functions with machine guns, cannons, and rockets, as well as training missions but the combat mission training of the Hawk aircrews is limited RSAF does not plan to use them in that role. The RSAF also had 13 Cessna 172s, one Jetstream, and 50 PC-9 aircraft in training units that were not armed for combat.

Some US advisors have argued that the Hawks present problems as training aircraft because they cannot be used to train for supersonic flight or for the kind of demanding mission

profiles needed for F-15 training. Others experts note, however, that the USAF is the only country to use supersonic trainers (the T-38 Talon) and that such training is normally conducted in supersonic fighters. This includes flight training in the US Navy – which uses a derivative of the Hawk called the Goshawk -- the RAF and Israeli and Japanese Air Forces.

The combat mission training of the Hawk aircrews is limited and they are vulnerable to short-range air defenses (SHORADS), although they could be useful in securing rear areas. Some experts feel that the Hawk's inability to train aircrews for demanding air-to-air and air-to-combat missions and has contributed so much to the problems in Saudi F-15 aircrew proficiency that the aircraft should be replaced, but it is far from clear what better trainer is available.

The RSAF is the only Gulf air force with an effective mid-air refueling capability. In 2002, its support units included a tanker squadron with 8 KE-3A tanker/transport, and 8 KC-130H tankers. It had three transport squadrons with 38 C-130 cargo-transport (7 E, 29 H, and 2 H-30), 1 KE-3B (EW), 3 L-100-30HS hospital aircraft, and 4 CN-235s. There were also two helicopter squadrons with 22 AB-205s, 13 AB-206s, 17 AB-212s, 40 AB-41EP (SAR) and 10 AS-5323A2 (SAR). There AS-532A2 Cougar search and rescue helicopters were ordered from France in September 1996, at a cost of \$590 million.<sup>5</sup> The Royal Flight provided substantial additional airlift assets, including 2 B-747SP, 1 B-737-200, 4 Bae 125-800, two Gulfstream III, 2 Learjet 35, 4 VC-130H, and 5 utility helicopters.<sup>6</sup>

Saudi Arabia had moderate but aging inventories of air munitions and spares in 2002 -- a marked decline from the large inventories of cutting edge munitions and high inventories it had at the time of the Gulf War. For example, the RSAF ordered 101 shipsets of F-15 conformal fuel tanks, 909 AIM-7F and AIM-9P/L air-to-air missiles, 100 Harpoon and 1,600 Maverick air-to-surface missiles, JP-233 and BL-755 bombs and munitions, before Iraq's invasion of Kuwait. It also ordered large numbers of additional Aim-9Ls and Aim-7Fs in August 1990, and 2,000 Mark 84 2,000-pound bombs, 2,100 CBU-87 cluster munitions, 770 AIM-7Fs, and components for laser-guided bombs in July 1991. The Kingdom did not continue to properly maintain and modernize its munitions inventory, however, and has not procured all of the air-to-ground and anti-ship ordnance it needs for joint warfare.<sup>7</sup>

Up until the mid-1990s, the Saudi Air Force had excellent foreign support. During the 1970s and early 1980s, Saudi Arabia was able to draw on the US Air Force and contractor support to create some of the most modern air facilities in the world. These programs have been steadily renewed and expanded ever since, and the current contract is worth \$2.5 billion and runs from June 1997 through May 31, 2002. There have, however, been growing financing and payment problems since the mid 1990s, and they grew worse after the “oil crash” of late 1997. Saudisation has not helped, nor has adequate use been made of the offset program. Foreign contractors have often been replaced with Saudis selected more for their contacts than their skills, and training programs for Saudis have not enforced the proper qualification standards.

Facilities remain excellent. No US or NATO base has sheltering or hardening equal to the Saudi bases at Dhahran and Khamis Mushayt, and similar facilities will be built at all of Saudi Arabia's main operating bases.

## **Operational History and Force Development**

The RSAF has a better past than a present. It first proved its effectiveness in Saudi Arabia's border wars with Yemen. In the late 1980s, it created effective air defenses to meet a threat from Iran during the Iran-Iraq War. It established the “Fahd Line,” which created an Air Defense Identification Zone and forward air defense system off the Saudi coast. Saudi Arabia defended its air space and shot down an Iranian F-4 that tested Saudi defenses on June 5, 1984.

The RSAF was the most effective single element of Arab forces in the UN Coalition during the Gulf War. It flew a total of 6,852 sorties between January 17, and February 28, 1991-- ranking second after the US in total air activity, and flying about 6% of all sorties flown. These sorties included 1,133 interdiction missions, and 523 battlefield air interdiction missions, for a total of 1,656 offensive missions. The RSAF flew 2,050 defensive counter-air missions, 129 offensive counter air missions, and 102 escort missions for a total of 2,281 air defense sorties. The RSAF flew 118 reconnaissance sorties, 85 E3-A AWACS sorties, 485 refueling sorties, and 1,829 airlift sorties.<sup>8</sup>

During the slightly longer period from January 16 to February 28, Saudi Air Force F-15C units flew 2,088 sorties (over one-third the total F-15C sorties flown by the USAF) and 451

Tornado ADV sorties. Saudi pilots were as capable in these air defense sorties as most pilots in NATO. The RSAF also flew 665 Tornado GR.1/IDS strike sorties, 1,129 F-5 sorties, and 118 RF-5 sorties. Saudi F-15Cs shot down three Iraqi Mirage F-1s with air-to-air missiles -- including the only double kill by a single fighter in the war on January 24, 1991. The RSAF lost only two aircraft -- one Tornado GR.1 because of a pilot error in reading the fuel gauge and making an emergency landing -- and one F-5 to unknown causes.<sup>9</sup>

### **Shaping the Saudi Air Force: The “Peace Sun” Program**

Much of the capability of the modern Saudi Air Force depends upon its ability to make effective use of the F-15 and Tornado. The F-15C/D was the first of these purchases, and had extensive US support. During the early 1980s, spare parts, equipment, and facilities for Saudi Arabia’s original F-15s were provided under an extensive, multi-stage program called Peace Sun (Royal Saudi Air Force Technical Support Program).<sup>10</sup> The second stage of Peace Sun (Peace Sun II) involved an \$82.5 million contract for spare parts and support equipment for 12 F-15 craft, and this contract was increased by \$20.1 million four months later.<sup>11</sup> Under Peace Sun IV, \$10.1 million worth of spare components and retrofit kits were provided for modifications and upgrades to the F-15s.<sup>12</sup> Three F-15D and nine F-15C aircraft were purchased from McDonnell Douglas under Peace Sun VI.<sup>13</sup> Also purchased under this contract were two F100 engines for use on the F-15.<sup>14</sup> A follow-up to Peace Sun VI in 1996 included an upgrade of the F-15 software at a cost of \$11.5 million.<sup>15</sup>

During the early 1990s, construction work was done at three bases in the Kingdom where the F-15s are based: Taif, Khamis Mushayt, and Dhahran (Peace Sun IX).<sup>16</sup> Thirty mission support systems were also purchased under this stage for the 72 new F-15 aircraft then on order. These systems are capable of flight planning, route planning and threat penetration, weapons delivery and target area tactics, radar predications, mapping and imagery, post-flight analysis, and debriefing and intelligence connectivity.<sup>17</sup> Peace Sun X involved a contract for the LANTIRN terrain following radar and forward looking infrared, and laser designator, from Martin Marietta.<sup>18</sup> In January 1999, Boeing was awarded a \$79.1 million contract to provide for direct manning personnel from January through March 1999 to assist the Saudi Air Force in the operation and maintenance of the F-15.<sup>19</sup> This contract has been renewed regularly since that time, and its total value of the contract over time now approaches \$1 billion..<sup>20</sup>

The Peace Sun program has been valuable in providing Saudi Arabia with both the F-15 aircraft it needs, as well as the support and upgrade capability necessary to maintain them over the long-term. However, the remaining stages of the Peace Sun program are facing the same funding difficulties as other Saudi military contracts. As of May 1999, the United States has considered not renewing the Peace Sun or Peace Shield programs due to Saudi Arabia's inability to make timely payments.<sup>21</sup> The program continues, but evidently at a significantly lower level of effectiveness.

### **The Saudi Tornado Buy and Al-Yamamah Agreement**

The RSAF has faced a broad range of additional problems in developing a modern offensive strike capability, and it is important to understand the history of this effort. The RSAF tried for nearly five years to buy more F-15s, and to acquire an advanced attack mission capability from the US, during the early 1980s. In July 1985, however, President Reagan sent King Fahd a letter stating that he could not obtain Congressional approval of the sales Saudi Arabia sought. As a result, the Saudi Air Force initiated talks with Britain. These talks led to an agreement in September 1985 that Britain would provide 60 Tornado ADV air defense fighters, 60 Tornado IDS/GR.1 attack strike-fighters, light attack aircraft, trainers, helicopters, munitions, and British support services.

That same month, Saudi Arabia signed a series of memorandums of understanding (MOUs) with Britain that gave Saudi Arabia the option of turning each MOU into an individual contract. These MOUs were called the al-Yamamah agreement. Saudi Arabia's first major contract under the MOUs cost \$8 billion, but the total value grew to a total of \$29 billion by 1992. This figure included training, support, construction, naval vessels, etc. It was worth roughly \$4 billion a year to Britain by the early 1990s.

Saudi Arabia agreed to pay for al-Yamamah by bartering 600,000 barrels of oil per day. This gave Saudi Arabia a guaranteed market and allowed it to bypass some of the constraints imposed by OPEC quotas.<sup>22</sup> Revenue from the sale of oil has been channeled into a Saudi account at the Bank of England, from which the British Ministry of Defense withdraws payments to contractors.<sup>23</sup> This arrangement created serious payment problems when oil prices were low, however, particularly during the "oil crash" that began in late 1997.

The first phase of the al-Yamamah program called for the purchase of 24 Tornado ADV air defense fighters; 48 Tornado IDS/GR.1 ground attack fighters; 30 BAe Hawk 65 trainers; 30 Pilatus PC-9 trainers; and two Gulfstream aircraft, air weaponry, and ground support and training services.

### **The Tornado ADV**

The Tornado IDS/GR.1 proved to be a relatively successful strike aircraft, although it lacked a laser tracking system for the self-targeting of laser-guided bombs, the advanced avionics for long-range attack missiles, and advanced electronic “stealth” features. In contrast, the Tornado ADV did not prove to be a successful air defense fighter for either the British Royal Air Force or Saudi Arabia. It turned out to be under-powered. While its limited dogfight performance might not have been important in areas where long-range missile combat is critical, the short distances and reaction times affecting many potential threats to Saudi Arabia require dogfight superiority. Its radar warning receiver was not fully effective, and the Tornado's radar and air defense avionics experienced development and performance problems, as did efforts to fully integrate and qualify advanced air-to-air missiles with the aircraft.

Such “teething” problems are scarcely unusual in new aircraft, but they were severe enough in the case of the Tornado ADV to prompt the RAF to talk about converting its air defense Tornados to reconnaissance, strike, or electronic warfare missions, or dropping them from service the moment it could obtain some form of Eurofighter. The RSAF's experience with the first eight Tornado ADVs was also negative. It converted some to the reconnaissance role, and converted the rest of its orders for ADVs to IDS strike-attack aircraft.

