

The Multifunctional Information Distribution System (MIDS) case study is different from the other case studies in which potential solutions to interoperability problems are analyzed and discussed. In this case study, the near-term solution for an interoperable communication system has already been selected, and it is MIDS.¹ Thus, this case study is really an acquisition case study that highlights the programmatic complexities of cooperative initiatives designed to enhance interoperability among coalition forces.

A summary of the case study was provided in Chapter Nine. There we describe the three major reasons for the MIDS program, summarize our observations of the case study, and present suggested actions the Air Force could take to ensure the success of the MIDS pro-

¹One of the drawbacks of MIDS, which is shared by other Link 16 terminals, is an aging system design that takes limited advantage of recent technology developments. This case study does not address the issue of whether this program—or, for that matter, JTIDS—will support all fighter data link needs in future military operations. As discussed in our past work (Hura et al., 1998), additional research on this larger issue is warranted. This case study focuses on short-term solutions to urgent operational requirements. More capable and more technologically advanced data link systems such as the Joint Tactical Radio System (JTRS) are under development by the DoD and may meet the more stressing far-term needs of the services. However, JTRS will not be available in the near term. On the other hand, if the MIDS program can be transitioned into the production phase without major delays, the urgent data link requirements of the MIDS program member nations can be satisfied in the near term.

After this research was completed, additional information regarding enhancements to Link 16 became available. In particular, the U.S. military is investigating enhanced throughput (higher data rates) and dynamic network management for Link 16 (Simkol, 2000). These enhancements would mitigate some of the current shortfalls of Link 16.

gram. Because of the complexity of the MIDS program and because there is a separate report on the case study,² most of the details are presented in this appendix. Here we examine the goals of the program and the MIDS terminal architectures; discuss programmatic issues, including the history of the program over the last decade; review how MIDS grew out of the original U.S. Air Force–led JTIDS joint-service program; discuss projected costs of MIDS production terminals; and compare those costs to the possible costs of JTIDS Class 2R production terminals if the latter program had proceeded as originally envisioned by the Air Force.

MIDS PROGRAM GOALS AND TERMINAL ARCHITECTURE

Goals

The first goal of the MIDS program was to develop a modular open terminal architecture. With an open architecture it will be easier to integrate MIDS terminals into dissimilar platforms built by different contractors.³

The second goal was to develop an affordable terminal that could be readily tailored to fit any military platform. Initially, MIDS terminals were developed for integration into a set of platforms specified by participating member nations.⁴ Later, the MIDS architecture was modified to accommodate additional U.S. aircraft.

The final and operationally most significant goal of the program was to provide interoperable, jam-resistant⁵ C2 data communication links between U.S. and allied platforms, regardless of whether they

²See Gonzales et al. (2000).

³This “open” architecture predates the Defense Information Infrastructure (DII) common operating environment (COE) and is distinct from it in that it is not specifically based on a set of open software or hardware standards. However, it is partially based on commercial standards for real-time processing systems and on the use of widely available commercial components, such as the Motorola 68040 microprocessor.

⁴In the early days of the MIDS program, the smallest aircraft in the inventory of MIDS member nations was the F-16. Compatibility with aircraft like the F-16 has been a driving program requirement.

⁵In this study, we do not address what level of jam resistance is likely to be required in future environments.

were ground-based C2 nodes, ships, or fighter/bomber aircraft. Such interoperability would be ensured by MIDS because participating member nations would be required to acquire MIDS terminals for their military forces.

LVT Terminal Architecture

Shown in Figure C.1 are key elements of the MIDS architecture for the LVT, the original terminal of the MIDS program. The LVT-platform integration approach is illustrated in the left-hand figure. The LVT is connected to the platform avionics bus (e.g., the 1553 bus of an F-16). Through the bus it exchanges information with platform systems, including cockpit input/output (I/O) devices such as numeric keypads, cockpit displays showing air threats or targets, communications and navigation antennas, and onboard processors. The MIDS architecture enables the LVT to exchange information with such systems on the specified platforms of participating member nations.

