DEFENSE ACQUISITIONS

Significant Challenges Ahead in Developing and Demonstrating Future Combat System's Network and Software

Why GAO Did This Study

The Army's Future Combat System (FCS) requires a software-based advanced information network to meld people, sensors, and weapons into a cohesive fighting force. As software controls 95 percent of FCS's functionality, it determines the success or failure of the program. The Army contracted with the Boeing Company as a lead systems integrator (LSI) to define, develop and integrate FCS, including software development.

GAO must by law report annually on FCS. This is one of two reports to meet this requirement. It addresses risks facing the development of network and software, the practices being used to manage software, and the timing of key network demonstrations.

In conducting our work, GAO has contacted numerous DOD, Army, and contractor offices; reviewed technical documents on software and network development and plans; attended meetings; and spoken to Army and other officials on various aspects of FCS network and software development. GAO also performed detailed work at five FCS software developers.

What GAO Recommends

GAO recommends that the Secretary of Defense direct the program to stabilize network and software requirements on each build to enable adherence to disciplined practices and establish clear criteria on acceptable network performance and demonstrations at each of the key program events. DOD concurred with GAO's recommendations.

To view the full product, including the scope and methodology, click on GAO-08-409. For more information, contact Paul L. Francis at (202) 512-4841 or francisp@gao.gov.
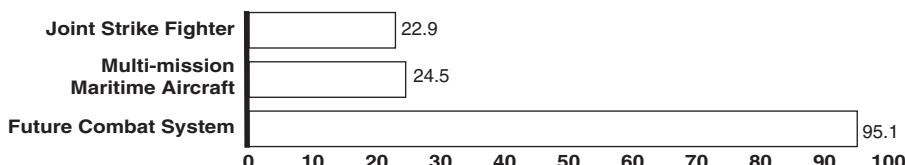
What GAO Found

Almost 5 years into the program, it is not yet clear if or when the information network that is at the heart of the FCS concept can be developed, built, and demonstrated by the Army and LSI. Significant management and technical challenges have placed development of the network and software at risk. These risks include, among others, network performance and scalability, immature network architecture, and synchronization of FCS with Joint Tactical Radio System and Warfighter Information Network Tactical programs that have significant technical challenges of their own. Software being developed for the network and platforms is projected to total 95.1 million lines of computer code, almost triple the size since the program began in 2003. As shown, FCS's software is about four times larger than the next two largest software-intensive defense programs.

Comparison of FCS Software Size to the Next Largest Software Intensive Defense Programs
Source lines of code (in millions)

Program	Value
Joint Strike Fighter	22.9
Multi-mission Maritime Aircraft	24.5
Future Combat System	95.1

Source: Army, Navy, Air Force (data); GAO (analysis and presentation).

Although several disciplined practices are being used to develop FCS's network and software, the program's immaturity and aggressive pace during development have delayed requirements development at the software developer level. For example, software developers for 5 major software packages that GAO reviewed report that high-level requirements provided to them were poorly defined, late, or omitted in the development process. This caused the software developers to do rework or defer functionality out to future builds. In turn, these poor or late requirements had a cascading effect that caused other software development efforts to be delayed.

It is unclear when or how it can be demonstrated that the FCS network will work as needed, especially at key program junctures. For example, in 2009, network requirements, including software, may not be adequately defined nor designs completed at the preliminary design review; and at the FCS milestone review later that year, network demonstration is expected to be very limited. The first major FCS network demonstration—the limited user test in 2012—will take place at least a year after the critical design review and only a year before the start of FCS production. That test will seek to identify the impact of the contributions and limitations of the network on the ability to conduct missions. This test will be conducted after the designs have been set for the FCS ground vehicles, which poses risks because the designs depend on the network's performance. A full demonstration of the network with all of its software components will not be demonstrated until at least 2013 when the fully automated battle command system is expected to be ready.

United States Government Accountability Office