### **Orders for the Tornado Strike-Attack Fighter, Hawk, and Helicopters**

At the same time, such problems did not prevent additional Saudi orders for British aircraft. In July, 1988, Saudi Arabia signed a letter of intent for a second phase of al-Yamamah. According to Saudi sources, the second phase included 48 more Tornado strike-attack fighters, 40 Hawk 100 and 20 Hawk 200 trainer-fighters, 3-6 Vosper Thorneycroft mine counter measure vessels, C<sup>4</sup>I systems, and additional weapons, spares, ground support, and training. The Hawk 200 has combat radars -- unlike the trainer version. It was also ordered with Sea Eagle anti-ship

missiles. Munitions included the Skyflash, ALARM, Sea Eagle, and AIM-9L missiles, and JP-233 and BL-755 bombs.<sup>24</sup>

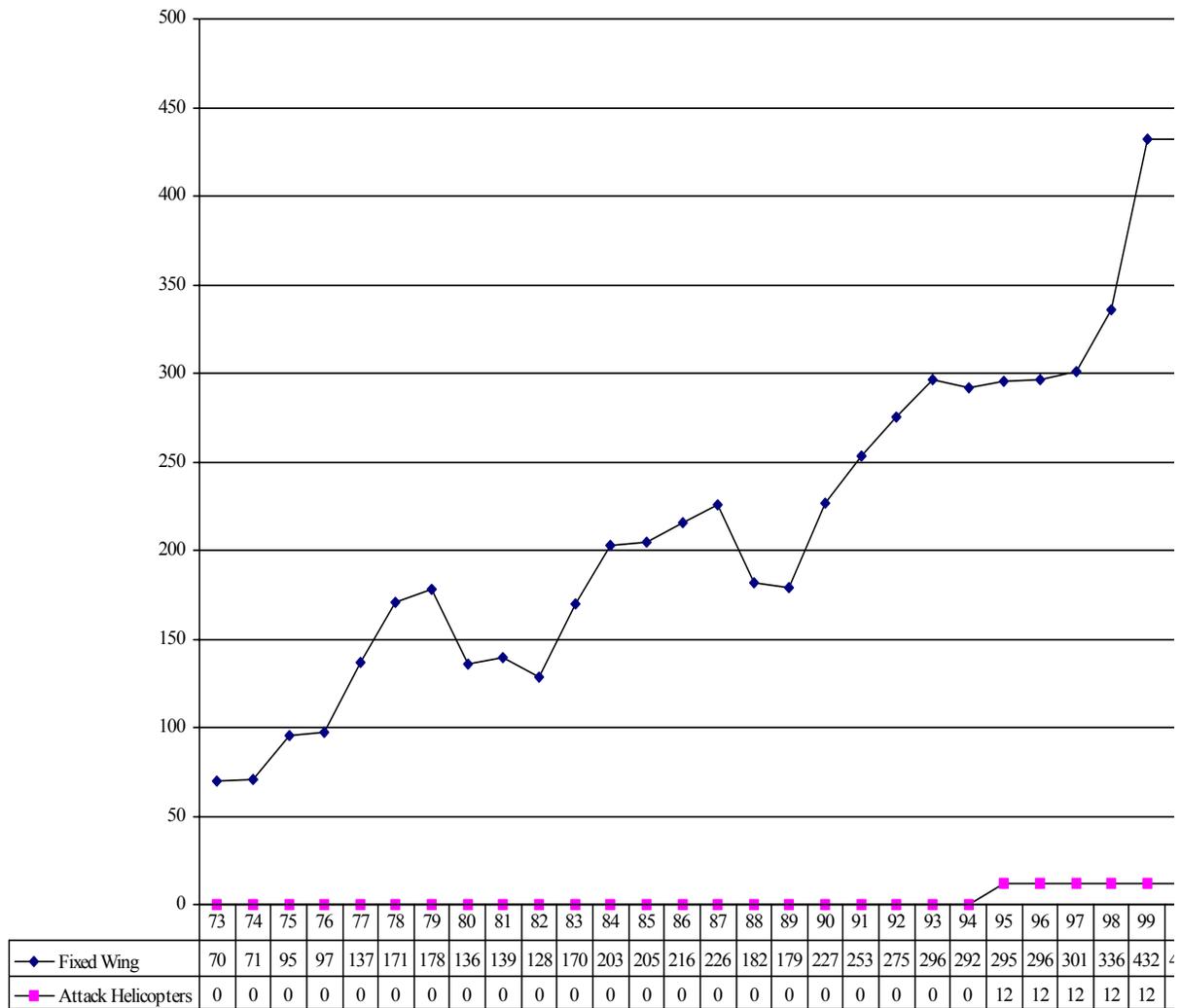
The new series of MOUs included the order for 80 Sikorsky Black Hawk helicopters for the army discussed earlier. The RSAF had already ordered 12 Black Hawks through the US, but these were transport versions of the aircraft and it was concerned that the US Congress would not sell it armed or attack versions. Accordingly, it ordered the 88 Black Hawks from Westland in Britain. According to some reports, it ordered them with TOW air-to-surface missiles.<sup>25</sup>

The total value of the memorandums of understanding that made up the second phase of al-Yamamah was approximately \$18 billion. The deal included light transport aircraft (12 BAe 125s and 4 BAe 146s), and two major military cities and air bases for the new Tornado forces, complete with British support.<sup>26</sup> The new British-built military cities and air bases were to be located at Taiba (about 290 kilometers southwest of Tabuk) and at al-Sulayyil (on the edge of the Empty Quarter). The air bases were to be equipped with at least 25 hardened multiple aircraft shelters. Saudi Arabia felt that its existing bases were adequate in the Eastern Province and near the PDRY, but were not suited for a force of nearly 400 combat aircraft. This brought the potential total value of the two phases of al-Yamamah to \$60 billion, projected over a 15-year program.<sup>27</sup>

There were good reasons for the Saudi purchase of the first phase of the al-Yamamah package. Saudi Arabia's 12 BAC-167 trainers were only armed with 7.62mm machine guns. They no longer could be used in anything other than light support functions. Saudi Arabia had bought its Lightning fighters from the UK under pressure from former Secretary of Defense Robert S. McNamara. The US effectively forced Saudi Arabia to buy the Lightning as part of a then-covert three-cornered deal, in which the Lightning sale to Saudi Arabia was designed to allow the UK to buy the F-111 from the US.<sup>28</sup> Even when first delivered, however, the Lightning never had the range, dual capability, and avionics Saudi Arabia needed. The investment in air bases was more questionable. While desirable, the cost was extremely high and Saudi Arabia soon found it faced serious funding constraints and that it had other priorities.

Chart 7.1

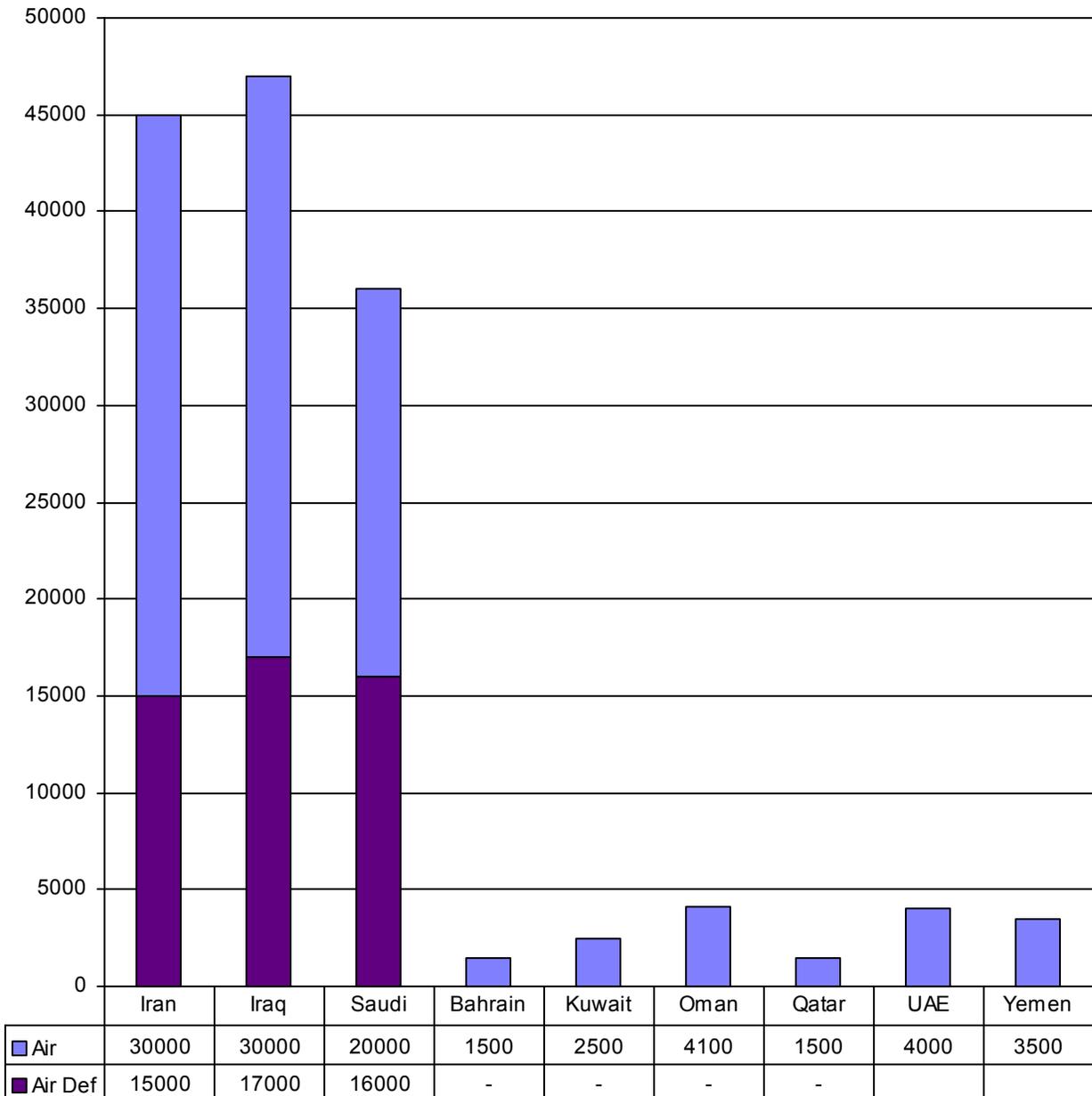
Saudi Arabia: Fixed Wing and Rotary Wing Combat Air Strength - 1979-2002



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel, and Jane's Defense Weekly, and material provided by US experts. Does not include armed naval helicopters.

Chart 7.2

Total Gulf Air Force and Air Defense Manpower: 2002

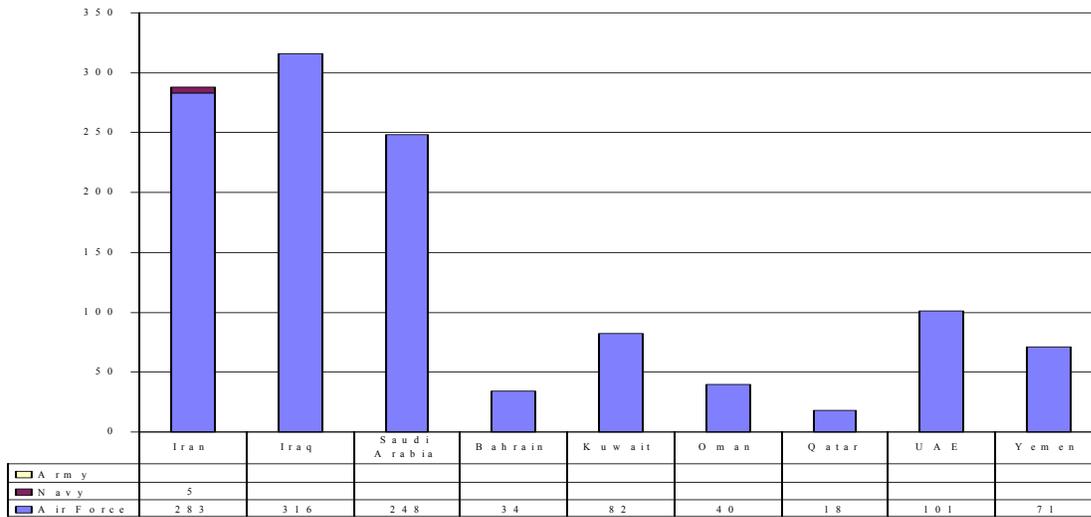


Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel, and Jane's Defense Weekly, and material provided by US experts.