The MIDS LVT hardware architecture is illustrated by the middle diagram in the figure. The basis of this architecture is the LVT chassis, which is common to all MIDS platforms. The chassis holds up to nine standardized electronic cards, or Standard Electronic Modules Format-E (SEM-E), each with specific functionality such as voice or message-processing functions. The cards can easily be replaced in

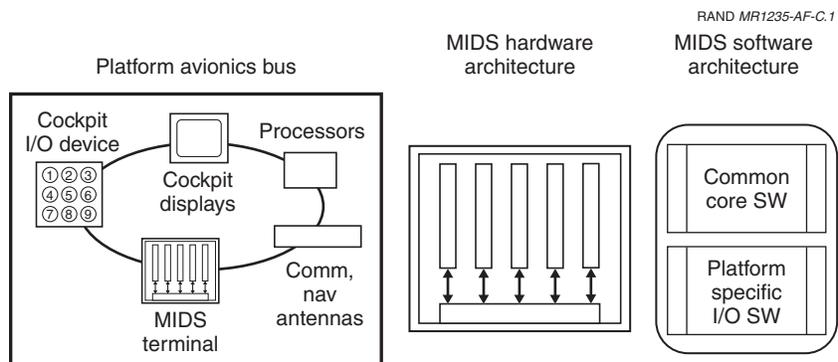


Figure C.1—MIDS LVT Terminal Architecture

the event of failure or if a specific functionality is desired. A significant goal (but not a requirement) of the MIDS program is for terminals to be interoperable at the card or SEM-E level—that is, to have the ability to take a card from the MIDS terminal on a European aircraft, place that card into a MIDS terminal on a U.S. aircraft, and have that terminal function correctly. If this interoperability goal is realized, it could increase the logistics flexibility of NATO allies' aircraft equipped with MIDS terminals.

The MIDS LVT software architecture is divided into two major parts, as shown in the right-hand diagram of Figure C.1. The common software core supports basic functions such as message processing, signal processing, and Link 16 waveform generation. This part is employed in the basic functioning of all MIDS terminals on all MIDS platforms.

The other major part is the I/O software module, which contains specific I/O interfaces for each LVT platform. For example, the U.S. reference platform for the LVT is the U.S. Navy F/A-18. The LVT I/O software module contains all the necessary software interfaces for the LVT to reside on the F/A-18 avionics bus and exchange information with other relevant systems on this bus. This module has grown in size and complexity because it contains the I/O interfaces needed for all LVT platforms. By design and to ensure compatibility, each LVT terminal is loaded with the same I/O software module, although only a portion of the module is used on any specific LVT platform. Thus, as the number of LVT platforms increases, so does the size of the I/O module. The LVT I/O module has grown to be on the order of 340,000 lines of code. Similarly, the LVT performance specification has grown to be over 800 pages in length, and the interface control document is now over 1500 pages long. Thus, a key challenge for the MIDS program from the beginning has been the harmonization of terminal requirements for the LVT platforms of the participating member nations. In the production phase, the MIDS LVT terminal will be manufactured by a U.S. and European industrial team.⁶

⁶For a more detailed discussion of MIDS LVT requirements issues that were negotiated between the international member nations, see Gonzales et al. (2000).

MIDS LVT PLATFORMS

Originally, the LVT was to be installed only on the U.S. Navy F/A-18, on U.S. Navy ships, and on the ships, aircraft, and ground C2 centers of the European MIDS participants (France, Germany, Italy, and Spain). The U.S. Air Force and Army were not program participants. In 1994 the U.S. Army decided to procure a version of the MIDS terminal called LVT(2). The LVT(2) terminals have different physical characteristics but are operationally interoperable with other Link 16 terminals, including LVT(1), which is the designation for the earlier LVT terminal. In 1998 the Air Force decided to acquire MIDS LVT(1) terminals for the F-16 and ABL. At the end of 1999, the LVT(1) and the LVT(2) were to be integrated into a large number of platforms (see Table 9.1), including the U.S. F/A-18, F-16, Spanish EF-18, Italian Tornado, French Rafale, and EF-2000 (Typhoon) aircraft.

In light of lessons learned from recent joint experiments and combat operations, the number of U.S. aircraft equipped with MIDS is likely to grow in the future. According to the Air Force road map, several additional aircraft are scheduled to receive Link 16 terminals. These aircraft are listed in the last row of Table 9.1. It should be noted that in late 1999, efforts were under way in Congress to procure Link 16 (MIDS LVT) terminals for Air Force B-1, B-2, and B-52 aircraft and Navy EP-3 and S-3 aircraft as well as to acquire additional LVT(2) terminals for the Army.

