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Report to the Chairman, Committee on
Appropriations, U.S. Senate

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August 1993

U.S.-ISRAEL ARROW/ ACES PROGRAM

Cost, Technical, Proliferation, and Management Concerns



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United States
General Accounting Office
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National Security and
International Affairs Division

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August 23, 1993

The Honorable Robert C. Byrd
Chairman, Committee on Appropriations
United States Senate

Dear Mr. Chairman:

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As requested, this is an unclassified version of our classified report on the U.S.-Israel Arrow anti-tactical ballistic missile program.

In response to your March 1992 request, we reviewed the U.S.-Israel Arrow/Arrow Continuation Experiments (ACES) missile program. Specifically, we examined (1) the program's cost, schedule, and technical risks in an effort to determine whether the Arrow/ACES program will provide the most cost-effective alternative for meeting Israel's ballistic missile defense needs; (2) the question of Israel's record on making unauthorized sales of U.S.-origin defense articles and technologies, whether Israel engaged in missile proliferation activities, and to what extent these factors were considered in the decision to extend the Arrow program into the ACES phase; and (3) the extent to which the United States is monitoring the use of Arrow technologies and funds.

Background

Israel continues to face missile threats from Iraq, Iran, Syria, and other hostile nations, and the United States is committed to supporting ballistic missile defenses for Israel against these threats. The Arrow missile is part of a complete Israeli anti-tactical ballistic missile system that, as currently configured, includes launchers, radars, and associated support equipment. The missile is designed to destroy conventional and unconventional warheads on incoming enemy tactical ballistic missiles. The Department of Defense (DOD) has no operational requirement for the Arrow missile and has no plans to buy it. The Arrow program resulted from a 1986 study, funded by the Ballistic Missile Defense Organization (BMDO), of Israel's ballistic missile defense requirements.

In 1988, the United States signed a Memorandum of Agreement (MOA) with Israel and subsequently signed a contract with Israel Aircraft Industries governing a limited scope Arrow missile experiment. In 1991, the follow-on ACES MOA and contract were signed. The Arrow contract is valued at \$156.9 million, and the ACES contract is valued at \$330.7 million. The United States is directly funding 75 percent of the contract costs with

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DOD research and development funds and indirectly paying an additional 20 percent through Foreign Military Financing grants to Israel, for a total of \$461.5 million. Table 1 shows the two contracts and the agreed U.S.-Israel funding.

Table 1: Arrow and ACES Contracts and U.S. and Israel Funding

Dollars in millions

Contract	U.S.	Israel	U.S. Foreign Military Financing grants	Total
Arrow	\$125.5	\$23.5	\$ 7.9	\$156.9
ACES	238.1	2.6	90.0	330.7
Total	\$363.6	\$26.1	\$97.9	\$487.6

While BMDO funds the Arrow/ACES, the U.S. Army's Strategic Defense Command in Huntsville, Alabama—the U.S. Army's focal point for theater missile defense—is responsible for managing the project. Contracting authority was transferred from BMDO to the Strategic Defense Command for the ACES contract. In Israel, the Strategic Defense Command established an Arrow program field office, which is staffed by a secretary and an Army civilian employee. The Defense Contract Management Command Area Operations Office in Tel Aviv is generally responsible for Arrow and ACES contract administration. The Defense Contract Audit Agency's European branch office in Weisbaden, Germany, has performed pre-award surveys on both contracts and a defective pricing review on the Arrow contract.

Results in Brief

The Arrow/ACES program has schedule and technical risk,¹ and Israel's cost estimate for a complete Arrow missile defense system may be understated. Because DOD has no plans to buy the Arrow missile, it has not (1) applied its major acquisition policies and procedures; (2) assessed the complete Arrow missile defense system's estimated cost, schedule, and technical performance to establish valid baseline data; or (3) analyzed the cost-effectiveness of potential U.S. alternatives for Israel's missile defense. There are technology transfer and security concerns over potentially providing a U.S. alternative system to Israel and Israeli industrial participation in a U.S. alternative. Without valid data and a full assessment, however, the United States cannot determine whether the Arrow is the best choice for meeting Israel's ballistic missile defense needs.

¹DOD has classified information regarding the levels of risk associated with the program.

DOD views the Arrow/ACES missile contracts as a discrete technology demonstration effort, but Israel considers the contracts as part of an Israeli major acquisition program to develop, produce, and deploy a complete anti-tactical ballistic missile system. The United States may be drawn into funding most of the costs of the complete Israeli Arrow missile defense system in response to incremental Israeli government requests.

Information in our report pertaining to the question of Israel's record of unauthorized sales of U.S. defense articles and technologies, missile proliferation activities, and the extent to which these factors were considered in the decision on ACES was classified by the Departments of Defense and State.