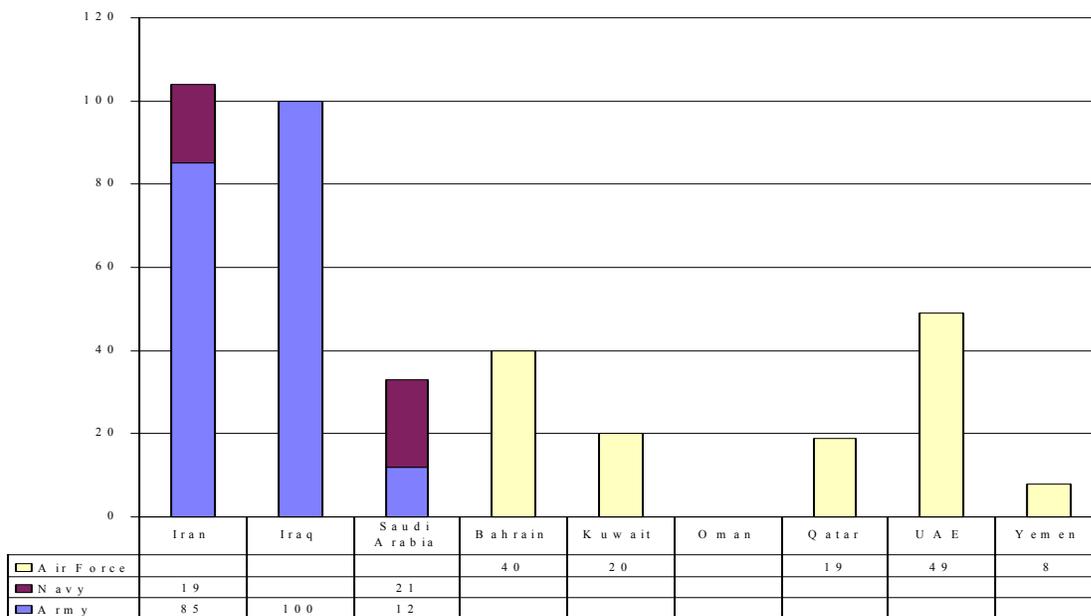
Chart 7.3

Total Gulf Holdings of Combat Aircraft – 2002

**Fixed Wing Combat Aircraft**



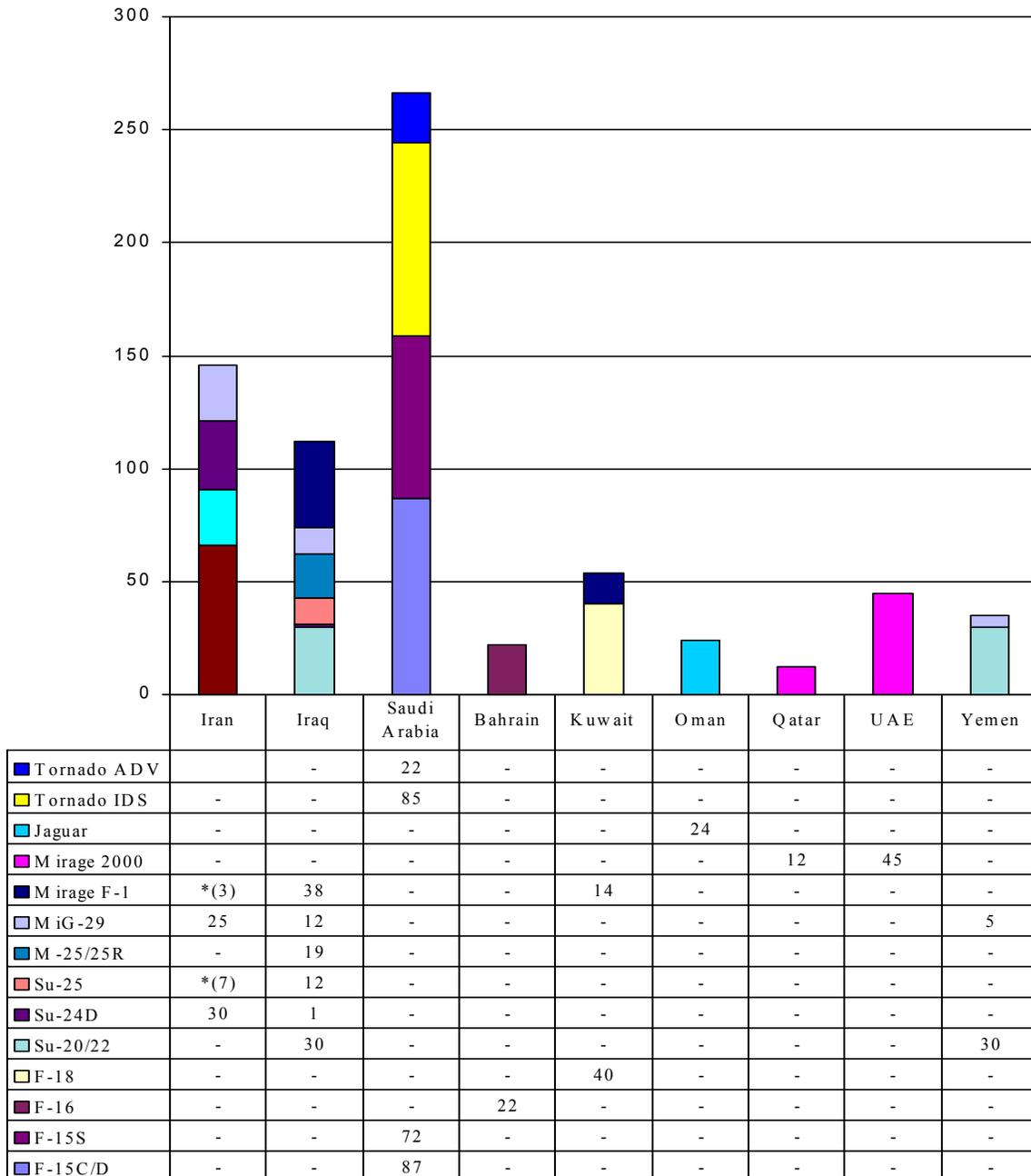
**Armed and Attack Helicopters**



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel, and Jane's Defense Weekly, and material provided by US experts.

Chart 7.4

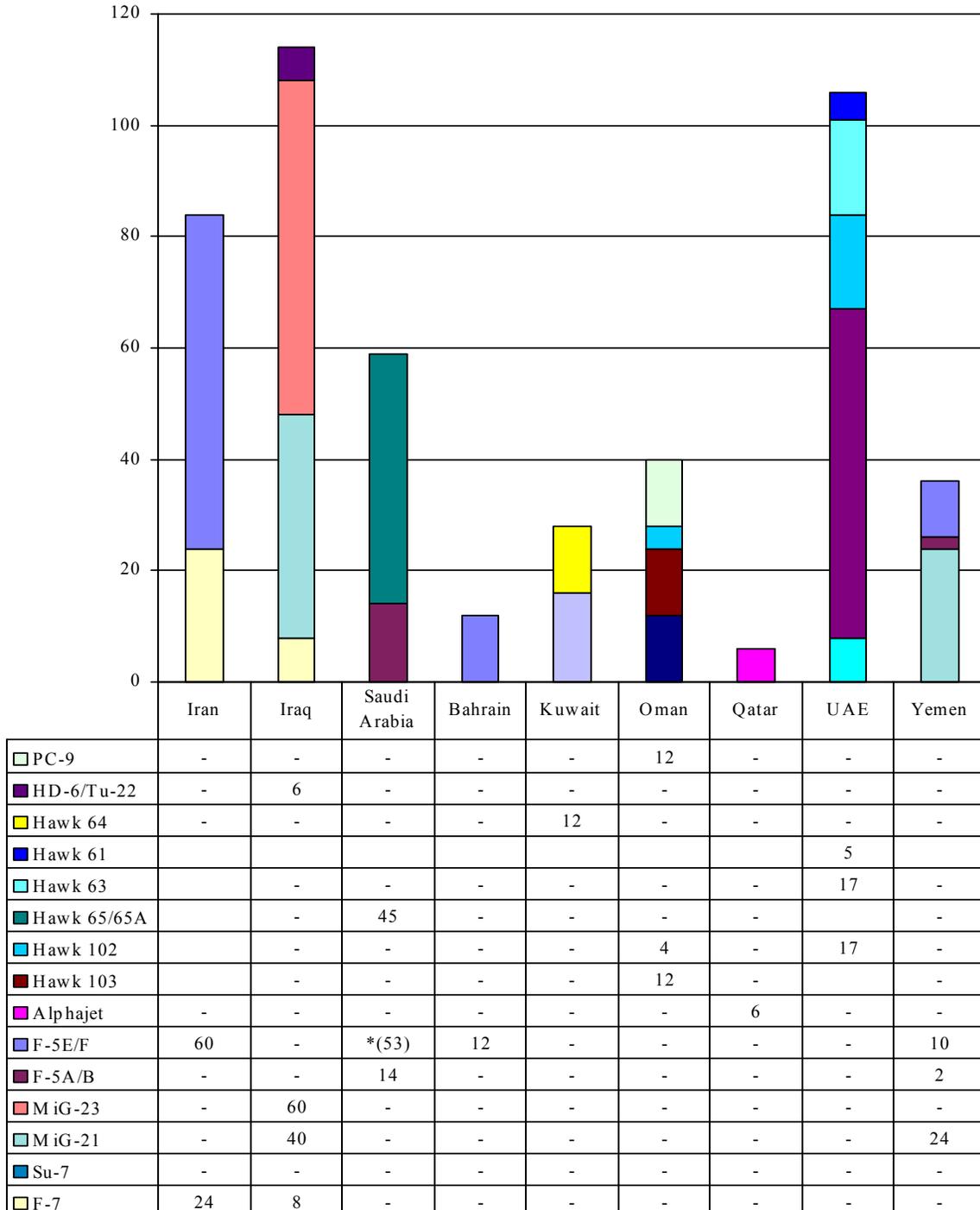
Gulf High and Medium Quality Fixed Wing Fighter, Fighter Attack, Attack, Strike, and Multi-Role Combat Aircraft By Type - 2002



Source: Adapted by Anthony H. Cordesman from the IISS, *Military Balance*, *Periscope*, JCSS, *Middle East Military Balance*, *Jane's Sentinel*, and *Jane's Defense Weekly*, and material provided by US experts.