FDL Characteristics

In 1995, at the direction of the OSD, the Air Force joined the MIDS program with a new variant of the MIDS LVT called the MIDS Fighter Data Link (FDL).⁷ The FDL terminal is designed specifically for the U.S. Air Force F-15. FDL is 80 percent common in hardware and software with the LVT. It shares the same modular architecture as the LVT, although the FDL chassis is a slightly modified version of the LVT chassis. However, new variants of existing LVT components were necessary in some cases because of unique avionics standards or performance requirements related to the F-15.

⁷The origin of the FDL terminal procurement is discussed later in this case study.

The FDL terminal differs in design from the LVT. The FDL has no voice or Tactical Air Navigation System (TACAN) capability and has a maximum transmit power level of 50 watts, in comparison to the 200-watt maximum transmit power level for the LVT. Thus, the FDL has a smaller antijam link margin than the LVT in the transmit mode and a shorter maximum range—200 nmi as compared to the 300 nmi of the LVT. Both the LVT and FDL have the same physical dimensions of 0.6 cubic ft.

HISTORY, SCHEDULE, AND MANAGEMENT STRUCTURE

The long and turbulent histories of the JTIDS and MIDS programs are illustrated in Figure C.2. In the late 1960s, the Air Force and Navy began JTIDS technology developments. The Air Force JTIDS system was based on a time division multiple access (TDMA) architecture, while the Navy’s competing JTIDS system was based on a distributed time division multiple access (DTDMA) architecture. Technical problems hampered both programs early on, but the problems encountered by the Navy were more severe. A working prototype DTDMA terminal was never demonstrated.

In 1974 Dr. William Perry, then director of DoD Defense Research and Engineering (DDR&E), directed that the service JTIDS programs be combined into a single joint program. The JTIDS Joint Program Office was created in 1976, and the Air Force was given the lead for this effort. The first operational application of JTIDS was the U.S. Air

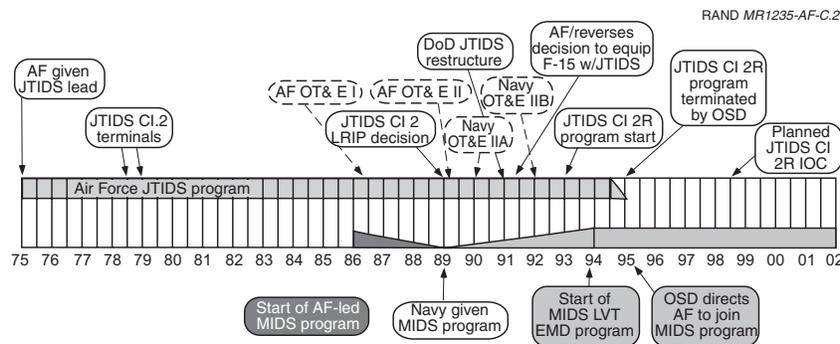


Figure C.2—Turbulent History of the JTIDS and MIDS Programs

Force JTIDS Class 1 terminal for U.S. AWACS aircraft. These terminals were large and took up several cabinets' worth of space on AWACS. They could not fit onto smaller fighter aircraft. In the late 1970s the Air Force started efforts to produce a JTIDS Class 2 terminal that could fit within the small confines of fighter aircraft. This effort encountered significant technical challenges, and progress was initially slow.

In the 1980s and early 1990s, a series of operational test and evaluations (OT&Es) were conducted by the Navy and Air Force to evaluate the performance and reliability of JTIDS Class 2 terminals. A number of significant problems were encountered in these operational tests, including high terminal failure rates, short lifetimes of key components, and software reliability problems. In short, the terminals were not reliable. Although the Air Force in 1989 went ahead with a decision for low-rate initial production (LRIP) of the JTIDS Class 2 terminal, DoD later restructured the JTIDS program because of these problems. The Air Force also grew increasingly concerned about the cost and reliability of JTIDS Class 2 terminals, even though there was strong support within the Air Force for putting a data link capability on fighter aircraft. In the face of mounting costs, reliability concerns, and worsening budget pressures, Air Force in 1991 the reversed its decision to equip the F-15 with JTIDS.

After the Gulf War, however, the importance of data communications for situational awareness and for the rapid transfer of targeting and threat information became apparent. In the early 1990s, the Air Force conducted a series of successful operational tests of candidate JTIDS Class 2 terminals with an F-15C squadron at Mountain Home AFB. In 1993 the Air Force started the JTIDS Class 2R program, with the Air Combat Command publishing the operational requirements document in 1994.