The U.S. government has exercised inadequate control over the technology and funds it has supplied to the Arrow missile program. No U.S. government agency has monitored or verified Israel's compliance with the provisions of the Arrow and ACES MOAs and licensing agreements. Moreover, no U.S. agency has comprehensive information on U.S. items and technology exported to the program to permit adequate U.S. oversight and help deter and detect unauthorized uses and transfers. Finally, the U.S. government has not adequately investigated Israel's claims to data under the Arrow and ACES contracts and has not sufficiently administered, overseen, or audited U.S. funds provided for the contracts.

We have made recommendations related to the Arrow/ACES program that can be found on pages 16-17 of this report.

Despite Program Risks, DOD Has Not Fully Assessed Arrow or Alternatives

Due to technical risk and other factors, we believe Israel's estimate for additional funds needed to develop, produce, deploy, and support a complete system—including launchers, radars, and other related equipment—may be understated. Moreover, the United States may be drawn into funding most of the complete Israeli system without the benefit of sound cost, schedule, and performance information. Similarly, while cost-effective alternatives to Arrow may exist, DOD has not assessed them.

DOD Has Not Independently Assessed Arrow Because It Has No Plans to Buy the Missile

While BMDO expects research and development benefits from the Arrow/ACES program, DOD has no plans to buy the Arrow missile. DOD has not conducted an independent assessment of the Arrow/ACES program because it considers the program a limited U.S.-Israeli technology effort that supports an Israeli military requirement. In June 1991, DOD concluded

that despite U.S. financial and technical support, Arrow/ACES was an Israeli defense program that should not be treated as a major U.S. defense acquisition program under DOD Instruction 5000.2, which requires a more disciplined management approach and Secretary of Defense oversight. Consequently, BMDO and the Strategic Defense Command have been responsible for primary oversight and review of the program, which to date has involved U.S. funding or commitments of nearly \$500 million.

Unlike major DOD acquisitions, the Office of the Secretary of Defense's Cost Analysis Improvement Group has not assessed the cost, schedule, and technical performance estimates for the Arrow/ACES effort or the complete Arrow missile defense system. In addition, the DOD Director for Defense Research and Engineering has not conducted technical assessments. Instead, a BMDO contractor conducted the primary U.S. assessments of the Arrow, and these assessments were limited to technical reviews pertaining to the Arrow/ACES efforts. In addition, BMDO and the Strategic Defense Command have not examined or validated Israel's cost and schedule estimates for the complete Arrow missile defense system and do not plan to review them.

Arrow System Cost Estimate May Be Understated

Israel's cost estimate to produce and deploy the complete Arrow missile defense system may be understated because of risks, such as concurrency and technical difficulties, and the limitations in Israel's cost-estimating approach.² Although DOD has not reviewed or validated Israel's cost estimate for the complete Arrow system, in June 1991, DOD determined that the ACES segment of the program had schedule, cost, and technical risks. In May 1992, a BMDO panel of technical experts concluded that the ACES flight test plan is a success-oriented program. Some U.S. weapons systems with significant risk have experienced schedule slippage and cost growth.

We are concerned about the highly concurrent approach being taken in the Arrow/ACES program. DOD cost analysis officials and Army technical experts told us that the Arrow program's strategy of schedule concurrency in the development phases is a risky approach. A DOD cost analysis official noted, however, that a more accurate assessment of cost and schedule risk cannot be made without a thorough program review. The first three Arrow flight tests were not successful. According to U.S. program officials, the next two tests had a high degree of success. To date, an intercept has not been achieved. Moreover, none of the Arrow/ACES flight tests have been

²Information on Israel's cost and schedule estimates has been classified by the government of Israel.

independently assessed by DOD or the Army Materiel Systems Analysis Activity, the Army organization responsible for performing technical assessments of U.S. missile systems.

Our evaluation showed that Israel's cost estimate for developing and deploying a complete Arrow anti-tactical ballistic missile system was not supported by details and was not reviewed by trained Israeli cost estimators. Israel's estimate also did not include more than \$518 million in U.S. and Israeli funds committed to the Arrow/ACES contracts and program management costs. It also does not include additional related expenses such as government salaries and travel.

United States May Be Drawn Into Funding Arrow Beyond Current Agreements

The United States has provided considerable funding to Israel not only for development of the Arrow missile but also for program management and support and for other programs related to deploying a complete Israeli anti-tactical ballistic missile system. The United States may be drawn into funding most of the elements needed to deploy and support a complete Israeli Arrow missile defense system in response to piecemeal Israeli requests. Table 2 shows current U.S. funding commitments related to an Israeli anti-tactical ballistic missile system.

Table 2: U.S. Funding Commitments for Arrow and Related Programs

Dollars in millions	
U.S. commitment	Amount
Arrow contract	\$125.5
ACES contract	238.1
Arrow/ACES program management costs	30.5
Test bed contract	31.9
Hypervelocity gun	13.9
Architecture studies; system engineering and integration contract	15.6
Total	\$455.5

Note: The Arrow and ACES contract figures do not include \$97.9 million of U.S. Foreign Military Financing funds used by Israel for its share of the contracts.

Source: BMDO.