Chart 7.5

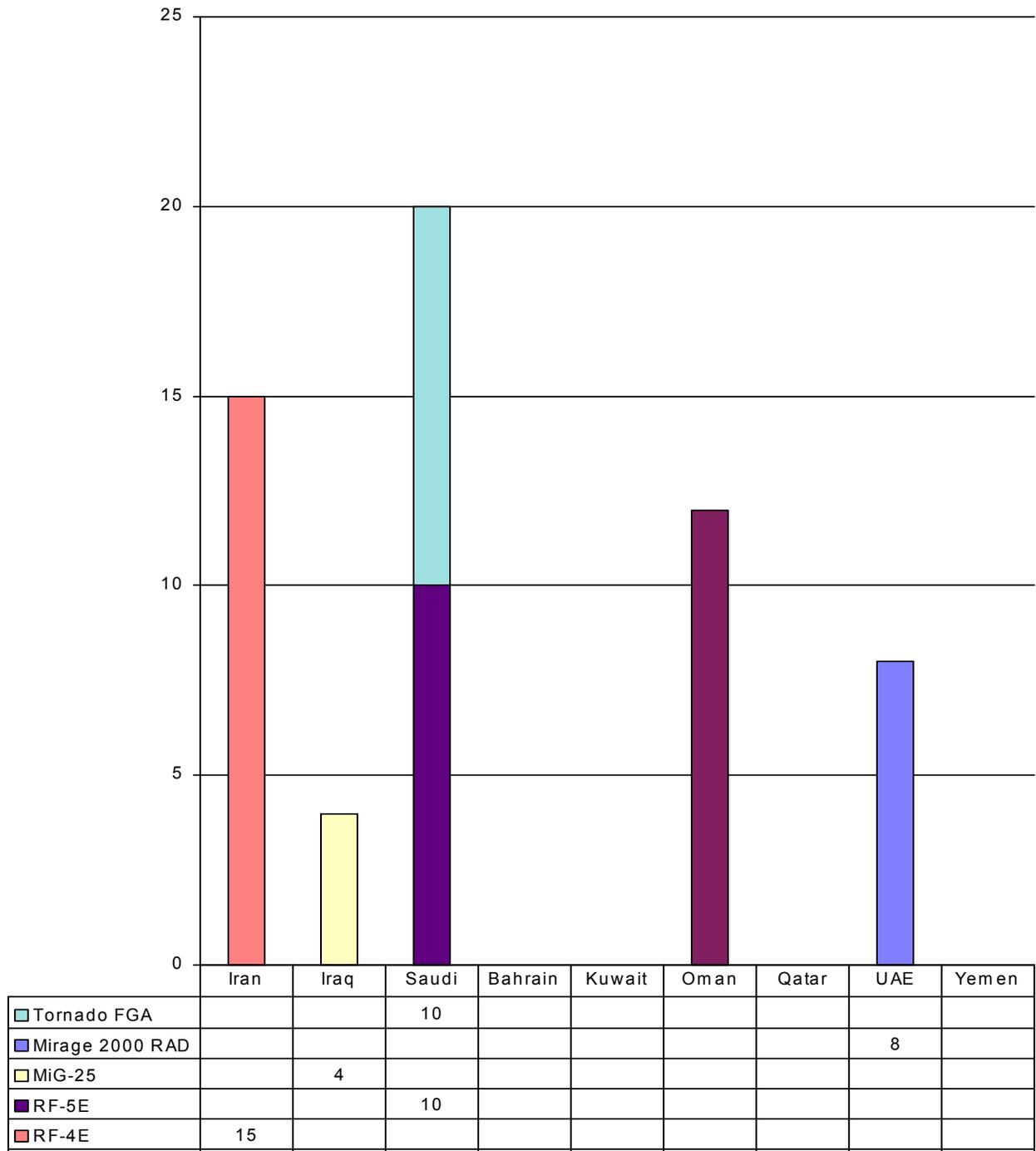
Gulf Low Quality Fixed Wing Fighter, Fighter Attack, Attack, Strike, and Multi-Role Combat Aircraft By Type - 2002



Source: Adapted by Anthony H. Cordesman from the IISS, *Military Balance*, *Periscope*, JCSS, *Middle East Military Balance*, *Jane's Sentinel*, and *Jane's Defense Weekly*, and material provided by US experts.

Chart 7.6

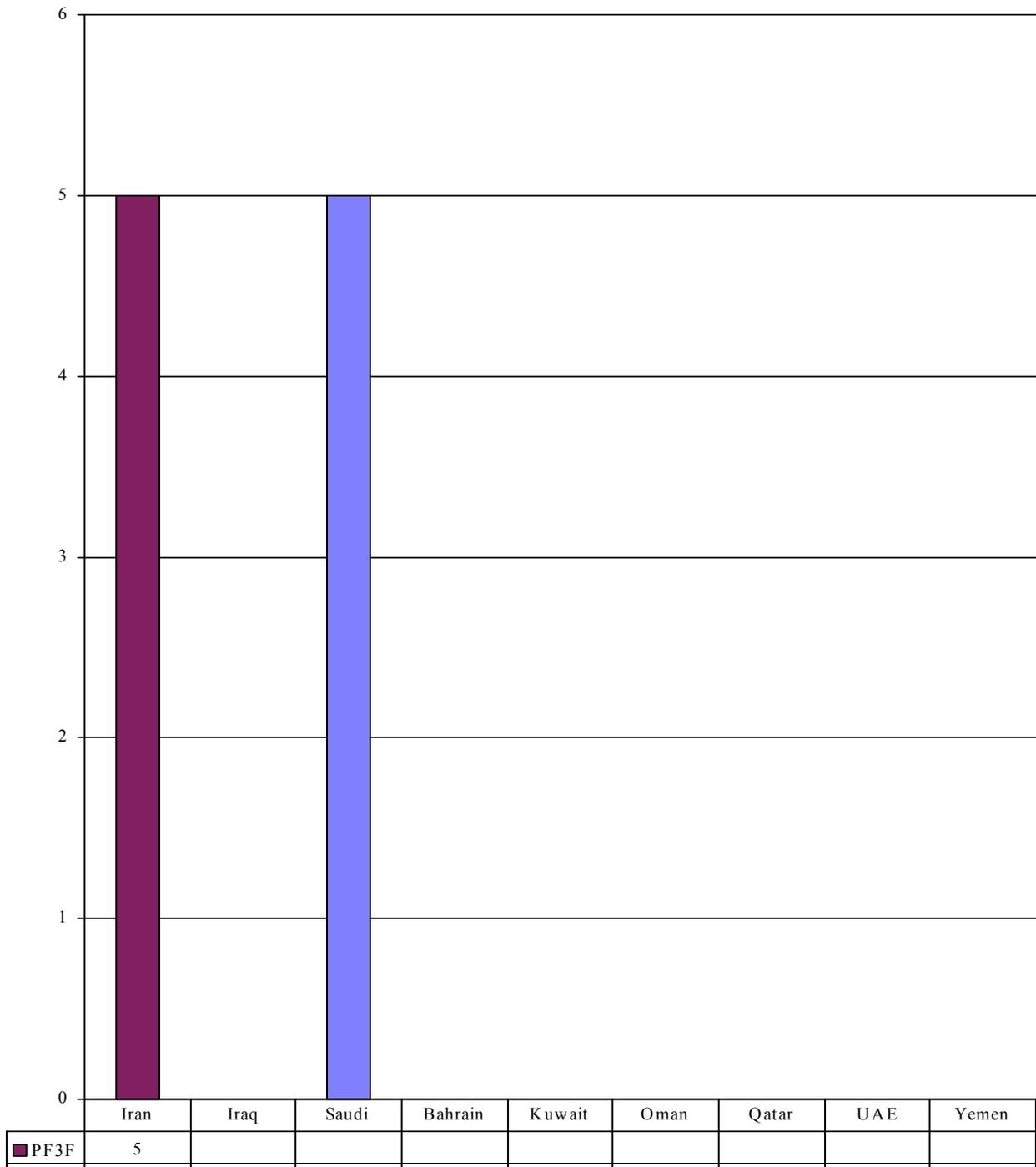
Gulf Reconnaissance Aircraft in 2001



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel, and Jane's Defense Weekly, and material provided by US experts.

Chart 7.7

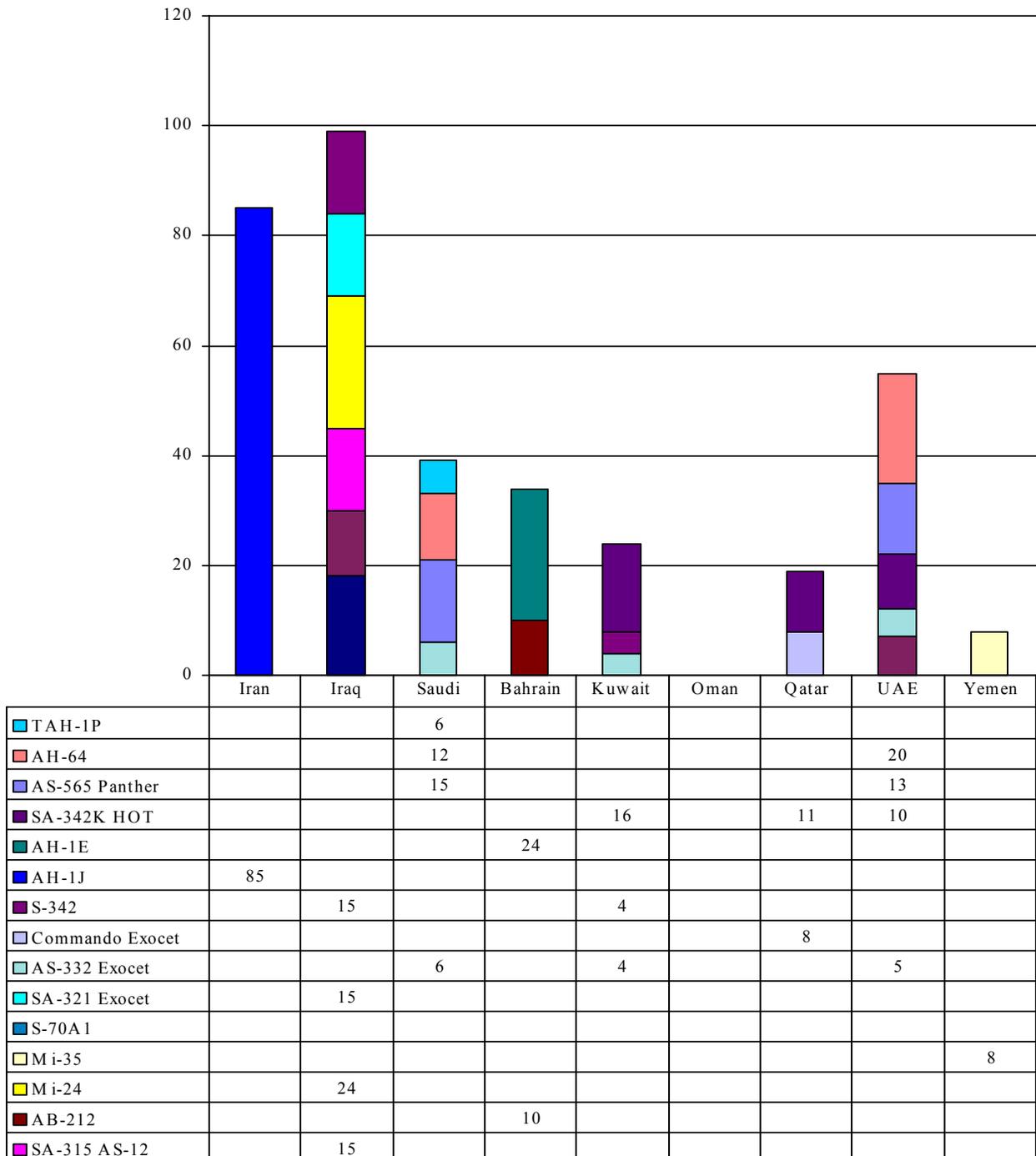
Sensor, AWACS, C<sup>4</sup>I, EW and Elint Aircraft in 2002



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel, and Jane's Defense Weekly, and material provided by US experts.

Chart 7.8

Gulf Attack Helicopters in 2002



Source: Adapted by Anthony H. Cordesman from the IISS, *Military Balance*, *Periscope*, *JCSS*, *Middle East Military Balance*, *Jane's Sentinel*, and *Jane's Defense Weekly*, and material provided by US experts.