NATO, Link 16, and MIDS

In parallel with United States national efforts to develop the JTIDS Class 2 terminal, the United States and NATO engaged in diplomatic and programmatic efforts to promote interoperability between NATO allies. In 1976 Dr. William Perry offered JTIDS to NATO. NATO interest in JTIDS waxed and waned over the next decade. In 1987 NATO signed a Military Operational Requirement (MOR)

document stating the need for jam-resistant tactical communications. In that same year the North Atlantic Council directed the Conference of National Armaments Directors to complete the NATO STANAG on MIDS (STANAG 4175, *Characteristics of MIDS*). Although the NATO MOR remains in effect, NATO did not start an acquisition program for a Link 16-capable terminal.

Instead, a number of NATO member nations initiated an R&D program in 1987 to develop a MIDS terminal in conformance with STANAG 4175. Initially, the Air Force led the U.S. portion of the MIDS program. In 1989, however, the Air Force became increasingly concerned about the reliability and cost of JTIDS Class 2 terminals. Shortly after, the Air Force withdrew the F-16 as the U.S. reference platform for the planned MIDS terminal, and the U.S. Navy quickly responded by offering the F/A-18 as the new U.S. MIDS reference platform. The Navy proposal was accepted by OSD, and the Navy assumed leadership of the MIDS program in early 1990. It should be noted that under Navy leadership, MIDS has never been a joint-service program. Since 1990, the MIDS program has been led by the U.S. Navy, and the IPO is at SPAWAR PMW-101.

A MIDS PMOU was signed by the participating member nations in 1991. This document places a restriction on member nations and forbids them to develop “competing systems” to the MIDS terminal. PMOU Supplement 1 (S1), also signed in 1991, authorized pre-EMD negotiations among participants and initial risk reduction activities. In early 1994, after the program had passed Defense Acquisition Board (DAB) review, the U.S. Navy was authorized to sign PMOU Supplement 2 (S2) and to award an EMD contract to MIDSCO, the consortium of international companies authorized to bid on the program.⁸ PMOU S2 defines the cost shares and management structure for the EMD program and gives the MIDS IPO the authority to contract directly with MIDSCO. It also establishes EMD exit criteria (i.e., criteria for successful completion of this phase of the program).

⁸MIDSCO is made up of GEC-Marconi Hazeltine (U.S.), Thomson-CSF (France), MID (Italy), Siemens (Germany), and ENOSA (Spain).

Fate of the JTIDS Class 2R Terminal

Meanwhile the U.S. Air Force and its industry partners were proceeding smoothly with the development of the JTIDS Class 2R terminal. The Air Force issued a cost target of \$100,000 per terminal and planned a commercial off-the-shelf/nondevelopmental item acquisition program. The Class 2R terminal was comparable in size and weight to the LVT, although it did not have all its capabilities (i.e., no voice or TACAN capability and lower power). In 1993, the Air Force determined that it had an urgent operational requirement for a Link 16 capability on its air-superiority fighters, the F-15, by the end of 1998.

Shortly thereafter, however, OSD became aware of the conflict between the MIDS LVT and the Air Force JTIDS Class 2R terminal programs. In 1995, to maintain compliance with the MIDS PMOU, OSD directed the Air Force to terminate the Class 2R program and effectively to join the MIDS program. A compromise was reached that satisfied the restrictions of the MIDS PMOU and that could apparently satisfy the Air Force's urgent need for an F-15 Link 16 capability by the end of 1998. The Air Force was permitted to proceed with the acquisition of a Link 16 terminal for the F-15, the FDL terminal, but the MIDS IPO was given responsibility for the acquisition of FDL (also called LVT((3)). FDL was selected over LVT (now designated LVT((1)) for the F-15 because of its expected earlier availability and lower costs. In addition, the FDL program was authorized to enter directly into the production phase and to bypass the MIDS LVT EMD program—at least in terms of acquisition milestone decisions—in order to meet the urgent operational requirement alluded to above.

Despite the testing and acquisition problems associated with JTIDS Class 2 terminals designed for fighter aircraft, JTIDS is operational on U.S. Air Force, U.K., French, and NATO AWACS; on JSTARS, Rivet Joint, ABCCC, the E-2C, the F-14, and the Army Patriot; and on Navy ships.