The Strategic Defense Command awarded the ACES contract to Israel Aircraft Industries in July 1991 before the Arrow had completed a fully successful flight test. As of early December 1992, terms of the Arrow contract had not been completely satisfied, and the contract had not been

closed. BMDO has also committed \$30.5 million for Arrow/ACES program management costs, including the Strategic Defense Command field office in Israel.

DOD awarded contracts to Israeli firms for Arrow system-related support—\$31.9 million to support the Israeli test bed and \$15.6 million for Arrow system engineering and integration. The test bed will initially be used to simulate the Arrow missile and related Arrow ground support equipment. Israel plans to convert the test bed to the Arrow battle management command, control, and communication center for the deployed Arrow anti-tactical ballistic missile system. The system engineering contract was primarily for Israel's missile defense architecture studies. DOD has provided \$13.9 million, with options for additional funds, to Israel's SOREQ Nuclear Research Center to research a hypervelocity gun, which could serve as a point defense for Arrow missile batteries and radar sites.

In 1992, Israel proposed to DOD a codevelopment program for the Arrow fire control radar. The radar is a portion of the equipment needed to field the complete Arrow system. At the time our fieldwork was completed, a DOD response to the proposal was pending. The United States is also funding an Israeli study on intercepting ascending theater ballistic missiles.

The National Defense Authorization Act for fiscal years 1992 and 1993 authorized DOD to fund \$54.4 million from its fiscal year 1992 budget to support development of Arrow ground support equipment, including battle management and the fire control radar, subject to certain conditions. Once all of the conditions set forth in the legislation were satisfied, the funds could be obligated. However, at the time of our work, the conditions were not fully met, and these funds were not obligated.

Cost-Effective Alternatives to Arrow May Exist but Have Not Been Assessed

U.S. missile defense systems may meet Israel's missile defense needs more cost-effectively than the Arrow, but there is insufficient information available to make such a determination. DOD has not assessed the cost-effectiveness of U.S. alternatives, and their employment in Israel may pose technology transfer concerns. If the Arrow were subject to DOD major system acquisition policies and procedures, an assessment of alternatives would be required. Various studies by DOD, Israel, and Raytheon have assessed the Arrow and U.S. alternatives, but none is sufficient to evaluate their cost-effectiveness in meeting Israeli requirements. We explored the

possibility of providing various U.S. alternative anti-tactical ballistic missile systems to Israel with numerous U.S. government officials. DOD classified details of these discussions. There are concerns about potentially providing a leading edge U.S. system and Israeli industrial participation.

U.S. theater missile defense systems deployed or in development include the Theater High Altitude Area Defense system, Patriot PAC-2 (Patriot Near Term Anti-Tactical Missile Capabilities) and PAC-3, and the Extended Range Interceptor. The Theater High Altitude Area Defense system is being designed to defend against tactical ballistic missiles for U.S. and allied assets. The Patriot missile system, originally focused on defending against aircraft and cruise missiles, is being improved through a series of software and hardware upgrades to defend against ballistic missiles as well. The Extended Range Interceptor is a missile experiment to demonstrate defense against ballistic missiles. Further details on the capabilities of these systems are classified.

Inadequate U.S. Oversight of the Arrow/ACES Program

The U.S. government's oversight and control of U.S.-origin defense articles, technologies, and funds in the Arrow/ACES program have been limited. No U.S. government agency or department has monitored or verified Israel's compliance with the restrictive provisions of the Arrow/ACES MOAs and licenses. Instead, the U.S. government relies on Israel's assurances that it will comply with the MOA and license restrictions for control of program technology. No U.S. agency has comprehensive information on U.S. hardware and technology licensed for export to the Arrow/ACES program. As a result, the U.S. government is unable to fully account for U.S. content in the program. In addition, although BMDO recently began efforts to do so, the U.S. government has not adequately investigated Israel's claims to background data³; these claims have proliferation and technology transfer implications.

While U.S. technical oversight and assistance have increased since the start of the program, overall U.S. management of the program has been limited. The program's contracts limit the oversight requirements and audit authority of U.S. contract administrators and auditors. No U.S. agency has performed Arrow/ACES contract administration functions as defined in the Federal Acquisition Regulation, and the role of the Defense Contract Management Command (DCMC) has been greatly reduced by the

³Background information is technical data and software that a party generates before the contract and brings to the program. Foreground information is technical data and software that are produced in the program or first used during the course of the contract.

program's contracting officers. In addition, because the contracts do not include performance reporting requirements or cost-based progress payments, the Defense Contract Audit Agency cannot audit the contracts to verify that the technical performance is commensurate with costs and that charges were reasonable.