## **Saudi Modernization After the Gulf War**

Saudi Arabia made significant new aircraft purchases as a result of the Gulf War. It purchased 24 additional F-15C/Ds from USAF stocks, 8 C-130Hs, and 2 C-130H-30 aircraft and large numbers of Aim-9Ls, and AIM-7Fs from the US in late August 1990. It also bought the Falcon Eye electronic warfare aircraft, although it knew that this plane lacked the sophistication and capability of US and Israeli ELINT aircraft.<sup>29</sup>

Saudi Arabia made these purchases because it felt it needed additional modern strike aircraft. Its F-5E-IIs and F-5Fs were relatively advanced models of the F-5E/F, equipped with INS, refueling probes, and the ability to fire Mavericks (the F-5F could also fire laser-guided bombs). The oldest of these F-5 aircraft, however, were nearing the end of their useful life, and the F-5 production line had long been closed. The F-5Es were not cost-effective to upgrade and required more than twice as much Saudi and foreign technical support manpower per plane as an F-15. The F-5E/Fs were also too short-ranged and limited in avionics and payload to cope adequately with the kind of advanced-threat aircraft being introduced into the region, or to deploy from one Saudi air base in support of another. As a result, the F-5Es were phased down into a training and light support role. Some 20-30% of Saudi Arabia's F-5 strength was already devoted to full-time training missions by 1990, and most aircraft gradually were deadlined during the 1990s.

The F-15C/D showed during the Gulf War that it could do an excellent job in air-to-air combat against the most advanced aircraft then in service in potential threat nations, and Iran and Iraq have not acquired more modern fighter types since that time. The Saudi F-15C/Ds, however, were configured as a one-mission aircraft and could only be used for air combat. The US Air Force had recommended that the Saudi Air Force be given an advanced dual-capable fighter as early as 1977 -- when it conducted the original studies that led to the US sale of the F-15 -- but the US could not then obtain Congressional permission to sell Saudi Arabia the bomb racks and attack systems necessary to make the F-15C/D effective in the air-to-ground role. As a result, a key part of Saudi Arabia's total first-line fighter strength was unable to perform effective attack missions, or provide attack support to Saudi land and naval forces.

## **The Search for Offensive Airpower and the F-15S Buy**

The Gulf War showed the Saudi Air Force the importance of offensive air power, and demonstrated that the Saudi Air Force could use the Tornado in long-range strike missions. The RAF proved during Desert Storm that the Tornado could be an effective strike fighter, once it was equipped with new FLIR and laser designator pods. The Tornado delivered over 1,000 laser guided bombs and ALARM missiles, and it was clear that the Tornado could help meet Saudi Arabia's need for a long-range deterrent to Iraq and Iran. However, the Tornado lacked the flexibility, maneuverability, and avionics to fly demanding missions using precision guided munitions against advanced air defenses in the forward battle area, and did not meet all of Saudi Arabia's needs for a first line strike aircraft.

Saudi Arabia reacted by buying 72 more F-15s in 1992. This purchase was possible because of the improvement in Saudi-Israeli relations and the strengthening of US and Saudi ties during the Gulf War. The potential risk of the F-15S being used by an unfriendly regime in the event of some unforeseen coup, is limited by the fact that Saudi Arabia accepted a reliance on US technicians and technical support to keep the aircraft operating, knowing that this reliance will continue well beyond the year 2005. As Iran showed during the first weeks of the Iran-Iraq War, even a relatively sophisticated air force can lose much of its operational strength in a few days if it lacks sophisticated technical support. Iranian F-14s had even lost their ability to use the Phoenix missiles by the time the Iran-Iraq War started.<sup>30</sup>

These factors, and a US commitment to provide Israel with enough technology superior to that of any potential Arab threat, allowed the Bush Administration to move the sale forward. President Bush and Defense Secretary Cheney made such a commitment to provide advanced technology at the time they announced the sale of the F-15S, and Israel's new Labor government indicated that it did not pose the same objections to the sale as did the Likud. As a result, Congressional leaders assured President Bush that they had the votes to ensure that Congress would not block the sale, and the President sent the proposed sale forward to Congress for approval on September 14, 1992.

Congress approved the sale on October 1, 1992, and this removed the last obstacle to a sale that provided major strategic benefits for both the Royal Saudi Air Force and the US. The

Saudi order included 72 more F-15 aircraft. All 72 aircraft were equipped with advanced avionics like LANTIRN, were designated the F-15S, and were dual-capable in both the air defense and strike/attack missions. The sale involved a total of \$5 billion worth of aircraft, and up to \$4 billion worth of other arms and supplies -- including \$800 million worth of construction. It also included 24 spare engines, 48 targeting and navigation pods, 900 AGM-65D/G Maverick air-to-surface missiles, 600 CBU-87 bombs, 700 GBU-10/12 bombs, and special mission planning systems.<sup>31</sup>

The radars of all the F-15Ss were better than those on the F-15C/D, however, and had a resolution of 60 feet at 20 nautical miles versus resolution of 530 feet in the F-15C/D. They could use the same AIM-7F and AIM-7M radar guided air-to-air missiles used by existing Saudi F-15C/Ds, and the AIM-9S, which is the export version of the radar guided AIM-9M air-to-air missiles. The F-15S also had the capability to be upgraded to use the Advanced Medium-Range Air-to-Air Missile (AMRAAM). In March 1999, the United States agreed to sell AMRAAM missiles to Saudi Arabia during a meeting with Saudi Defense Minister Prince Sultan. The missiles cost more than \$380,000 each, but can be used to shoot enemy aircraft at ranges of over 50 miles (80km).<sup>32</sup>

The F-15S variants of the F-15E Strike Eagle that were delivered to the Saudi Air Force were some of the world's most advanced combat aircraft, but did differ from the US Air Force version of the F-15E in several ways. They used the AAQ-20 Path Finder navigation pods, the AAQ-20 Sharpshooter targeting pods, and a laser illuminator. The Path Finder pods have terrain-following radar, but have reduced ECCM capabilities that allow them to be tracked by US types of fighters. The Sharpshooter pods for the F-15S only had limited cluster bomb delivery capability. They delivered the A/B version of the electro-optical Maverick and the D/G version of the IR Maverick, but did not have a missile boresight correlator. They only had a single-fire capability for Maverick, rather than multiple fire capability, and were not equipped to deliver the HARM anti-radiation missile.

The US also limited the offensive performance of the F-15S force. It did provide conformal fuel tanks for all of the aircraft, but without mounts to carry offensive air-to-ground weapons on these stations. The US only provided 48 pod sets plus spares for the F-15Ss in order to limit the RSAF's ability to use the aircraft with smart air-to-ground munitions to only 48

fighters at any given time. Without the pods, the other aircraft could not use navigation and targeting pods, or laser illuminators, and could only drop general purpose bombs.

The F-15S had several other changes from the F-15E. It had a de-tuned version of the APG-70 radar on the 15E. The radar on the F-15S had only 60% of the bandwidth of the regular APG-70, and only has 16 channels, rather than the regular 32. It did not have a computerized mapping capability, and had a resolution of 60 feet at 15 nautical miles versus 8.5 feet at 20 nautical miles in the F-15E. The F-15S had altered software for the AWG-27 armament control system. It lacked a data transfer module, and its ASW-51 auto flight control did not include the terrain following mode. It used a commercial- grade secure voice and global positioning system navigation system.

The F-15S's electronic warfare suite was missionized for use against non-US aircraft and threats in the Gulf and Red Sea area. This meant substantial modifications to the ALQ-135 internal countermeasures set, the ALR-56C radar warning receiver, the ALE-45 countermeasures dispenser, and MX-9287 interference blanker set. The ALQ-135 initially supplied to Saudi Arabia did not have the capability to jam friendly aircraft by type, and the radar warning receiver did not identify friendly aircraft by type.

There also were software issues as well. The performance of the F-15S is heavily affected by the software that its computer and other avionics use to recognize threats, launch air combat and attack munitions, counter enemy sensors and weapons, and navigate to target. The Saudis could not alter the software on the F-15S, and it had no software optimized to attack US or Israeli air and air defense systems. The terms of the sale also meant the software could not be modernized to operate a new type of weapon, or be optimized to deal with a new type of threat aircraft without US approval.

This situation began to change in 1998-2000. The RSAF F-15S were supplied with conformal fuel tanks of the kind supplied on the F-15E, adding two extra tangential stores stations for carrying extra munitions and some of its ability to carry precision guided weapons. The US also agreed to deliver Modern Mark IV IFF systems and Have Quick secure communications in the early 2000s. The F-15S's software has been steadily upgraded, however, as part of the US Air Force multi-stage improvement programs (MSIPs) for the F-15. The US

has also granted access to the software codes for the F-16C to the UAE, and may eventually give the F-15 codes to the RSAF.

The end result is that F-15S are now a far more advanced strike-fighter than any aircraft in service in Iran and Iraq, and could give Saudi Arabia a decisive edge over Iraq and Iran well beyond the year 2010. The F-15S fully meets Saudi Arabia's desire for an F-15E-like aircraft that can attack deep into Iraqi or Iranian territory, defend itself in air-to-air combat, and launch air-to-ground ordnance from outside the range of short-range air defense missiles. The F-15S can also be rapidly upgraded in an emergency if Iran or Iraq should acquire new types of fighters with advanced avionics.

In practice, however, the Saudi F-15 force has serious problems. These problems include inadequate funding of readiness, the lack of air and maintenance crews, inadequate offensive and joint warfare training, and the need for larger stocks of offensive munitions and more advanced types of munitions. Saudi Arabia is also developing a capability to conduct depot level maintenance for either the overall aircraft or the APG-70 radar.

### **More Tornados**

The Saudi Air Force also purchased additional Tornado and trainer aircraft. In April 1992, Britain announced that Saudi Arabia had agreed to a financing package for a \$2.7 billion follow-on sale, and indicated that the deal would again be financed "off-budget," by shifting oil revenue directly to a London account. The purchase of the additional aircraft was made financially possible by Saudi Arabia's decision deciding not to turn past MOUs into firm contracts. Saudi Arabia also took some cost-cutting measures. On August 24, 1992, Saudi Arabia cut the number of new air bases it would buy from two to one. This decision was a result of Saudi Arabia's discovery during the Gulf War that its existing facilities could sustain the build-up of some 500,000 foreign troops, and that they had substantial over-capacity. This decision saved Saudi Arabia \$15.6 to \$19.5 billion, and released funds it could use to complete the buy of 48 Tornado IDS/GR.1s.

Saudi Arabia signed a contract with Britain in early February 1993, to complete a buy of 48 Tornado IDS/GR/1s, and which included shelters, maintenance, weapons, and training for the aircraft. The aircraft were to be delivered in configurations similar to those used by the RAF, and

had Turbo-Union RB-199 engines, Sky Shadow ECM pods, and GEC-Marconi flight control systems, radars, and radar homing and warning receivers.<sup>33</sup>

The order did not include more Hawks and mine-countermeasure vessels, but negotiations continued on these purchases. When oil prices increased in 1994, Saudi Arabia ordered 20 more Hawk 65 jets and 20 more Swiss Pilatus PC-9 turboprop trainers, at a cost of \$750 million. This purchase helped provide training for the new pilots but meant Saudi Arabia would not buy enough advanced Hawks to replace its F-5s and would rely more on the lower-performance, tandem-seat, Hawk 100 variant of the aircraft.<sup>34</sup>

The future status of al-Yamamah is in doubt. Crown Prince Abdullah was not included in the 1986 negotiations that led to the signing of the first part of al-Yamamah, and is said to be concerned with some aspects of the agreement. In particular, he may not favor the arrangement by which al-Yamamah is able to escape budgetary pressures while these constraints increased on other military forces, such as his National Guard.<sup>35</sup> He may oppose arrangements that grant Britain 400,000 to 600,000 BPD of Saudi oil to pay for al-Yamamah almost indefinitely into the future. If Abdullah becomes king, he might seek to make the al-Yamamah deal a regular part of the Saudi budget.<sup>36</sup>

Some Saudi officers and officials have expressed concern that the al-Yamamah program has gotten too broad and unwieldy. Many in the Saudi government now privately express their concern over allowing the Saudi Ministry of Defense to operate the three billion dollar program independent of normal budgetary constraints, particularly in view of Saudi Arabia's structural budget deficits. Political support for the al-Yamamah deal has also eroded as funds have grown progressively tighter, and many officials and some members of the Royal family in civil ministries feel that the program has become wasteful, corrupt, and over-ambitious.