LVT Engineering and Manufacturing Development

We now turn to the history of the LVT EMD program and to the prognosis for a smooth transition to the LVT production phase. EMD started in 1994 with a six-month restructuring and development

study in order to reduce program cost and schedule by implementing a streamlined acquisition approach, as indicated in Figure C.3. At that time, the MIDS member nations agreed to an open architecture and the use of commercial parts. A one-year reduction in the original EMD program schedule was planned in this streamlining effort. In the third quarter of 1995, the Army LVT terminal, LVT(2), was added. The Air Force FDL LVT(3) contract was awarded in the third quarter of 1996.

Beginning in 1999, the MIDS IPO announced significant delays in the EMD program. Terminal LRIP was delayed one year to the first quarter of CY 2000. The Milestone III decision was delayed two years to the beginning of CY 2002. EMD, originally scheduled to end in CY 1999, was extended six months in order to meet the program exit criteria. In addition, production readiness activities were extended by six months.

According to the MIDS IPO, there were two major reasons for the delays in the EMD program. The first was the lack of a sufficient number of EMD terminals for terminal-platform integration activities. The second reason for the delay was the slow pace and incremental delivery of the TDP.

As of April 1999, 33 EMD terminals were to be produced and made available to the member nations, and the first production terminals

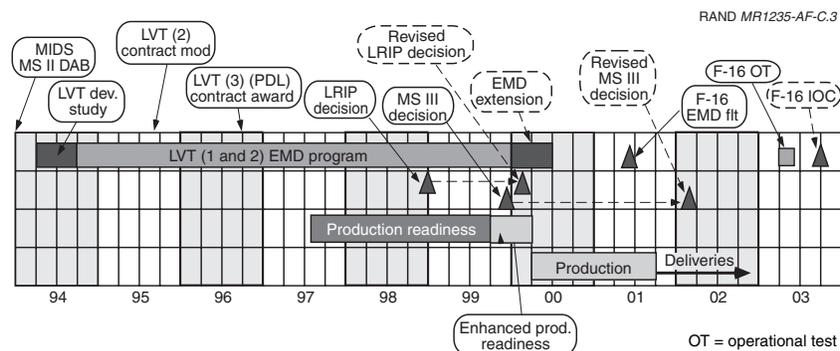


Figure C.3—MIDS LVT Program History and Prognosis

were to be available in CY 1999. However, only 19 were available and the terminal production phase was delayed until CY 2000. There appear to be two reasons for the EMD terminal shortage. The first is a shortage of key parts from foreign suppliers. The second is requirements growth, which has delayed final terminal design. A complicating factor was the late addition of the U.S. Air Force F-16 to the LVT EMD program. This increased the EMD terminal requirement substantially beyond the initial 33 that were contracted for.

A complete TDP is a critical deliverable of the EMD program—it is essential for ensuring competition and contractor readiness for the production phase. It will also be critical for ensuring competition for the U.S. production contract. The TDP will be owned by the MIDS member nations and not by MIDSCO, so the entire TDP or portions of it could be made available to U.S. contractors that are not members of MIDSCO. It will not provide a build-to-print blueprint of the EMD terminal; however, it should provide sufficient technical detail to produce many of the system components. The status of the TDP has caused concern in some circles regarding LVT contractor production readiness and the MIDS IPO production plan.

From a U.S. Air Force perspective, the immediate effect of the delays described above has been to move the IOC for the first Link 16-capable F-16 squadron to the third quarter of CY 2003. This represents a delay of almost three years in fielding an operational data link capability for the F-16. In addition, although its design has been approved by the MIDS IPO and MIDS Steering Committee, the F-16 LVT interface has yet to be implemented. There is concern within the Air Force that the necessary software for this interface will not be completed before the scheduled end of the EMD program. This could further delay the F-16 MIDS LVT IOC and could thus cause further delays in various operational capabilities and significant reprogramming actions by the F-16 SPO.

FDL Production Program

Initially, the design of the FDL terminal for the F-15 was significantly different from that of the LVT. This is because the programs were developed in response to different requirements. In contrast to LVT, FDL has a lower-power transmitter and lacks TACAN and voice capability. However, there has been substantial sharing of technology

and system design information between the two programs, and over the course of time the designs of the two terminals have converged. From the program management standpoint, the relationship between the two programs has been informal even though many contractors are developing and producing components for both terminal systems.