No U.S. Monitoring to Ensure Compliance With Agreement or License Restrictions

The State Department, BMDO, the Arms Control and Disarmament Agency, and Strategic Defense Command Arrow project officials have not monitored or verified compliance with MOA, contract, and license provisions restricting the use and transfer of applicable program defense articles and technologies. The Strategic Defense Command field officer, who is stationed in Israel as the primary on-site technical representative for the Arrow/ACES program, told us he was not responsible for monitoring Israel's compliance with such provisions. BMDO and Strategic Defense Command personnel who are assigned to the project and often visit Arrow/ACES program sites in Israel could monitor the use of program technology. However, these personnel generally provide U.S. technical input and do not monitor the program to ensure compliance with MOA restrictions. State Department and BMDO officials told us that it was not their job to monitor for compliance with MOA restrictions.

The primary means of controlling U.S. defense articles and technologies in the Arrow/ACES program is through the U.S. export licensing review process. However, this process provides only limited control and does not ensure against unauthorized uses or retransfers of U.S. items and technologies provided for the Arrow/ACES program in Israel. Specifically, there was no central, comprehensive source of information within the U.S. government on all U.S. licensing activity for the program, and no checks were performed to verify the end use and destination of U.S.-provided items and technologies. Without such information, the U.S. government is unable to effectively account for U.S. content in the program.

U.S. Content in Program Greater Than Stated Earlier in Program

DOD program assessments in the early stages of the Arrow and ACES contracts and later statements by BMDO and Israeli officials indicated that U.S. content in the Arrow/ACES program was relatively minor. By October 1988, the Strategic Defense Command indicated that Israel had requested 39 items for the experiment. We identified 98 Arrow/ACES-related licenses that had been approved between September 1987 and October 1992, including 8 applications for technical assistance agreements and amendments. In addition to licensing activity, many Strategic Defense

Command and BMDO contractors have provided technical assistance to the program in various areas. The level of U.S. technical assistance has increased significantly over the course of the program.

Selected U.S. items approved for use in the Arrow/ACES program include (1) focal plane arrays, (2) accelerometers, (3) various propellants, (4) graphite fiber and composite materials, and (5) computers (parts and software). The United States has also provided technical assistance in the design and construction of a simulation test bed, aero-optic analysis, endoatmospheric nonnuclear kill simulation, radar seeker enhancement, and radome and seeker analysis. A more complete list of items and technologies requested and approved for the program is restricted information contained in our classified report.

No Central Knowledge of U.S. Arrow/ACES Licenses

No one in the U.S. government has comprehensive knowledge of (1) all Arrow/ACES-related license applications processed by the Departments of State and Commerce or (2) the ultimate disposition of defense articles and technologies approved for the program. Various U.S. government offices review Arrow/ACES license applications, applying proliferation and technology transfer criteria. For Arrow/ACES and other international military programs, the Commerce Department licenses exports of dual-use items and technologies, and the State Department licenses munitions items and technologies. The State Department sends license applications requiring additional scrutiny to other agencies, principally DOD. Also, an interagency panel chaired by the State Department reviews selected Arrow/ACES applications from a missile proliferation perspective. For the license applications referred to it, the Strategic Defense Command's Arrow project office checks that amounts, stated end use, and applications are within the program scope.

Without comprehensive information, the U.S. government cannot account for U.S. content in the Arrow missile or ensure that U.S.-licensed items are exported commensurate with program needs and are not transferred to third parties. For example, while we identified 120 Arrow/ACES-related license applications, as of August 1992, the project office was aware of only 68.

In addition, the limitations of the U.S. government's licensing data bases make effective monitoring of program licenses and applications difficult and do not always facilitate searches on a particular weapon system. For example, the key word "Arrow" is not in the State Department data base,

so it is impossible to electronically retrieve all Arrow/ACES-related cases. Similarly, a Commerce official noted that Commerce's licensing data base is not designed to maintain historical information; we believe this makes overall program monitoring difficult.

The provision of U.S. focal plane arrays to Israel is an example of the U.S. government's failure to accurately determine or track the types and quantities of defense articles and technologies provided for the Arrow program. A focal plane array is a small energy detector used in the Arrow's infrared seeker and is among the most sensitive U.S. technologies provided to Israel for the program. U.S.-supplied focal plane arrays are of technology transfer and proliferation concern to the United States and have been approved for export by the State Department and shipped to the Arrow/ACES program.⁴

Through inquiries of Israeli industry, the Strategic Defense Command attempted to account for all focal plane arrays exported from the United States to the Arrow/ACES program. However, the Strategic Defense Command's record of the ultimate disposition of the arrays was incomplete and inconsistent with the records of U.S. companies. U.S. licensing and company records showed that 14 licenses had been approved to export over 60 focal plane arrays and associated technical data for Arrow/ACES; 33 of these focal plane arrays were shipped to Israel. In addition, two Arrow technical assistance agreements include information on seeker design and analysis and focal plane arrays. However, the Strategic Defense Command's records showed that only 30 arrays had been shipped and did not include information on an approved hardware license for multiple focal plane arrays and sensor assemblies.