There are senior Saudis who feel that fully integrating all defense expenditures into a public national budget is a key step in bringing military spending under control, ensuring the proper trade-offs between military and civil expenditures, reducing corruption and favoritism, and building a popular consensus behind Saudi military efforts. At the same time, Saudi Arabia has a long tradition of secrecy and Prince Sultan is not likely to give up his prerogatives without a fight.<sup>37</sup>

Other factors are at work. A number of non-British firms have attempted to obtain part of the al-Yamamah funding. For example, Canadian Bell and Eurocopter have both sought to get money shifted to helicopter purchases<sup>38</sup> and were recently successful. Saudi Arabia chose to buy 12 Cougar Mark 2 search-and-rescue helicopters from Eurocopter in August 1996. The contract, valued at \$590 billion, included training, logistics, and technical support and marks the first significant order of French equipment by the Saudi Air Force.<sup>39</sup>

An additional 44 Canadian Bell-Boeing 412 search-and-rescue helicopters were expected to be purchased under the al-Yamamah deal by November 1997.<sup>40</sup> The new deal, however, encountered political and financing problems. The political problems related to British willingness to suppress the Saudi opposition. Saudi government made it clear during the 1990s that its purchases of British equipment were dependent on a less hospitable climate for Saudi dissidents in Britain. The British government responded to a November 1995 car bombing in Riyadh by ordering the expulsion of Mohammed al-Mas'ari, the head of the CDLR, after he made statements seemingly condoning the bombing. This move was blocked in a British court, however, and the Saudi government threatened to halt further defense purchases as well as other major contracts. It was only after Al-Mas'ari went bankrupt, that Saudi Arabia made it clear it would not take political action.<sup>41</sup>

Saudi Arabia tightened its control over the Al-Yamamah account at the end of 1996 by shifting responsibility for the daily sale of 650,000 barrels of oil to Aramco from Royal Dutch Shell and British Petroleum. The switch was a warning that the Kingdom's felt the funds derived from petroleum sales are to be used at the discretion of the Ministry of Defense, rather than exclusively for the purchase of British equipment. In addition, these developments occurred at a time when Saudi Arabia faced serious budget deficits and the Saudi budget was strained by a sharp decline in oil prices that began in late 1997. The resulting drop in oil revenues also aggravated concerns elsewhere in the Saudi government over allowing the Ministry of Defense to operate Al-Yamamah independent of normal budgetary constraints. The Ministry of Finance made it clear that it would like to end all off-budget programs, including Al-Yamamah.<sup>42</sup>

## **Looking Towards the Next Generation: The F-5EII Replacement Problem**

The next major procurement challenge the Saudi Air Force faces is how to deal with phasing out its aging F-5Es. The RSAF now has some 87 F-5s of various types in storage, and Saudi Arabia has talked about replacing the F-5EII for years. At various times, it has considered buying entire new aircraft -- like F-16s, and F-18s -- as replacements for its F-5s. At other times, it discussed the purchase of 72 F-15S aircraft, and 48 more Tornado IDS/GR.1s, plus some additional Hawks.

There were reports that Saudi Arabia would purchase of 70-102 F-16C/D fighters to replace its F-5Es in the summer of 1996 and early 1997. Press reports appeared in January 1997 that Prince Sultan would announce such a purchase during a coming visit to Washington. These reports indicated that this announcement would in part be an effort to defuse the tension between the US and Saudi Arabia over the investigation of the June 25, 1996 terrorist bombing of the Al-Khobar barracks. The sale was reported to have a potential value of up to \$6 billion, and include a potential buy of the AIM-120 AMRAAM long-range air-to-air missile.<sup>43</sup>

The reports of such a sale were exaggerated, and the USAF privately indicated to the RSAF that it would be better off buying a smaller number of additional F-15Ss because of better commonality, lower manpower requirements, and economies of scale in maintenance and training. Nevertheless, these reports raised a number of issues. Prime Minister Netanyahu expressed concern over the sale on February 11, 1997 -- creating the possibility of a new round of Congressional battles over arms sales to Saudi Arabia. Serious questions arose over Saudi Arabia's ability to fund the deal, given the fact it was already some \$13 billion in debt to the US for past arms buys and had previously agreed to limit its future debts to \$10 billion. A number of US military advisors privately indicated that Saudi Arabia was not yet ready to absorb such a purchase and had a higher priority for investments in training, readiness, and sustainability.<sup>44</sup> It is unclear whether Saudi Arabia ever planned to make such an announcement before press leaks triggered this debate, but no such announcement was made during Prince Sultan's visit.

There is no question that an export version of the F-16 C/D, Block 60, could have been an excellent replacement for the F-5 -- *if* it could have been properly financed, and supported

with the proper crews and readiness. It would then have been able to serve both Saudi and Western strategic interests by providing an advanced multi-role fighter that would be directly interoperable with USAF power projection forces and allow full integration into an advanced air battle management system using the AWACS, JSTARS, and US electronic warfare and intelligence systems. The F-16 also could have providing a powerful new offensive capability against Iraq and Iran that would compensate in part for the continuing weakness of the Saudi Army and Navy.

The same, however, would have been equally true of the purchase of a number of other types of combat aircraft including more F-15s. More importantly, the key issues that Saudi Arabia face – and will continue to face -- were not related to aircraft performance. They were money; and the difficulties in converting an already inadequate maintenance, training, and sustainment base to an advanced new aircraft type. This has led to three very different views of how the Saudi Air Force should deal with the F-5EII replacement issue:

- Those who argue for a major new purchase feel a properly phased long-term buy of new fighters would ease Saudi Arabia's sustainability problems because such aircraft would be less of a maintenance burden than the F-5E, in spite of their greatly superior performance capabilities. They admit that trade-offs would have to be made with investment in improvements in other aspects of Saudi military capability, but feel that strengthening Saudi multi-role air capability would be the most effective investment that Saudi Arabia can currently make. They feel the main constraint in ensuring that such a purchase met Saudi Arabia's overall needs would be to schedule in ways where the result payments did not place too large a burden on the Saudi budget.
- Those who argue against a major new purchase – and they now include most US military advisors to Saudi Arabia – feel that Saudi Arabia already had enough problems in making its F-15s and Tornados fully combat effective. They feel that Saudi Arabia did not have the money for such major aircraft buys, and that it either has higher military investment priorities or should concentrate its investment funds on the civil sector. They did not see a major air threat from either Iran or Iraq, and feel that Saudi Arabia cannot eliminate its de facto dependence on the US in the event of a major regional war in any case.
- Those who argue for standardizing around the F-15 force, and buy a limited number of F-15s to replace the F-5s. There have been reports that this is the course the RSAF would follow. In the spring of 2000, there were reports that Prince Sultan would announce that the Kingdom would buy 12 more F-15Ss, with a goal of buying 24. At the same time, there were reports that Boeing offered a major offset program that would potential hire 3000 Saudis and would give the Kingdom a depot-level maintenance and repair capability for its F-15s.<sup>45</sup> In the event, however, no such announcement took place.

There is no easy way to resolve the merits of this debate, and there is continuing outside pressure on the Kingdom to make a massive new arms buy. In fact, a Boeing Corporation executive “leaked” a plan in 2000 that would have called for a small buy of 12-24 F-15s to

replace the F-5s, with the sweetener that Boeing would provide a depot-level maintenance facility for the aircraft. Other contractor efforts have been made to push the F-16 Block 60 and Eurofighter, What is clear, is that Saudi Arabia has gradually seen its F-5 force become almost inactive.

**In any case, the sheer cost of any additional aircraft purchase has proved to be a key in factor that has delayed any decision to make any major new purchase as a follow-on to the F-5, although Saudi Arabia also faces serious aircrew numbers, quality, and sustainment problems. Furthermore, the RSAF has found that major diseconomies of scale arise in trying to make a limited buy of a new advanced fighter like the F-16 or F-18. It takes about 50% to 100% more Saudi and foreign manpower to support a new type than it does to add an additional F-15 or Tornado. A new type also creates major problems in terms of additional facilities and maintenance stockpiles.<sup>46</sup>**

## **The Readiness and Warfighting Capabilities of the Saudi Air Force**

The Saudi Air Force has considerable experience with defensive operations. During the Iran-Iraq War, the Saudi Air Force worked closely with the US Air Force, and developed a patrol line called the Fahd Line near the center of the Gulf, a scramble line where aircraft on alert took off the moment an intruder came close, with inner defense lines covered by its Improved Hawk missiles. This air defense system was modified during the Gulf War to initially cover both the north and south, because of the possible risk of hostile air attacks from Yemen and the Sudan. During the rest of the war, Saudi Arabia steadily refined its system, working with the US Air Force and other UN Coalition forces to develop a layered system of land and airborne sensors and defense lines that could cover threats from Iraq as well as Iran.

### **The Lessons of the Gulf War**

The first Saudi F-15C/Ds were operational in Dhahran by early 1983. A second squadron was formed at Taif by the end of 1983, and a third became operational at Khamis Mushayt in July 1984. Saudi aircraft attrition levels were significantly higher than those of the US, but overall training levels were good. The Saudis began with an aircrew to aircraft ratio of 1.5:1 and the Saudi 34th Squadron became the most experienced F-15 squadron in the world, with pilots

who have 700-900 hours each. Saudi pilots flew 22-33 hours per month versus 18 hours in Israel and 2 1/2 hours in Egypt. Saudi live firing exercises met NATO standards, and Saudi Arabia routinely fired off older missiles and munitions for training.

By late 1984 and early 1985, the Saudi Air Force was conducting exercises in both the Gulf and Red Sea areas, and conducting Red-Blue or aggressor exercises similar to those employed by the US Air Force. Saudi Arabia maintained these proficiency levels, and began joint exercises with other members of the GCC. Its F-15 units scored 1st and 2nd place in three exercises with NATO forces.

Saudi F-15C pilots performed well in air defense missions during Desert Storm, although they flew missions planned by the US, and supported by US E-3As, electronic warfare and intelligence aircraft. The Saudi Air Force flew some 6,800 sorties during the Gulf War (January 17, 1991 to February 28, 1991), and some 2,000 sorties over the Kuwaiti Theater of Operations and Iraq. These sorties were largely counter-air. Saudi F-15C pilots proved to be competent and aggressive in air-to-air combat during the brief period when Iraq actively challenged Coalition fighters, and one Saudi pilot scored a double kill. Saudi Arabia was also the only Southern Gulf country that had a modern concept of air defense operations.

At the same time, the Gulf War showed the Saudi Air Force still had some serious weaknesses:

- The ratio of qualified Saudi pilots to first combat aircraft was too low to maintain high sortie rates. Saudi Arabia could not reach the internationally accepted average ratio of 1.5, and its operational experience indicated that it needed 1.8 pilots per aircraft to maximize its sortie rates and combat efficiency.<sup>47</sup> Ironically, the Saudi Air Force now has only 0.9 aircrew per F-15 and only 0.5 effective maintenance crews per aircraft.
- The RSAF did well in flying air combat interdiction, airlift, and AWACS sorties, but it had weak mission planning and could not plan or control large-scale offensive operations. It had no force-on-force doctrine, jointness, or ability to operate beyond the squadron level. There were language, communications, inter-service cooperation, and mission planning problems. Coordination problems often emerged between the RSAF and the Ministry of Defense (MODA).
- The RSAF lacked the pilot numbers to operate all its British-supplied aircraft properly and British pilots flew some Saudi Tornados. Additional foreign technicians had to be brought in to maintain reasonable sortie rates with the F-15s and Tornados. The war showed that the RSAF will be dependent on such technicians for at least the next decade.
- The Saudi Air Force initially had difficulty in finding the manpower to operate its AWACS, and could not easily integrate AWACS data into its Command Operations Center in Riyadh, and Sector

Operating Centers (SOCs) throughout the Kingdom. The Air Force operates these centers, although the Air Defense Force has responsibility for some functions and the radars and equipment at surface-to-air missile sites and some other formations.