When the FDL program began, the scheduled date for the IOC of the first F-15 squadron was at the end of 1998 (which coincides with the original requirement for the JTIDS Class 2R terminal IOC), as indicated in Figure C.4. However, according to MIDS IPO projections, the FDL IOC will occur approximately 22 months later than the planned IOC for the JTIDS Class 2R terminal.⁹ If additional parts delays are encountered in the LVT program, there could be further delays in the FDL program, which could delay IOC and force significant reprogramming actions by the F-15 SPO.

MIDS IPO Management Structure

During the EMD phase of the program, the MIDS IPO is headed by a U.S. Navy O6-level program manager and a French O6-level officer

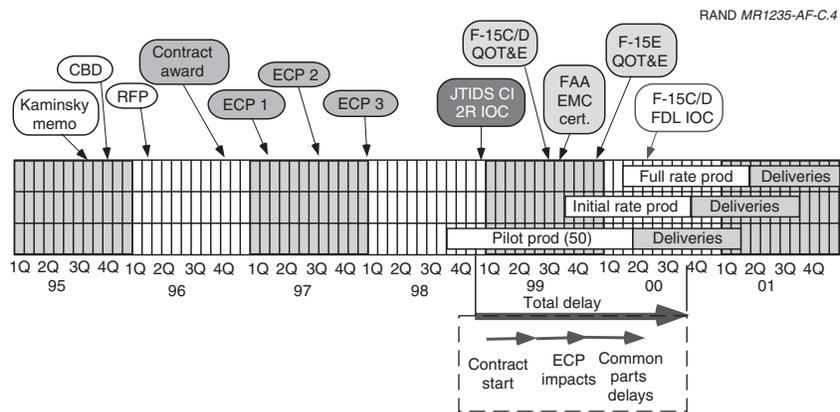


Figure C.4—MIDS FDL Program History and Prognosis

⁹For more detailed information on the causes of the delay, see Gonzales et al. (2000).

deputy program manager. Program oversight is provided by an international board of directors called the MIDS Steering Committee, which consists of one representative from each country. The U.S. representative is the OSD program sponsor, currently the Director of Command, Control, and Communications within OASD(C3I). The Steering Committee is reportedly given substantial management authority for the EMD program as stipulated in PMOU S2.

The MIDS EMD program also has a U.S.-only management committee, the PEC. The current U.S. Air Force representative to the PEC is the ESC Vice Commander. The PEC is chaired by the Navy Program Executive Officer (PEO). To date, the role of the PEC has been largely limited to financial issues such as program cost sharing between the individual services. As noted above, MIDS is not a joint-service program—it is a Navy-led international program. Therefore, according to the current MIDS program manager, detailed joint issues regarding costs and schedules are resolved within the MIDS IPO.

At the time this research was conducted, the senior Air Force officer within the MIDS IPO was an O6-level officer. However, this individual did not have any written or agreed-upon responsibilities within the IPO. He was essentially an Air Force representative-at-large within the IPO. *Therefore, it is not clear that the senior Air Force officer in the IPO has had timely access to all program information necessary to manage the program efficiently from an Air Force perspective or to coordinate with other acquisition organizations in the Air Force, such as the fighter SPOs.*

The management structure for the EMD program was established several years ago, when PMOU S2 was negotiated and signed by the member nations. However, the management structure and cost shares among the international partners for the production phase are now being negotiated and will be established in PMOU S3. Details of the draft PMOU S3 were not made available to the authors except for a few major features of the draft agreement. One of these stipulates that the IPO will remain the central management structure for the procurement of both European and U.S. MIDS terminals. European MIDS terminals will be acquired under a separate contract with a single European industry consortium. However, the U.S. contract for MIDS terminals destined for U.S. platforms will be com-

peted. Many of the details of how these two contracts will be managed are likely to be laid out in PMOU S3.

A second agreement, the JMOA, establishes the contributions and roles of the individual U.S. military services in the MIDS program. A draft JMOA for the production phase of the MIDS program was also under negotiation at the time this research was completed in late 1999. Because the EMD program is essentially a Navy program, the roles of the Air Force and Army in the program are rather limited. An issue we recommend that the Air Force address in the ongoing negotiations over the production-phase JMOA is whether it should have a larger and more substantial role in the production phase to ensure that the MIDS IPO establishes and maintains a viable production plan that will deliver MIDS terminals on schedule and within budget, and that effectively supports Air Force fighter and bomber SPO modernization needs.