Inadequate Investigation of Israeli Background Claims Has Potential Technology Transfer and Proliferation Implications

The U.S. government has not adequately investigated Israeli claims to background data on the Arrow and ACES contracts. Israel Aircraft Industries presented lists of background technologies to the Strategic Defense Command shortly after each contract was signed and initially claimed that all its background was indigenous. Verification of these claims is not required by either the contracts or the MOAs. However, insufficient U.S. investigation of the Israel Aircraft Industries lists has potential proliferation and technology transfer implications for U.S. technology in the Arrow/ACES program. If Israel Aircraft Industries' claims are left unverified, U.S. program hardware and technology incorporated

⁴In the near future, the Commerce Department will have licensing authority over nonmilitary focal plane arrays.

into areas declared as Israel Aircraft Industries background could be inappropriately transferred to third parties or applied to other Israeli projects.

Over the past 10 years, numerous U.S. manufacturing, technical assistance, and hardware agreements with Israel for missile-related systems have been approved, increasing the likelihood that U.S.-origin technology is in Israeli missiles and missile technologies. While it is difficult to determine whether modified technology loses its origin or at what point it would do so, we believe it is likely that U.S.-origin manufacturing and technical assistance has contributed to Arrow/ACES background items claimed by Israel.

An Israeli Defense Ministry official initially told us that all of Israel Aircraft Industries' claimed background data were of Israeli origin. The Ministry later stated the claimed background data were mostly indigenous. During our review and at our suggestion, BMDO and the Strategic Defense Command began investigating Israeli background claims on both the Arrow and ACES contracts. However, U.S. questions submitted to Israel about where the data had been acquired and whether U.S.-origin technology and hardware were involved in the data's development remained unresolved.

Certain items claimed as background by Israel contained U.S. parts, and some may contain U.S. technology that may have been controlled under other licensing agreements. For example, Israeli officials recognized that the Arrow's central data computer was based on technology from the U.S.-funded Lavi aircraft. Other examples are contained in our classified report. Lack of U.S. government investigation of these and other Israeli background claims may lead to inaccurate U.S. assessments of future Israeli transfers of Arrow/ACES technology.

Program Management and Contract Structure and Implementation Limit U.S. Oversight

The U.S. government's overall management of the Arrow/ACES program and contracts has been limited. Until flight test problems forced U.S. officials to increase U.S. technical oversight, BMDO's management approach was to discourage U.S. government intervention and allow the Israelis to manage Arrow. In addition, the structure and implementation of the program's contracts limit the oversight requirements and audit authority of U.S. contract administrators and auditors. Although the Arrow and ACES contracts combined are worth over \$487 million, contract administration functions as defined in the Federal Acquisition Regulation

have not been performed, and DOD contract audit officials have limited authority for auditing program funds. Further, more comprehensive audits could encourage accountability and provide assurance that funds are not used to support other Israeli projects.

Program Management

BMDO originally let Israel pursue the Arrow/ACES program as it wished, believing that Israel could proceed more quickly because it did not have to adhere to complex U.S. acquisition rules and regulations. According to project officials, BMDO instructed the project office not to actively manage or oversee the program technically unless requested to do so by the Israelis. A number of U.S. officials characterized the overall management approach to date as "hands off" and "management by exception." However, after the third unsuccessful test, the United States increased its technical oversight and assistance in the program to enhance the likelihood of technical success. On the other hand, U.S. contract and program management and oversight remained limited. For example, the BMDO contracting office responsible for the Arrow contract did not have information on the amount of U.S. funds spent or disbursed on the contract to date and was unable to obtain this information in a timely manner.

Contract Structure Reduces Oversight

According to a former BMDO contract official, firm fixed-price contracts with milestone payments were used for the Arrow and ACES program phases to reduce U.S. risks. According to U.S. government officials, this type of contract requires less oversight because it limits the U.S. government's financial obligations by setting a fixed price and linking payments to specific accomplishments or milestones. However, the Secretary of Defense discourages firm fixed-price contracts for high value, high risk development projects because such projects are, by nature, difficult to define. The defense appropriation acts for fiscal years 1988-93 and DOD's acquisition regulations prohibit fixed-price contracts for development efforts over \$10 million and \$25 million, respectively, unless a written determination is made that (1) the use of a fixed-price contract permits equitable and sensible allocation of program risk between the government and the contractor, and (2) the level of program risk permits realistic pricing. BMDO made such a determination in 1988 for the Arrow contract and again in 1991 for ACES and in both cases the Under Secretary of Defense granted an exception to the policy.

However, the Defense Contract Audit Agency's 1988 pre-award review of the Arrow contract stated that a firm fixed-price contract placed excessive risk on the U.S. government, not the contractor, because the Arrow design

and drawings had not been definitized and the costs were based primarily on estimates. The review further stated that claims submitted by the contractor because of design changes made during the research and development phase of the contract could result in increased cost to the government. The Audit Agency recommended that a fixed-price-incentive-type contract be negotiated to protect the government's interest. Furthermore, as part of a limited DOD review of the Arrow/ACES effort, the Deputy Under Secretary of Acquisition for International Programs noted that the firm fixed-price contract did not absolve the U.S. government of the responsibility for sound project management.