- The Saudi air force did not do well in electronic warfare, and reconnaissance missions. The Saudi RF-5 force proved largely useless in seeking out targets and rapidly processing information, and Saudi Arabia was almost completely dependent on the US for reconnaissance and intelligence.
- Saudi Arabia learned it needed the passive ELINT systems that are being fit to US AWACS. These electronic intelligence systems are called the AN/AYR-1, and provide the ability to detect, locate, and identify the radar emissions of ships, aircraft, and ground systems -- often indicating their precise type and location. Saudi Arabia may also need the upgraded CC-2E central computer, GPS navigation system, and Class 2H version of the secure Joint Tactical Information Distribution System (JTIDS). These upgrades to the E-3A, however, were only be available for US aircraft during 1995-1999, and will not be available to Saudi Arabia until 2000-2001.

### **Saudi Air Force F-15, F-5, Tornado, and E-3A Readiness**

Although Saudi Arabia's economic problems threatened its ability to take delivery on its new F-15S in the mid-1990s, Saudi Arabia gave a high priority to funding the F-15S, and the rescheduling of US arms purchases discussed earlier eased its funding problems. As a result, the roll-out of the first F-15S took place in the US in late September, 1995, and the RSAF began to receive the F-15Ss at the rate of one squadron a year. The first full squadron of F-15Ss became operational in Saudi Arabia in 1996, and the second in 1997, and the third in 1998.<sup>48</sup>

This Saudi operation of the F-15S has improved the potential interoperability of the US and Saudi Air Forces, but there has been insufficient RSAF exercise activity to ensure that the RSAF can fully exploit the F-15S since the mid-1990s. Saudi Arabia has bought additional service and training facilities, munitions, spare parts, and specialized electronics facilities that could support both Saudi and USAF F-15 strike-attack aircraft—as well as Saudi and US F-15 air defense fighters. Such facilities and munitions stocks could be used to improve US rapid deployment capabilities in the Gulf in an emergency, and to help give the US the ability to deploy and support well over 72 F-15E attack aircraft in a matter of days. More broadly, Saudi plans to create a depot maintenance capability in Saudi Arabia that could improve the ability repair both RSAF and USAF combat stress and damage.

Nevertheless, the overall warfighting capability of Saudi Air Force has deteriorated since the mid-1990s, and the RSAF now faces a crisis in readiness. Saudi Arabia has not been able to keep up with its force expansion, and even the lead elements in its F-15 force have lost readiness, reduced training standards, and experienced growing accident rates. Saudi Arabia now has only

0.9 aircrews and 0.5 ground crews per plane, something like one-third to two-thirds of its requirement for intense, “24-hour a day,” sustained combat against a major Iraqi invasion. Its pilots fly an average of 3.5-5 hours of training per month versus a NATO standard of 20. This is roughly the same number of flight hours as a low performance air force like Syria.

Accident rates have been high, and at least nine fatal accidents – five in 1999-2000 – can be attributed to training and readiness problems. Proficiency levels have dropped from moderate to low, with particular problems in joint warfare and offensive missions. This decline has taken place even though large numbers of Saudi Arabia’s F-5s have effectively been withdrawn from service. Although most estimates still show 77 F-5E/Fs in Saudi Arabia’s attack squadrons, 10 RF-5Es in reconnaissance units, and 14 F-5Bs in other combat units, experts indicate that up to 87 F-5s are semi operational or grounded.

This decline in the F-15 and F-5 force is partly the result of the Kingdom’s cash flow problems in the 1990s, partly the result of the pace of its expansion into highly sophisticated aircraft when the RSAF did not have time to recruit and train enough personnel, and partly the result of the Saudi failure to impose high training and proficiency standards on other Saudis. It is compounded by the Saudisation and language skill problems discussed earlier. It is also, however, the result of a serious crisis in top-level leadership that was compounded by corruption.

The problems in Saudi Air Force proficiency in using the Tornado have been similar. At least four Tornados crashed between November 2000 and July 2001 – in the Beesha in November 2000, in the Eastern Province in March 2001, in the Southern Province in June 2001, and in the Eastern Province in July 2001.<sup>49</sup> The Tornado has not been upgraded in ways that impose as many new training and command and control requirements. RAF only announced a comprehensive upgrade program for the Tornado in October 1997, and then cut back on many aspects of this program. It is unclear what aspects of the RAF program, if any, will be adopted by the RSAF.<sup>50</sup>

The RSAF now crews its five E-3A AWACS aircraft. The software for the E-3As has been updated, and infrared countermeasures were added to the engines. Although the upgrades to the E-3A are less advanced than originally planned, an improved mission computer with removable hard drives, new IFF hardware and Mode IV interrogation capability will be added by

the end of 2002. Secure communications, satellite communications, GINS, passive detection, improved radar, and additional consoles are now planned for another date, but are not currently funded. This will limit RSAF ability to carry out advanced attack missions and interoperability with US forces until such improvements are funded and installed.<sup>51</sup>

Saudi Arabia has, however, failed to train its E-3A crews to properly support large-scale air battle operations, maritime surveillance missions and joint warfare. It has also been slow to upgrade the overall C<sup>4</sup>I/BM used by the Air Force and Navy to make full use of the capabilities of the E-3A. It has allowed its equivalent of a Rivet Joint intelligence aircraft to become nearly useless. It also has failed to develop the mix of training and exercise activity necessary to make full use of its modern Combined Air Operations Center (CAOC) without US manning and assistance. This has compounded the impact of the much broader failure of the Saudi forces to develop effective combined operations, the lack of communication between the Air Force and National Guard, the lack of effective close support exercises between the Air Force and Army, and the problems in creating a smooth interface between fighter air defense coverage and the land-based air defense coverage provided by the Air Defense Force. It would also force the USAF to segregate the operations of Saudi E-3As and US into “boxes” with their own zones of responsibility.

The Air Force has also been slow to give its aircraft all of the advanced avionics and electronics, Mark IV identification of friend or foe (IFF) munitions, and secure communications capability they have needed, although US delays in making key systems available has also caused problems. These systems – Mode IV IFF and secure communications systems like Have Quick – are “planned” but their availability, funding, and implementation status is unclear.<sup>52</sup> Saudi officers feel US release problems are creating serious additional interoperability problems.

These readiness problems show that the Saudi Air Force is still very much an Air Force in transition. It has purchased several billion dollars worth of contractor and maintenance services from the US to support its air defense and communications system, and signed a \$2.5 billion contract to cover the period from June 1, 1997-May 31, 2002.<sup>53</sup> It has since signed a series of contracts to support its aircraft purchases, such as contracts with Boeing to support the F-15. Nevertheless, Saudi Arabia has experienced serious problems in funding its maintenance contracts since the crisis in funding its arms purchases in 1995. These were worsened by the oil

crash that began in 1997, and while spending recovered during the oil boom in 2000, problems still remain.

## **The Saudi Air Force Enters the 21st Century**

Today, Saudi Arabia has the most modern Air Force in the Gulf. At the same time, it has scarcely solved all of its modernization problems and still faces funding problems. The Saudi Air Force must also make hard decisions over the next few years:

- Money remains a major problem. The F-15S sale alone cost nearly \$9 billion, and the Tornado sale cost \$7.5 billion. Saudi Arabia faces significant problems in funding the further modernization and expansion of its force structure and improved readiness, despite a slow payment schedule and some concessionary terms.<sup>54</sup> By the time the RSAF fully absorbs all its F-15S aircraft into its force structure, all of Saudi Arabia's F-5s will be over twenty years old by 1999, and its initial F-15C/Ds will be 12 to 18 years old.<sup>55</sup>
- Overall, readiness and warfighting capability need improvement, and this involves more than aircrew proficiency. It is one thing to train pilots and another thing to try to reshape an entire air force to carry out an offensive and multi-mission warfare, achieve joint warfare capability, and adequately supports the Saudi Navy. The purchase of the F-15Ss and additional Tornados requires the Saudi Air Force to focus on creating advanced offensive war-fighting capabilities. It has not yet made this conversion fully combat effective. The RSAF still needs to rethink many aspects of its command and control, reconnaissance and targeting, combined operations, offensive and joint warfare doctrine and training, and support and sustainability capabilities.
- Finally, Saudi Arabia's C<sup>4</sup>I/BM assets are still better structured for air defense than air offense. Saudi Arabia needs to rethink its C<sup>4</sup>I/BM needs for theater interdiction and large-scale attack missions comprehensively and acquire the necessary systems.

### **Saudi Air Force Capability for Effective Offensive and Joint Warfare**

The RSAF has sought to upgrade some of its reconnaissance and targeting problems by improving the reconnaissance equipment on its aircraft, and by buying a relatively high-resolution satellite imaging capability from the US. This satellite imaging service will be provided by Orbital Sciences of the US, and will be the first time the US has sold such precision imaging abroad.<sup>56</sup> The Saudi Air Force has also sought to improve its land-based C<sup>4</sup>I/BM system, and to acquire automated mission planning support. Mission planning, however, remains a key weakness in Saudi operations, and the RSAF is still highly dependent on the US.

The RSAF would also need US support in missions like airborne warning and control. Saudi Arabia has found that flying a full air defense and air control and warning screen against a Northern Gulf state like Iraq or Iran can require up to four simultaneous orbits by AWACS

aircraft, or a total of 9-12 aircraft. Saudi Arabia can only fly two orbits with its current five E-3As. Saudi Arabia has studied the purchase of four more AWACS aircraft, based on either a B-767 air frame or a modified Saudi B-707. Such a purchase would allow Saudi Arabia to support continuous air defense and maritime surveillance coverage over both coasts. The RSAF has found such a purchase to be too expensive, however, and must rely on the US both for full coverage of Saudi Arabia and for coverage of its neighbors.<sup>57</sup>

The Gulf War showed that the Saudi Air Force needed far more extensive exercise training, equipment, and organization for offensive operations. The RSAF has since failed to make such improvements and its slow improvements in its training at the tactical and squadron levels are inadequate. It has failed to improve its training and organization at the mid- and high-command levels, and for joint operations at anything like the rate required – a serious, if not inexcusable, failure in military leadership.

The RSAF has made some improvements in its exercise activity since January 1996, when it held the Flag of Glory exercise. This exercise was one of the first force-wide exercises by any Gulf military service and involved 150 Saudi aircraft flying from bases at Dhahran, Khamis Mushayt, Tabuk, and Taif. It involved Saudi E-3As, F-5Es, F-15C/Ds, and Tornados, and involved combined offensive and defensive maneuver to deal with a threat like an Iraqi invasion. The Saudi Air Force also improved its performance in joint exercises with US and Kuwaiti forces after 1995, and recent exercises have demonstrated that Saudi, Kuwaiti, and USAF aircraft could operate jointly using US and Saudi E-3As, the US JSTARS, other US C<sup>4</sup>I/BM systems, and digital data links. These efforts have declined, however, since the RSAF and USAF commands ceased to be collocated following the attack on the USAF barracks at Al Khobar.

### **Saudi Air Force Capability for Joint and Coalition Warfare**

There are other areas where the Saudi Air Force is not making significant progress. It needs to give still more emphasis to high-intensity, 24-hour a day operations against a threat like Iran and Iraq. It needs to raise its sortie rates sharply, and to improve its targeting and force-wide C<sup>4</sup>I and battle management capabilities for offensive operations. This again may require more dynamic leadership at the top.

Nearly a decade after Desert Storm, the Saudi Air Force is not well organized to support the Saudi Army in the defense of Kuwait and Saudi Arabia's northern border. It found during the Gulf War that it lacked many of the capabilities it needed for joint operations with the Army and Navy. While the Saudi Air Force could fly against fixed, lightly defended, interdiction targets, it could only do so with foreign planning and support. The Saudi Air Force proved to have limited operational flexibility in adapting from range training to actual close air support missions, and communications between the Saudi Air Force and Army presented major problems.