MIDS AND CLASS 2R COSTS

In this section we consider the cost implications of achieving interoperability among NATO allies with the MIDS program. First, we briefly review the cost structure of the current EMD program. Next, we consider how the costs of the FDL terminal would compare with those of the JTIDS Class 2R terminal if the latter program had not been canceled. This enables us to assess the cost penalty, if any, for achieving interoperability in a cooperative development program such as MIDS.

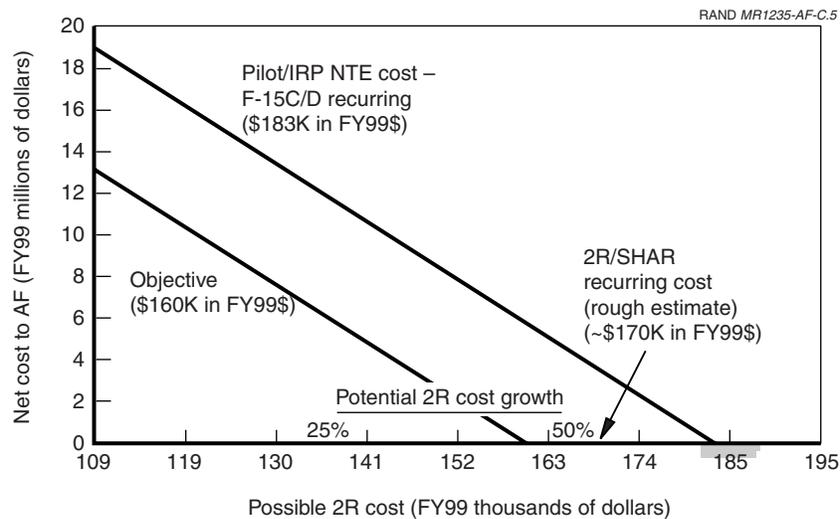
RDT&E funding shares, defined in the PMOU S2, were determined in rough accordance with their expected share of the total buy and the value of the EMD contracts let to contractors from participating MIDS program member nations (the work share allocated to each country). The largest share has been funded by the United States at approximately \$265 million, with France and Italy not far behind.

As noted earlier, in February 1995 the U.S. Air Force announced the need for a reduced-function JTIDS Class 2 terminal (the Class 2R) for the F-15 to meet a critical-need date of December 1998. It subsequently received a bid to provide Class 2R terminals at a unit cost of \$109,000 (FY 1999 dollars). In August of that year, the Under-

secretary of Defense for Acquisition & Technology directed the Air Force to join the MIDS LVT program and to cancel the Class 2R.

The cost implications of the decision to cancel the Class 2R and join the MIDS program are uncertain, but the range of possible cost impacts for this decision is shown in Figure C.5. The current not-to-exceed (NTE) cost for the pilot buy of 50 MIDS FDL terminals is about \$183,000. These are the only units under contract at this writing. The objective cost is approximately \$160,000. Note that both the Class 2R target and FDL objective costs are approximate. The Class 2R terminal was never under contract, and the FDL costs for the remaining lot buys remain to be negotiated.

Had the Air Force been able to procure the Class 2R at the target price, the additional cost per terminal for FDL would have been \$50,000 to \$75,000, or between \$13 and \$20 million for the current 257-terminal buy, enough to equip about 70 percent of the F-15C/D



NOTE: Assumes 257 terminals are procured.

Figure C.5—Cost Implications of the Decision to Cancel the JTIDS Class 2R Program and Buy FDL

fleet. This \$13–\$20 million figure represents an upper bound on the net cost impact of the decision to cancel the Class 2R and procure MIDS for the F-15.

