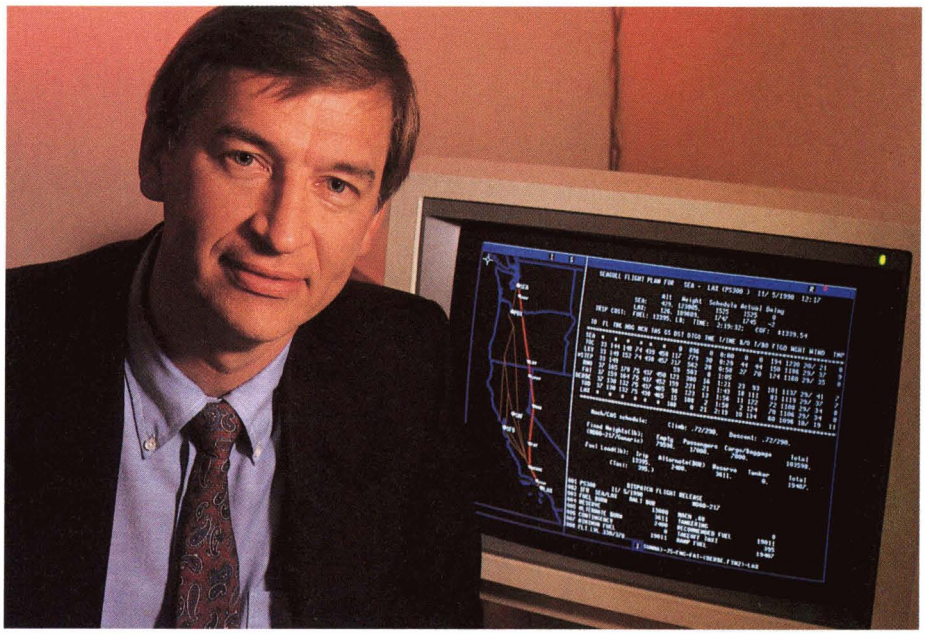
Flight Planning



The direct operating cost of an airplane is basically the sum of the time flown and the fuel burned. In the case of an airline operating thousands of flights, millions of gallons of fuel could be saved annually if the airline could fly precise point-to-point trajectories optimized for fastest time or minimal fuel expenditure.

However, it is far more complex than it sounds to develop a computer program for devising optimal trajectories, due to the many considerations of airline flight, such as air traffic control constraints, weather and winds, local climb and descent requirements, airplane weights and payloads, and a variety of other factors.

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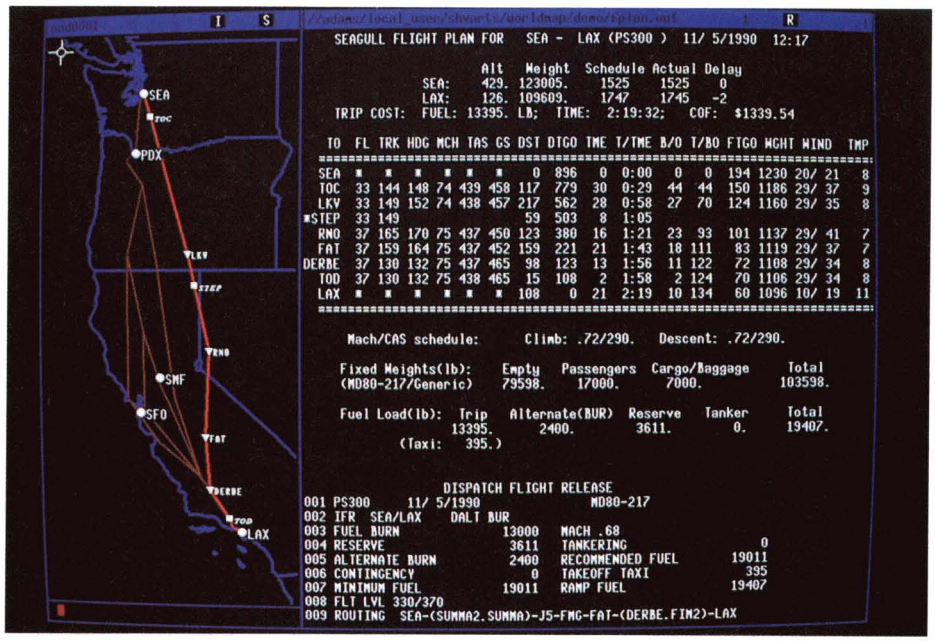
In 1979, NASA took a first step toward development of a comprehensive optimum trajectory software package; Dr. Heinz Erzberger and Homer Q. Lee of Ames Research Center developed a basic system for computing the most fuel-efficient flight path. This concept formed the basis for the first generation flight management systems used by the commercial airlines in the 1980s. It was estimated at that time that such a system could save the airlines some $200 million a year in fuel costs.