Israel Aircraft Industries has not completed the scope of work initially agreed to under the Arrow contract and was allowed to shift tasks from Arrow to the follow-on ACES contract. Two intercept tests and the fabrication of one key item were shifted to the ACES contract, and fabrication of another item was replaced by other tasks, with no cost reduction to the Arrow contract. In addition, examination of certain critical issues that were not resolved under the first contract will now be performed under the ACES contract.

Because the Arrow and ACES firm fixed-price contracts use milestone rather than progress payments, periodic contract audits and surveillance are not required. U.S. contract officials told us that milestone payments are unusual and speculated that the Arrow and ACES contracts were set up this way because Israel Aircraft Industries' accounting system could not support the financial reporting requirements of progress payments. However, the Defense Contract Audit Agency determined in its 1988 pre-award review of the Arrow contract that Israel Aircraft Industries' accounting systems and controls were adequate for progress payments. In addition, Israel Aircraft Industries uses progress payments on other firm fixed-price contracts it has with the U.S. government.

Moreover, U.S. government and project officials stated that the milestones for the Arrow and ACES contracts are loosely defined, with no requirements or incentives for technical performance. Examples of contract deliverables for the Arrow and ACES contracts, linked to calendar-based milestone payments, are subsystem design reviews, technical documents, or manufacturing of missile components. A former project official suggested that deliverables should be linked instead to technical accomplishments—such as effective reviews of a particular design and

Contract Administration Not Performed

successful manufacturing of a particular component—or to monetary incentives in the contract.

Although responsible for contract administration,⁵ the Defense Contract Management Command Area Operations Office in Tel Aviv has not administered the Arrow and ACES contracts largely because of limitations placed on its role. The Arrow and ACES contracting officers relieved the Operations Office of several contract administration functions and delegated some of them to the Strategic Defense Command project office's technical representative. For example, the BMDO contracting officer for Arrow waived the Operation Office's production surveillance and engineering design study review duties because BMDO believed project office personnel provided sufficient oversight, and only a few test items were to be produced under the contract. According to an ACES contracting official, the delegation of technical surveillance responsibilities to the project office is standard practice for Strategic Defense Command contracts. However, the delegation of contract administration functions to the project office's technical representative is contrary to September 1991 DOD guidance, which states that technical representatives are not authorized to perform contract administration functions. Furthermore, a DCMC official noted that DCMC performs production surveillance on other research and development projects that are limited to the production of test hardware.

For the Arrow contract, the contracting officer suggested that some of the contract administration functions be performed jointly by the Operations Office in Tel Aviv and the Strategic Defense Command field office. In practice, however, neither office had performed any contract administration functions, such as performance of engineering surveillance to assess compliance with contractual terms for schedule, cost, and technical performance. DCMC and Operations Office officials were concerned about their limited roles in the Arrow and ACES contracts, stating that their authority had been greatly limited and that they were unable to perform their duties effectively. They also stated that they could not perform thorough oversight of these contracts without improved access to Israeli contractor facilities.

Audit Authority Limited

Because of the Arrow/ACES contracts' structure, Defense Contract Audit Agency officials have not conducted audits to verify that the technical performance on the contracts is commensurate with costs and that

⁵The contract administration functions are listed in the Federal Acquisition Regulation, subpart 42.302. The regulation lists 67 contract administration functions.

charges have been reasonable. The Audit Agency conducted forward pricing reviews before award of the Arrow and ACES contracts and a defective pricing review of the Arrow contract. However, Audit Agency officials told us that their agency cannot initiate an audit of incurred costs because the contracts are firm fixed-price contracts with milestone payments rather than cost-based progress payments.

Under this type of agreement, the actual costs incurred by the contractor have no effect on the government commitment to pay the firm fixed price established in the contract. The Audit Agency told us that, as a result, it had no authority to perform incurred cost audits regarding the allowability and reasonableness of costs unless the contracts are restructured to include performance reporting requirements or cost-based progress payments. Additionally, because DOD acquisition policies and procedures have not been applied to the ACES program, the requirement for cost, schedule, and control criteria on the contract was removed, eliminating requisite baseline information for an Audit Agency cost and schedule audit.

Conclusions

DOD does not have the valid baseline information on the Arrow missile defense system necessary to assess its cost, schedule, and technical performance and to evaluate its cost-effectiveness relative to U.S. alternatives. Even though DOD has no plans to buy the Arrow, such an analysis is needed, given the risks the program faces and the potential for increased U.S. funding commitments for an Israeli missile defense system. However, technology transfer concerns raised over the possibility of providing a U.S. alternative and Israeli industrial participation also need to be considered.