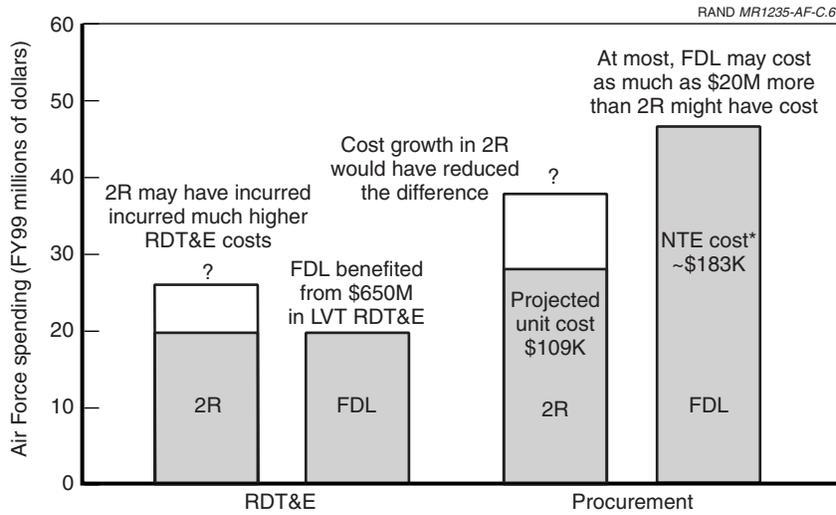
However, it is not clear that the Class 2R program would have come in at its target cost. The Rockwell-Collins SHAR terminal is a derivative of the Class 2R terminal, and its specifications are similar to those of the original Class 2R. Thus, it provides an indication of what the Class 2R might have cost had it continued in development and gone into production. The SHAR cost is consistent with FDL costs, falling midway between the NTE pilot cost and the objective cost. Had the Class 2R come in at the SHAR cost, the net cost of the decision to terminate the Class 2R and buy FDL would have been negligible. Had the Class 2R cost increased by 25 to 50 percent, the net cost impact would have been on the order of a few million to several million dollars.

Even in the worst case, the net cost of the decision to cancel the Class 2R and procure FDL is small relative to Air Force spending on modifications for the F-15, which runs into the hundreds of millions of dollars each year. Had the Class 2R not achieved its cost objective, the net cost impact would have been even less.

Adding in RDT&E spending provides a more complete assessment of the possible cost impact of the decision to cancel the Class 2R terminal and procure FDL (see Figure C.6). As noted earlier, the Air Force may have incurred as much as \$20 million in additional costs from that decision. Cost growth in the Class 2R program could have reduced this total considerably.

However, procuring a MIDS terminal variant (FDL) for the F-15 allowed the Air Force to leverage the \$650 million RDT&E investment made by the U.S. Navy and the allied partners involved in the program. This investment level dwarfs the relatively modest RDT&E effort associated with FDL. The high degree of commonality between the FDL and LVT terminals and software suggests that the FDL program has benefited from LVT RDT&E. Discussions with the program office confirm this finding.

Had the Air Force continued with the Class 2R program, it might have been forced to fund additional development efforts, thus offsetting some of the additional costs associated with procuring



NOTE: Assumes 257 terminals are procured. *Based on Pilot/IRP NTEs

Figure C.6—Additional Costs of FDL May Be Limited

FDL. The Class 2R terminal did not continue in development, so however, so it is impossible to know what additional RDT&E costs might have been incurred. Still, any additional costs would have further reduced the net cost of the decision.

In some ways, the MIDS terminal program has been a dramatic success. Six nations have participated in the development, and all plan to procure the system. Each of the participants has a substantial incentive to continue with the program, as their domestic industries are rewarded as a function of the country’s participation. The integration of MIDS on allied fighters should substantially increase situational awareness and subsequently increase force effectiveness. U.S. exercises have repeatedly shown that JTIDS-equipped aircraft perform much more effectively than equivalent aircraft that lack the system.

However, the success of the program has not come without cost. Had the United States and other nations chosen to procure an off-the-shelf JTIDS terminal such as SHAR, they might have avoided pay-

ing hundreds of millions in MIDS RDT&E costs. They might have saved on procurement as well, as SHAR's costs are substantially lower than those of MIDS.

The discussion of the MIDS and SHAR programs is complicated by the fact that they are not independent. SHAR is built by Rockwell-Collins, which is a major partner in Digital Link Solutions, a prime contractor on the MIDS program. SHAR probably benefited from the substantial RDT&E investment made in the MIDS program. In the absence of MIDS, SHAR's development costs might have been much greater.

While it is possible that the United States could have procured JTIDS terminals at a lower cost than that of MIDS, such an arrangement would probably have involved only U.S. contractors. The NATO allies may not have been willing to simply procure a U.S. system; they might have pursued an independent program instead and subsequently ended up with a system that might have been less compatible with the U.S. JTIDS systems. Absent U.S. leadership, they might not have pursued a JTIDS capability at all and would subsequently not have achieved the improvements in interoperability that they are likely to enjoy over the next few years.

Thus, the success of the program must be viewed in the context of the broader policy objectives. MIDS may be more expensive than some of the alternatives, but it has created incentives for allied participation and significantly enhanced the likelihood that aircraft participating in future coalition operations will have greater situational awareness—and subsequently greater effectiveness—than they do today.