The Ames software served as a departure point for subsequent NASA-sponsored steps toward an advanced flight management system. One step was an extensive survey of the airlines to determine how they generate flight plans and what features are the really important operational considerations. The survey was conducted by Seagull Technology, Inc., Sunnyvale, California, a company that provides engineering design/analysis and develops special purpose software products. Seagull also produced an experimental computer program that would generate optimal flight plans between a pair of cities.

From the survey of the airlines' flight planning capabilities, it was apparent that there was need for a new commercial flight planning computer program that would minimize direct operating costs while complying with the various airline operating constraints. In 1985, Seagull received a Small Business Innovations Research grant from Langley Research Center for development of such a program. Under the grant, Seagull produced STAFPLAN (Seagull Technology Advanced Flight Plan), specifically designed for small to medium sized

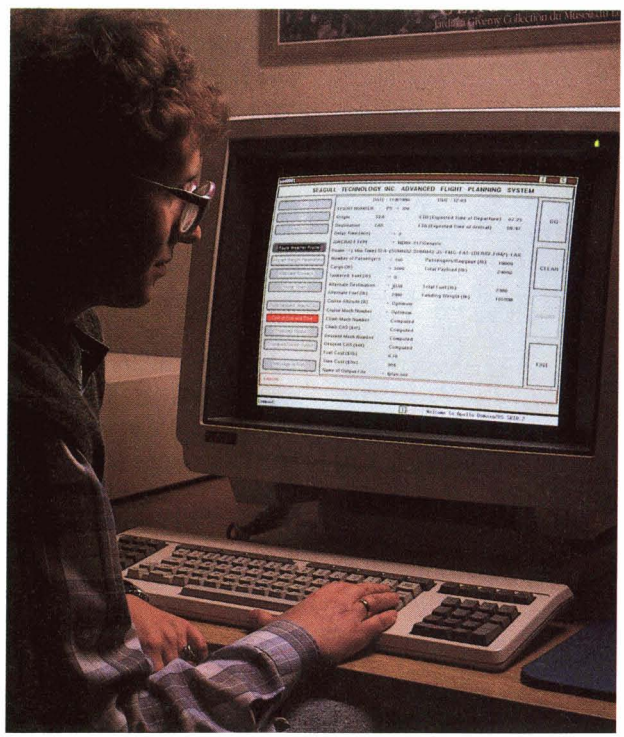
airlines that might not have in-house capabilities for optimal trajectory planning.

At left is Dr. John A. Sorensen, president and founder of Seagull Technology. **At lower left,** Sorensen is pictured with Susan Dorsky, primary STAFPLAN systems designer; on the console screen, and shown in closeup **at right,** is a STAFPLAN display that gives the airline dispatcher optimization information for a flight plan from Los Angeles to Seattle (STAFPLAN can compute flight plans for any pair of cities).



STAFPLAN incorporates four input databases: weather and associated meteorological data (**below,** company programmer Ann Shvarts is working on route weather profiles); route data with associated navigational aids and airport information; performance data on airline aircraft and engines; and flight-specific data, such as scheduled departure and arrival times, payload, assigned aircraft type and crew, and cost of fuel.

In sequential steps, STAFPLAN provides the dispatcher the precisely correct amount of fuel the flight needs, with allowance for a safety margin (excess fuel costs money because it takes extra fuel to carry the excess fuel); optimal cruise altitude; step climb and step descent points; optimal cruise speed; and optimal flight path. If a fixed cruise speed is specified by the airline, STAFPLAN computes the "minimum time track" for best direct operating cost.



Seagull's NASA-sponsored experience in flight planning research and flight management system development has led to a number of other work assignments for the company, including contracts with Ames Research Center involving development of an on-board aircraft performance monitoring system and multiplane air traffic control simulations. For the Federal Aviation Administration, Seagull is assisting in design of a method for computing optimal schedules for approaching aircraft to optimize runway utility. Seagull is also developing, for flight path generation and cost analysis, a Transport Aircraft Synthesis Program for airlines and aircraft component manufacturers.

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