The U.S. government has exercised only limited control over U.S. technology and funds in the Arrow/ACES program. No U.S. agency or department has assumed responsibility for monitoring or verifying compliance with program restrictions. The Arrow and ACES contracts' structure—firm fixed price, with milestones—does not contain adequate contractor performance incentives, promote accountability, or provide for sufficient U.S. oversight. The U.S. government licensing and contract audit and administration processes available to help control and oversee defense articles, technologies, contractor performance, and funds have not been fully applied. Moreover, improved access to Israeli Arrow/ACES design and production facilities is needed to apply these oversight functions. We believe the risks facing the program—including cost,

schedule, performance, technology transfer, and proliferation—warrant improved safeguards and oversight by the United States.

Recent Strategic Defense Command and BMDO efforts to verify the Israeli claims to background on the Arrow and ACES contracts are appropriate, and we believe that the clarification and resolution of questions regarding origin are critical to controlling program technology.

Recommendations

Before additional U.S. funds are committed for the development, production, or deployment of an Arrow anti-tactical ballistic missile system for Israel, we recommend that the Secretary of Defense develop accurate baselines for the complete Arrow anti-tactical ballistic missile system's cost, schedule, and technical performance. We also recommend that the Secretary use these baselines to thoroughly assess the cost-effectiveness of U.S. alternatives to Arrow for meeting Israel's ballistic missile defense needs. The analysis should fully consider the technology transfer and missile proliferation implications of providing alternative U.S. systems to Israel and potential Israeli industrial participation. The Secretary should report the results of these studies to the House and Senate Committees on Armed Services and Appropriations as expeditiously as possible.

To improve the U.S. oversight of the Arrow and ACES MOAs, U.S. licenses, and contracts and to ensure that U.S. funds are being spent as intended, we recommend that the Secretary of Defense ensure that no additional Arrow/ACES or related contracts are signed until the following steps are taken:

- Adequate access, as determined by DOD, the Defense Contract Audit Agency, DCMC, the Arms Control and Disarmament Agency, and the State Department's Bureau of Politico-Military Affairs, is granted by Israel to U.S. officials for the thorough monitoring of U.S. Arrow/ACES defense articles, technologies, and funds.
- The State Department's Bureau of Politico-Military Affairs performs end-use checks on selected U.S.-supplied Arrow/ACES hardware and technologies, to include focal plane arrays.
- The Secretary of Defense initiates a process for the establishment of a central repository for recording and maintaining information on all U.S. Arrow/ACES-related licenses applications.
- DCMC begins to administer and monitor the contracts by performing the functions contained in the Federal Acquisition Regulation 42.302,

particularly (1) engineering surveillance to assess compliance with contractual terms for schedule, cost, and technical performance in the areas of design, development, and production and (2) production support, surveillance, and status reporting, including timely reporting of potential and actual slippages in contract delivery schedules.

- The Arrow and ACES contracts are amended or restructured as necessary to authorize the Defense Contract Audit Agency to conduct complete audits of both contracts to ensure that incurred costs are commensurate with technical performance and that charges have been reasonable. Such audits could also (1) encourage accountability and (2) as a side benefit, provide assurance that funds are not used to support other Israeli programs. The amendments to the contracts should cover the full period of both contracts. In the case of ACES, the contract should be amended to provide appropriate incentives for efficient and effective contractor performance.
- The Defense Contract Audit Agency conducts complete audits of both contracts as authorized by the amended or restructured contracts.

In addition, to ensure that U.S. national interests and technologies are protected and proliferation concerns are addressed, we recommend that the Secretary of Defense work with the Secretaries of State and Commerce and other relevant agencies to continue investigating Israel's claims on background data used in the Arrow and ACES contracts. This effort should be completed before each contract is closed out and should include investigation of related U.S.-Israel manufacturing and technical assistance agreements approved before the commencement of the Arrow program. We further recommend that the verified claims be incorporated into the respective contracts and provided to each of the participating agencies.

To improve oversight of U.S. Arrow and ACES export licenses and items, we recommend that the Secretary of State direct the Bureau of Politico-Military Affairs to perform end-use checks on selected U.S.-supplied Arrow/ACES hardware and technologies, to include focal plane arrays.

Agency Comments and Our Evaluation

We obtained comments from the Departments of State, Defense, and Commerce, and the Arms Control and Disarmament Agency. The comments were, for the most part, classified.

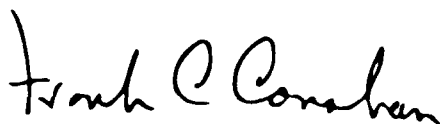
Scope and Methodology

We performed our work at the Departments of State, Defense, and Commerce, BMDO, and the Arms Control and Disarmament Agency in Washington, D.C.; the Strategic Defense Command in Huntsville, Alabama; and the Israeli Ministry of Defense in Tel Aviv and Israel Aircraft Industries/MLM in Israel. We also obtained information from Lockheed Missiles and Space Company in Huntsville, Alabama, and Raytheon Corporation in Arlington, Virginia.

We conducted our primary review from April through December 1992. Since then, we have updated information on the fifth Arrow flight test and costs. Details on our scope and methodology and limitations on our work are presented at appendix I. Except as noted in appendix I, our work was performed in accordance with generally accepted government auditing standards.