The Saudi Air Force needs more extensive joint training and joint operations activity with the Saudi Army, although the lack of initiative and leadership in this area seems to be more the fault of the Army than the Air Force. The Air Force needs to develop a coordinated operational concept with the Saudi Navy, practice making more effective use of the maritime surveillance capabilities of the E-3A, and conduct joint training with the Navy. Here, however, the Air Force will have to wait until the Saudi Navy begins to transform its equipment strength into military effectiveness. At present, the Navy is more a showpiece than a force.

These weaknesses in Saudi Air Force war fighting capability must be kept in perspective. They indicate that Saudi Arabia will have major problems in defending against Iraq or Iran unless it has extensive foreign support. The RSAF will need at least a decade more of US and British assistance to become an effective Air Force capable of force-on-force operations and combined operations. At the same time, such problems are common in even the best European air forces in the developing world and many air forces in NATO. They do not prevent the Saudi Air Force from being the most effective air force in the Southern Gulf, and one of the most effective air forces in the Arab world. The Saudi Air Force not only has the most capable aircraft of any Southern Gulf or Gulf Cooperation Council (GCC) Air Force, it is the only one with a fully modern command and control system and with the E-3A AWACS. Regrettably, this is unlikely to change until the GCC creates a fully modern and integrated air battle management, C<sup>4</sup>I, and strategic reconnaissance system and -- as of 2001 -- its C<sup>4</sup>I integration consisted of little more than a glorified "hotline."

Hopefully, the appointment of Khalid bin Sultan as Assistant Defense Minister will lead to the same effort to revitalize the Saudi Air Force that is beginning to take shape in the Army. It

may also help lead to a new emphasis on training and readiness standards, merit-based promotion, and top-door integrity in every aspect of contracting—including construction. The Saudi Air Force still has a cadre of excellent personnel at every level, and great potential. It deserves the kind of leadership it needs.

## Endnotes

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<sup>1</sup> Unless otherwise specified, the military data quoted here are taken from the relevant country sections of various annual editions of the IISS, Military Balance; CIA, The World Factbook; Jaffee Center for Strategic Studies, The Middle East Military Balance, Tel Aviv University, Tel Aviv; on-line editions of Jane's Sentinel series and Periscope, Jane's Intelligence Review, and Jane's Defense Weekly. The cut-off date for such material is January 2002.

Other sources include interviews with Saudi officials and military inside and outside of Saudi Arabia, US experts, and British experts. These are not identified by source by request of those interviewed. They also include the author's publications and other sources mentioned at the start of the section on Saudi Arabia, Dr. Andrew Rathmell, "Saudi Arabia's Military Build-up -- An Extravagant Error," Jane's Intelligence Review, November, 1994, pp. 500-504; Andrew Rathmell, The Changing Balance in the Gulf, London, Royal United Services Institute, Whitehall Papers 38, 1996; Edward B. Atkenson, The Powder Keg, Falls Church, NOVA Publications, 1996. they include various editions of USCENTCOM, Atlas, 1, MacDill Air Force Base; Jane's Air-Launched Weapons; Jane's Aircraft Upgrades; Jane's Avionics; Jane's All the World's Aircraft; Jane's World Air Forces; Jane's Land-Based Air Defense, 1997-1998; Jane's Air-Launched Weapon; Jane's Radar and Electronic Warfare Systems; Jane's Military Communications; Jane's Unmanned Aerial Vehicles and Targets.

<sup>2</sup> Historical sources include James Bruce and Paul Bear, "Latest Arab Force Levels Operating in the Gulf, Jane's Defense Weekly, December 12, 1987, pp. 1360-1361; and various editions of the "Middle Eastern, North African, and South Asian Navies," sections of the March issue of Proceedings.

<sup>3</sup> USCENTCOM, Atlas, 1996, MacDill Air Force Base, USCENTCOM, 1997; IISS, Military Balance, 1996-1997, 1999-2000, 2000-2001, and 2001-2002.

<sup>4</sup> USCENTCOM, Atlas, 1996, MacDill Air Force Base, USCENTCOM, 1997; IISS, Military Balance, 1996-1997, 1999-2000, 2000-2001, and 2001-2002.

<sup>5</sup> Defense News, September 9, 1996, p. 26.

<sup>6</sup> USCENTCOM, Atlas, 1996, MacDill Air Force Base, USCENTCOM, 1997; IISS, Military Balance, 1996-1997, 1999-2000, 2000-2001, and 2001-2002.

<sup>7</sup> Washington Post, July 30, 1991, p. A-12; Richard F. Grimmett, "Arms Sales to Saudi Arabia," Congressional Research Service, IB91007, August 28, 1991, p. 4.

<sup>8</sup> Cohen, Dr. Eliot A, Director, Gulf War Air Power Survey, Volume V, Washington, US Air Force/Government Printing Office, 1993, pp. 232 and 279-287. Note that these data are not consistent from table to table.

<sup>9</sup> Cohen, Dr. Eliot A, Director, Gulf War Air Power Survey, Volume V, Washington, US Air Force/Government Printing Office, 1993, pp. 316-317, 335, 340, 343, 641, 653-654.

<sup>10</sup> Defense Daily, July 31, 1991, pg.24.

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- <sup>11</sup> Defense Daily, May 14, 1991, pg.258.
- <sup>12</sup> Defense Daily, February 2, 1993, pg.162.
- <sup>13</sup> Defense Daily, August 14, 1991, pg.258.
- <sup>14</sup> Defense Daily, July 31, 1991, pg.24.
- <sup>15</sup> Business Wire, September 23, 1996.
- <sup>16</sup> Middle East Economic Digest, February 26, 1993, pg.29.
- <sup>17</sup> Defense Daily, March, 1995; October 3, 1995.
- <sup>18</sup> Defense Daily, September 17, 1993, pg.434; E-mail from Tom Cooper of 1-23-2002, 9:34.
- <sup>19</sup> Defense Daily, January 5, 1999.
- <sup>20</sup> Defense News, May 31, 1999, pg. 1.
- <sup>21</sup> Defense News, May 31, 1999, pg. 1.
- <sup>22</sup> Middle East Economic Digest, January 19, 1996, pp. 7.
- <sup>23</sup> Jane's Defense Weekly, August 14, 1996, pg.23.
- <sup>24</sup> Jane's Defense Weekly, February 13, 1993, p. 41; Middle East Economic Digest, January 19, 1996, p. 7.
- <sup>25</sup> Jane's Defense Weekly, February 13, 1993, p. 41.
- <sup>26</sup> Jane's Defense Weekly, July 9, 1988, p. 23, July 16, 1988, p. 59, July 23, 1988, p. 111 and 122-123, March 28, 1992, pp. 533-535; Newsweek, July 25, 198, p. 47; New York Times, July 11, 1988, p. 1 and July 12, p. 3.
- <sup>27</sup> Jane's Defense Weekly, July 9, 1988, p. 23, July 16, 1988, p. 59, and July 23, 1988, p. 111 and 122-123, June 15, 1991, p. 998, October 26, 1991, p. 770, March 28, 1992, pp. 533-535; Newsweek, July 25, 198, p. 47; New York Times, July 11, 1988, p. 1 and July 12, p. 3.
- <sup>28</sup> See the author's, The Gulf and the Search for Strategic Stability, pp. 122-126.
- <sup>29</sup> Richard F. Grimmett, "Arms Sales to Saudi Arabia," Congressional Research Service, IB91007, August 28, 1991, p. 3; Defense News, September 7, 1992, p. 7.
- <sup>30</sup> There are unconfirmed reports that air force officers loyal to the Shah ensured that the F-14s were not fully operational.
- <sup>31</sup> Aviation Week, September 21, 1992, p. 26; New York Times, September 12, 1992, p. A-1, September 15, 1992, p. A-1; Defense News, January 30, 1994, p. 32, June 62, 1994, p. 30. February 13, 1995, p. 21;
- <sup>32</sup> Reuters, March 7, 1999.
- <sup>33</sup> Jane's Defense Weekly, February 6, 1993, p. 6, February 13, 1993, pp. 38-42; New York Times, January 30, 1993, p. 3; Defense News, October 12, 1992, p. 3; Manchester Guardian, October 25 ,1992, p. 9; Financial Times, November 18, 1992, p. 10; Financial Times, January 29, 1993, p. 1..
- <sup>34</sup> Financial Times, January 29, 1993, p. 1; Armed Forces Journal, November, 1994, p. 41.
- <sup>35</sup> Defense News, January 8-14, 1996, pp. 1, 20, March 24, 1997, pp. 1, 66.
- <sup>36</sup> Jane's Defense Weekly, August 14, 1996, p. 23.

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- <sup>37</sup> Defense News, March 24, 1997, pp. 1, 66; Washington Post, April 19, 1996, p. A-31.
- <sup>38</sup> Defense News, March 24, 1997, pp. 1, 66,
- <sup>39</sup> Jane's Defense Weekly, August 7, 1996, pg.3.
- <sup>40</sup> Defense News, November 10, 1997.
- <sup>41</sup> Middle East Economic Digest, January 19, 1996, p. 7; Wall Street Journal, January 5, 1996, p. A6; Jane's Pointer, March 1997, p. 5; Jane's Intelligence Review, August, 1996, Jane's Pointer, March, 1997, p. 5; Washington Post, April 19, 1996, p. A-31.
- <sup>42</sup> Defense News, November 10, 1997, pg.60.
- <sup>43</sup> Jane's Defense Weekly, February 5, 1997, p. 3; Wall Street Journal, February 24, 1997, p. B-4; Defense News, February 3, 1997, p. 4.
- <sup>44</sup> Defense News, February 3, 1997, p. 4, March 2, 1997; Reuters, February 12, 1997, 1448; Washington Times, January 30, 1997, p. A-1, January 31, 1997, p. A-3, February 23, 1997, p. A-5; Washington Post, January 31, 1997, p. A-1.
- <sup>45</sup> Reuters, April 10, 2000, 0520, April 15, 2000, 0503.
- <sup>46</sup> Signal, August, 1991, p. 116; Aviation Week, December 5, 1988, p. 23; Aerospace Daily, October 28, 1991, p. 152.
- <sup>47</sup> Defense News, April 14, 1997, p. 3.
- <sup>48</sup> Defense News, January 24, 1994, p. 32; January 23, 1995, p. 1, February 13, 1995, p. 22; Jane's Defense Weekly, September 30, 1995, p. 19.
- <sup>49</sup> E-mail from Tom Cooper of 1-23-2002, 9:34.
- <sup>50</sup> Jane's Defense Weekly, October 22, 1997, pg.1.
- <sup>51</sup> Fax from Department of Defense, OSD/LA, January 11, 1987; Baltimore Sun, September 26, 1989, p. E-9; Jane's Defense Weekly, October 7, 1989, p. 744.
- <sup>52</sup> Information current as of January 15, 2002.
- <sup>53</sup> The contract involves the services of 25 US government and 300 contract personnel. Associated Press, September 26, 1997, 1917.
- <sup>54</sup> The deal would be in addition to the \$3.5 billion Al Yamamah I sale and bring total related sales to around \$10 billion. Jane's Defense Weekly, April 11, 1992, p. 597; Flight International, April 21, 1992, p. 21; Defense News, August 31, 1992, p. 40.
- <sup>55</sup> Defense News, January 24, 1994, p. 32; January 23, 1995, p. 1, February 13, 1995, p. 22; Jane's Defense Weekly, September 30, 1995, p. 19.
- <sup>56</sup> Baltimore Sun, June 6, 199C, p. 20C.
- <sup>57</sup> Richard F. Grimmett, "Arms Sales to Saudi Arabia," Congressional Research Service, IB91007, August 28, 1991, p. 3; Defense News, September 7, 1992, p. 7; .