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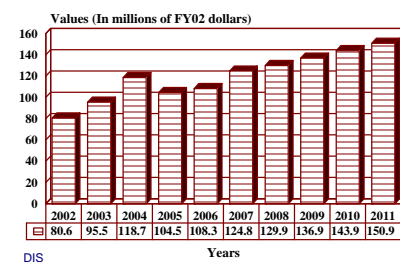
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Distributed Information Systems (DIS) - Archived 09/2003

Outlook

- Forecast International projects DARPA to spend some US\$1.194 billion on the Distributed Information Systems (DIS) program over the next decade
- Expect the DIS program to finalize the evaluation protocols and metrics for heterogeneous human computer dialog systems in 2002
- Look for the DIS program to create an initial capability to process Arabic text and audio sources in 2002

Forecast Funding Levels
2002 - 2011



Orientation

Description. The Distributed Information Systems (DIS) program is a US Defense Advanced Research Projects Agency (DARPA) research endeavor. The DIS program develops and demonstrates information-processing technology for US Department of Defense command, control, and communications (C³) needs.

Sponsor

Defense Advanced Research Projects Agency (DARPA)
 Arlington, Virginia (VA)
 USA

Prime Contractors

General Electric – GE R&D Center
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General Dynamics – Communication Systems

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Lockheed Martin Corp – Tactical Defense Systems
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Contractors

Carnegie-Mellon University
 Pittsburgh, Pennsylvania (PA)

USA	University of Massachusetts
Cornell University	Amherst, Massachusetts (MA)
Ithaca, New York (NY)	USA
USA	University of Southern California
Harvard University	Information Sciences Institute
Cambridge, Massachusetts (MA)	Marina Del Rey, California (CA)
USA	USA
Rice University	Status. Ongoing research and development.
Houston, Texas (TX)	Total Produced. Not applicable.
USA	Application. To develop technology for US
University of California	Department of Defense information processing systems
Los Angeles, California (CA)	serving C ³ needs.
USA	Price Range. Indeterminate

Technical Data

Design Features. The Distributed Information Systems (DIS) program develops and demonstrates technology for building secure, real-time, geographically distributed information systems. The DIS program develops advanced architectures and devices in large-scale, high-performance, secure/survivable communications networks for worldwide command and control.

These distributed systems are based on personal work stations interconnected by high-bandwidth local area networks (LANs). The systems can support large-scale

testing, evaluation, and enhancement of the capabilities of information networks. Applications for distributed systems under development include a message system, war games, and a sensor network.

In the area of software technology, the wideband satellite channels are being integrated into the Internet system, and experiments are being conducted to evaluate protocols and alternative routing to meet requirements for end-to-end network security and multilevel operating system security.

Variants/Upgrades

The thrust of this project is to provide a technological development base for the ongoing enhancement of US Department of Defense command and control programs.

Program Review

Background. By the early 1980s, the Internet system had been developed to the point that it could be used regularly by a large community of users. In order to facilitate this achievement, an Internet electronic message and forwarding system was developed. Additionally, the standard US Department of Defense (DoD) transmission control protocols/Internet protocols (TCP/IP) were implemented on most Advanced Research Projects Agency Network (ARPANET) hosts. TAC access control was specified and implemented. A packet speech program was completed as well.

By the end FY85, protocols had been developed to support distributed communication and control applications, including multimedia conferencing. Network partition detection and recovery mechanisms were

evaluated in the Internet system, and the Internet Private Line Interfaces (IPLIs) were certified for use with packet radios.

In related efforts during the year, the TAC access control system was installed on the ARPANET, and the DES-based encryption device was evaluated for compartmentalization of a secure local network. In addition, the multimedia message system was enhanced for operational use at Fort Bragg, and the Berkeley version of the UNIX operating system was extended to allow the execution of distributed programs to be monitored.

Later, preliminary testing of a distributed operating system, whose nodes span a set of connected networks,

was conducted. The effect of process migration on performance was then measured in an experimental multicomputer system. Next, an evolutionary method for describing and evaluating the performance of C³ systems architectures was devised based on high-level functional descriptions. Finally, a rapid prototyping environment was designed to support experimental development of new software systems.

During FY86, techniques by which distributed real-time applications operating on the Internet system could support multimedia conferencing were demonstrated. New end-to-end communication services were developed and demonstrated to support such applications. Finally, the interoperability of the Internet system with commercial systems, including electronic mail, was demonstrated.

An initial prototype of a new-generation experimental environment was completed in FY87, along with the design of an advanced prototype Ada programming environment. During FY89, development continued on ways to support very large networks and enhance interoperability among C³ systems, with emphasis on very-high-speed networking. Additionally, new methodologies were explored for developing C³ systems, including object-based image communication techniques in a multimedia environment, using Ada and Mach. Security requirements and architectures for Internet technology and experimental networks were explored, and selected distributed systems technology components were adapted for use in tactical distributed C³ systems. Three simulation network (SIMNET) sites were activated, and long-haul networking among the sites was demonstrated.