This report was prepared under the direction of Joseph E. Kelley, who may be reached on (202) 512-4128 if you or your staff have any questions. Other major contributors are listed in appendix II.

Sincerely yours,



Frank C. Conahan
Assistant Comptroller General

Scope and Methodology

In an effort to determine whether the Arrow will provide the most cost-effective alternative for meeting Israel's ballistic missile defense needs, we examined (1) the status of the Arrow anti-tactical ballistic missile effort, (2) Israeli estimates of the complete Arrow missile defense system acquisition and support costs, and (3) potential alternative U.S. theater missile defense systems. We obtained and analyzed U.S. and Israeli government information on the cost (Arrow and ACES contracts as well as Israeli government estimates of the Arrow missile defense system costs), schedule, technical performance, and risks in the Arrow missile project. We gathered this information from BMDO, the Strategic Defense Command, and the government of Israel. We obtained data on alternative U.S. systems from the Patriot, Extended Range Interceptor, and Theater High Altitude Area Defense system project offices in Huntsville, Alabama, and BMDO in Washington, D.C. We also met with officials of the DOD Cost Analysis Improvement Group, DOD Strategic and Space Systems Office, and the Defense Technology Security Administration in Washington, D.C., and the Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Maryland, to discuss the feasibility of further assessing the Arrow and U.S. system alternatives. We also met with Lockheed and Raytheon officials. At the time of our review, fully assessed and validated test and cost data on the Arrow missile or Arrow-related systems were not available.

To examine the question of Israel's record on unauthorized transfers of U.S.-origin defense articles and technologies, whether it engaged in missile proliferation activities, and to what extent these factors were considered in the decision on ACES, we reviewed numerous documents and further discussed these matters with various officials.

To assess U.S. monitoring of the use of Arrow and ACES technologies and funds, we reviewed the Arrow and ACES MOA and contracts, the U.S. program management structure and responsibilities, the U.S. licensing processes and checks that might be performed through the State Department's end-use check program, and U.S. contract management, oversight, and audits. We reviewed documents and interviewed officials from the Arrow project and program offices at the Strategic Defense Command and BMDO; the State Department's Office of Defense Trade Controls; the Defense Technology Security Administration; the Defense Contract Audit Agency (Washington, D.C. and Wiesbaden, Germany); and DCMC (Washington, D.C. and Dayton, Ohio) and its field office in Tel Aviv, Israel. We obtained and analyzed Arrow/ACES and other licensing data from the Departments of State, Defense, and Commerce and in some cases U.S. companies.

Limitations on Our Work

Various conditions imposed and problems with some of the sources, availability, and presentation of data created limitations on the scope of our work and report. For example, the Central Intelligence Agency would not provide us access to officials or information. The State Department provided us access to a number of documents, but the nature of our access to records may have resulted in some impairment of scope. We were not provided access to all the pertinent files at State. State would not permit us access to officials or documents in the Bureau of Intelligence and Research and screened other State documents before making them available. Our meetings with State officials were similarly screened, which may have impeded the flow of information. In addition, State provided access to certain documents we requested on the condition that their content not be discussed in our report.

Israeli officials provided summary information on the complete Arrow missile defense system acquisition and support cost estimates but did not provide the backup documentation we requested on the cost estimates. Further, we were not given access to Israel Aircraft Industries' Arrow missile design and production facilities as requested. Finally, in some cases information obtained from the government of Israel was inconsistent with information obtained from other sources.

The data we obtained on U.S. licensing for the Arrow project are generally subject to limitations inherent in the U.S. data bases at the Departments of State, Defense, and Commerce. All data bases are limited by possible input and keypunch errors and in some cases the lack of key word-sorting capability. Program-related license applications can be appropriately identified through the data bases only if they are entered into the system with the word Arrow or ACES. At State, the Office of Defense Trade Controls performed computer runs and file searches on the basis of our requests; we did not verify that all of the relevant cases were retrieved by the Office. Furthermore, because the Office could not segregate all Arrow/ACES licenses, it relied on our list of Arrow/ACES licenses to verify whether State Department end-use checks had been performed on U.S.-provided Arrow/ACES items. Our statement regarding the lack of Arrow/ACES end-use checks is based on the Office's review of this list. DOD, which reviews approximately 20 percent of license applications sent to State, generated and provided computer runs from its data base on the basis of key words we provided them. These data are through August 1992. The Missile Technology Export Control Group, which is headed by State, provided a summary of Arrow/ACES cases it reviewed and its recommendations on those cases. We could not independently verify the

Appendix I
Scope and Methodology

accuracy of this summary. Commerce licensing data are based on our sort of downloaded tapes from Commerce's data base, which includes information through May 1992.

Unless specifically indicated, we did not verify that all approved licenses and license agreements resulted in the shipment of the licensed defense articles and/or technologies. In addition, due to the above-mentioned limitations, we cannot certify that the universe of Arrow/ACES licenses we have identified is complete.

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