: What was the first computerized decision support system (DSS)?

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There is not a simple, indisputable answer to this question. Some would argue Scott-Morton's Management Decision System (MDS) or the UNIVAC application used to forecast the 1952 U.S. Presidential election was the first DSS. Management Scientists might argue Dantzig and Orchard-Hays's Linear programming software was the first DSS. Others cite JOSS and NLS. My current view is that the U.S. SAGE air-defense command and control system was probably the first "real" computerized, data-driven decision support system (DSS). Let's review these systems.

1952 CBS election forecasting system

On election day November 4, 1952, a computer application was used to assist in predicting the U.S. Presidential voting results. The fifth UNIVAC computer built was programmed by Remington-Rand (UNIVAC division) staff to analyze the partial results in order to anticipate the outcome. That evening "only a few minutes after the East Coast election booths closed that the UNIVAC being used on behalf of the CBS television program, was ready to predict a landslide victory for Dwight D. Eisenhower over Adlai Stevenson. But the CBS producers were unprepared for such an early prognostication, and thus made it appear that the UNIVAC was not ready to made a statement. Just after midnight when the outcome was as predicted, a spokesman for the network apologized on the air for not believing the analysis (Lee, 1996)." This example is not however a DSS because it was for one time use, it was used by "experts", and it was not an interactive system (see DSS characteristics in Power, 2002; 2003). This example is better classified as a computerized decision support special study.

1954 Linear programming software

In the mid-1950s at the Rand Corporation, George Dantzig was working on a linear programming computer application for optimization problems and Dick Bellman was developing the associated Simplex method of computation and dynamic programming (Ware, 2006). According

to Dantzig (1991), William Orchard-Hays of the Rand Corporation, wrote the first commercial-grade software for solving linear programs in 1954. More than likely some model-driven DSS were built using Orchard-Hayes' software, but I can't cite specific examples.

1958 SAGE system

In the mid-1950s, the first large scale data-driven DSS was designed by Jay Forrester and George Valley, professors at MIT's Lincoln Lab. The Semi-Automatic Ground Environment (SAGE) air-defense command and control system was deployed beginning in 1958 and was fully operational in 1963. The name SAGE, a wise mentor, indicated the decision support nature of the system. Some parts of the system remained in operation until 1983. SAGE was designed to coordinate radar stations and direct airplanes to intercept incoming hostile aircraft. Everett et al. (1963) in a 14 page document that was handed to visitors of SAGE centers, claimed "SAGE is a real-time control system, a real-time communication system, and a real-time management information system."

The computer used in the SAGE system was the AN/FSQ-7, the first large-scale, real-time digital computer. It had to handle many different tasks at the same time, sharing central processor time among them. A web page at Williamson Labs notes Sage "gathered information over telephone lines from as many as 100 radar and observation stations, processing it and displaying it on some 50 cathode-ray tube screens. The 'direction centers' were also linked to each other by telephone lines. SAGE was an enormous project, requiring some six years of development and 7000 person-years of programming."

Operators accessed the SAGE system through cathode ray tube displays and used a light pen to select tracks of potential incoming hostile aircraft and manage their status. When SAGE was fully deployed, it consisted of 24 Direction Centers and 3 Combat Centers, each linked by long-distance telephone lines to more than 100 radar defense sites across the U.S., this created one of the first large-scale wide-area computer networks.

The AN/FSQ-7 computer was designed by researchers at MIT and

constructed by IBM. The computer was a general purpose, binary, parallel, single-address machine with 32-bit word length, it was a dual-processor nonstop timesharing system that used large magnetic drums used both for secondary storage and as communications buffers, it had magnetic core memories (256K bytes with 6 microsecond cycle time), it used approximately 55,000 vacuum tubes, it used about ½ acre (2,000 m²) of floor space, weighed 275 tons and used up to three megawatts of power and it required a large air conditioning system to avoid overheating. Each SAGE site included two computers to increase reliability, with one processor on "hot standby" at all times. Each SAGE site "cube" had four floors, with air conditioning and wiring on the ground floor, the computers on the second floor, offices on the third and the combat center on the fourth floor. The "big screen" tracking display extended two stories from the third to the fourth floor. The total project cost is estimated at between 8 and 12 billion 1964 dollars. Please check the photos and additional information about SAGE at Wikipedia, the free encyclopedia.

According to Mitre.org, the Semi-Automatic Ground Environment (SAGE) system, was "the first major real-time, computer-based command and control system. Designed as a new air defense system to protect the United States from long-range bombers and other weapons, the SAGE system sent information from geographically dispersed radars over telephone lines and gathered it at a central location for processing by a newly designed, large-scale digital computer. As the system evolved, SAGE broke new ground in radar, communications, computer, information display, and computer programming technologies. ... The largest real-time computer program of that time, it automated information flow, processed and presented data to 100 operator stations, and provided control information to the weapons systems. ... SAGE demonstrated pioneering solutions to the problem of the user interface. The System displayed extremely large amounts of information to its operators using the then-new cathode ray tube; operators could then obtain additional information on aircraft tracks by selecting them with a light gun."