In less than a decade progress was extensive. By the year 1990, SIMNET technology had been transferred to the US Army, and a simulation of interconnectivity between the Battle Force In-port Trainer (BFIT) and SIMNET via the high-performance wide-area Internet had been demonstrated.

The transition of the Internet to support OSI (Open Systems Interconnection) standard protocols began in FY91. Moreover, techniques that could be used to provide real-time data communication in support of distributed command and control applications in an Internet environment were demonstrated.

In 1993, the DIS program was transferred from PE#0602708E, Integrated Command and Control Technology – Project IC-1, to PE#0602301E, Computing Systems and Communications Technology – Project ST-20 Distributed Information Systems/C³. The transfer reflected the program element/project consolidation and realignment that had occurred within DARPA. During the transition period, file-system

technology was transferred to a self-sustaining industrial base.

DIS was transferred again in FY94, from Project ST-20 (Distributed Information Systems C³) to Project ST-11 (Intelligent Systems and Software), still within PE#0602301E (Computing Systems and Communications Technology). This transfer reflected further program element/project consolidation and realignment within DARPA.

Program activity during FY94 focused on developing the test-case scenarios and Internet-accessible software testbeds that typify the type of advanced information-processing requirements in DoD systems. In other efforts, information fusion and aggregation services were developed to make heterogeneous databases interoperable.

During FY95, further progress was made in developing prototypes for the system architecture software formulas. New high-performance computing technologies being produced under Project ST-10 – High Performance Computing (HPC) within this program element were also developed.

Evaluations were the main focus of work during FY96. Many of the program aspects were experimentally implemented and studied. The targeted areas included human-aided machine translations, document understanding, and robust speech recognition in adverse acoustic conditions.

During FY97, distributed design tools and multi-agent systems for the capture of collaborative design history were evaluated and demonstrated. Additional research focused on developing new image understanding technologies for image exploitation, and video surveillance/monitoring to enhance battlefield awareness.

In FY98, RaDEO (Rapid Design Exploration and Optimization) design computation tools were selected for use in demonstrating robust multidisciplinary design. FY99 activities included software composition and an Instrumented Feasibility Demonstration (IFD) of design technologies.

In 2000, the DIS program developed a translingual C⁴I database for use in US and Republic of Korea coalition operations. Also, the DIS program conducted experiments of use of the system in providing disaster relief and humanitarian assistance.

Recent Developments. In 2001, the DIS program demonstrated and evaluated dialogue performance for United States Marine Corps small unit logistics. The program also conducted an initial evaluation of summarization technology.

<u>Year</u>	<u>Major Development</u>
	military application for use in demonstrating an integrated distributed systems technology base selected
1993	Initial examples of domain-specific application interface definitions developed
1994	Information fusion and aggregation services developed
1995	Prototypes for system architecture software formulas developed
1996	Human-aided machine translations evaluated
1997	Initial web-structure configuration management capability demonstrated
1998	Embedded image understanding technologies demonstrated and evaluated
1999	Active approaches to software composition investigated, emphasizing aspect-oriented programming, on-the-fly component generation and interconnection, and module self-evaluation and configuration
2000	DIS program developed translational C ⁴ I database
2001	Initial evaluation of summarization technology conducted
2002	DIS program to demonstrate the ability to follow events described in English and Chinese news sources

Worldwide Distribution

The DIS program is a **United States** endeavor.

Forecast Rationale

The Distributed Information Systems (DIS) program is a US Defense Advanced Research Projects Agency (DARPA) research effort. The DIS program develops and demonstrates information-processing technology for US Department of Defense command, control, and communications needs.

As indicated by the outlook chart, Forecast International projects DARPA to spend some US\$1.194 billion on the DIS program over the next decade. The Department of Defense's commitment to achieve information superiority over United States adversaries is driving DIS program spending.

Project ST-11, a critical component of the DIS program, develops and applies new software database management and human computer interaction technologies. These technologies will provide new capabilities of importance for a wide range of national security needs.

Specifically, these technologies will enable advanced information systems to:

- automatically exploit large volumes of speech and text in multiple languages
- effectively accomplish computing and decision-making tasks in stressful, time-sensitive situations
- collect, filter, synthesize, and present information in a timely and relevant form to assist US war fighters.

With the US War on Terrorism highlighting the importance of information dominance, Forecast International expects the DIS program to be well funded beyond 2011.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR FUNDING (\$ in millions)													
Designation	Application	Thru 01	02	High Confidence Level		Good Confidence Level			Speculative			Total 02-11	
				03	04	05	06	07	08	09	10		11
DIS	INFORMATION PROCESSING TECHNOLOGY	1070.140	80.570	95.500	118.700	104.520	108.250	124.790	129.910	136.910	143.920	150.920	1193.990