According to Les Earnest (1990), a designer of SAGE, "The upper floor of each SAGE command center had a large room with subdued lighting and dozens of large display terminals, each operated by two people. Each terminal had a small storage-tube display for tabular reference data, a large CRT display of geographical and aircraft information (with a flicker period of just over one second!), and a light gun for pointing at particular features. Each terminal also had built-in reading lights, telephone/intercoms, and electric cigar lighters.

This dramatic environment with flickering phosphorescent displays clearly looked to the military folks like the right kind of place to run a war. Or just to 'hang out.'"Earnest recalled that "Both the prototype and operational SAGE centers were frequently visited by military brass, higher level bureaucrats, and members of Congress. They generally seemed to be impressed by the image of powerful, central control that this leading-edge technological marvel had."

In 1994 Patent hearings Earnest testified "It is fortunate that the Soviet Union never attacked the U.S. in that era, because the marvelous technology in SAGE had several 'Achilles heels' that would have caused it to fail catastrophically under attack. However, those shortcomings were kept well hidden from Congress and the public and, as a result, so-called 'command-control-communications' technology became a major growth industry for the military-industrial complex." Check Wikipedia for more information on Les Earnest and SAGE.

1963 JOSS, JOHNNIAC Open Shop System

JOSS may have been the first model-driven DSS generator software. JOHNNIAC Open Shop System (JOSS) was an on-line, interactive programming system for the JOHNNIAC computer. At the Rand Corporation, Cliff Shaw envisioned the possibilities for an english-like interactive programming environment for non-programmers. Shaw claims November 7, 1960 is the birthdate of JOSS. According to Mills, the application was first used in May 1963 with an initial five terminals and a minimal system. One terminal was installed at the JOHNNIAC, and four were located in the offices of Rand staff selected to evaluate JOSS. The system used an IBM model 868 typewriter terminal with a small box that indicated the status of the terminal's communication electronics and controlled their functions. By the time Shaw was installing JOSS I on the JOHNNIAC, the machine had 4096 words (40 bits each) of core storage with a cycle time of 15 microseconds, drum storage of 12,288 words, punched card input/output, and a high speed printer. It had no magnetic tapes, no indexing, and no built-in floating point. According to Smithsonian.org, "Shaw was a pioneer in the field of computer programming languages, artificial intelligence, and the development of on-line, interactive, time-sharing computers." In the late 1950s, Shaw collaborated with Herbert Simon and Allen Newell to develop computer programs that attempted to simulate human decision-making (cf., Newell et al. 1960). This was a pioneering application development system, but I am not aware of any DSS actually built with the system.

1967 Management Decision System (MDS)

In the business DSS literature, Michael S. Scott Morton's work on a Management Decision System (MDS) for his Harvard Ph.D. is generally considered the first model-driven DSS. In 1966-67 Scott Morton studied how computers and analytical models could help managers make a key decision. He conducted an experiment in which managers actually used a computerized system. Marketing and production managers used MDS to coordinate production planning for laundry equipment. MDS ran on an IDI 21 inch CRT with a light pen connected using a 2400 bps modem to a pair of Univac 494 systems. Scott Morton's (1967) dissertation research was a pioneering implementation and investigation of a model-driven decision support system. In 1971, Scott Morton&#65533;s book Management Decision Systems: Computer-Based Support for Decision Making describing his research was published by the Division of Research, Graduate School of Business Administration, Harvard University. Decision support systems as a field of academic inquiry developed following the 1971 article by Gorry and Scott Morton coining the term decision support system.

1968 NLS (oN-Line System)

On December 9, 1968, Douglas C. Engelbart and a group of 17 researchers working with him in the Augmentation Research Center at Stanford Research Institute in Menlo Park, CA, presented a 90-minute live public demonstration of an innovative decision support system called NLS, (oN-Line System). The team had been working on it since 1962 when Engelbart wrote a pioneering paper on augmentation systems. The Stanford Mousesite notes "This was the public debut of the computer mouse. But the mouse was only one of many innovations demonstrated that day, including hypertext, object addressing and dynamic file linking, as well as shared-screen collaboration involving two persons at different sites communicating over a network with audio and video interface." Streaming video clips from the demonstration are available at URL sloan.stanford.edu/mousesite/1968Demo.html .

Quoting Allen Newell "Everything must wait until its time; science is the art of the possible." This maxim has certainly been true for

decision support systems research and development.

As always your comments and suggestions are welcomed. Happy holidays from all of us at DSSResources.com.

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From Power, D., What was the first computerized decision support system (DSS)? DSS News, Vol. 7, No. 27, December 31, 2006.

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Last update: 2007-03-02 11:50