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IT Goes Strategic

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A new decision-making role emerges for information technology.

Computer simulations have been around for decades, and now the technology behind sophisticated computer simulation models is leaping to a new level of strategic decision-making.

While a few Fortune 50 corporations are beginning to employ strategic models, the specifics are scant because they tie into efforts to secure competitive advantage.

Earlier this year, however, the U.S. Federal Aviation Administration (FAA) implemented a National Airspace System (NAS) Strategy Simulator. This will not only change the way decisions are made in managing national air space, but will also serve as a notable example of what is now possible — an example that isn't cloaked in corporate secrecy.

As David F. Andersen, distinguished service professor of Public Administration and Information Science at the State University of New York (SUNY) at Albany, puts it, "The national air space simulator being developed by Ventana Systems Inc. for the FAA is really way cool stuff — the kind of thing not generally done in the world of computer modeling."

Such models may become indispensable tools for senior executives, and ultimately change how top-level management works in both the public and private sectors, according to Andersen and others working to create strategic simulations for top-level management. If these simulation experts are right, CIOs and other IT executives may want to watch developments closely.

Evolutionary Process

By all accounts, the FAA's Strategy Simulator is beyond typical simulation models. "A balanced story here would be, 'How does one do decision analysis in this very complex world of infrastructure management at a national scale?' This stands on the shoulder of all other IT," said Ron Suiter, president of Suiter and Associates Inc., a key contributor to the NAS Strategy Simulator.

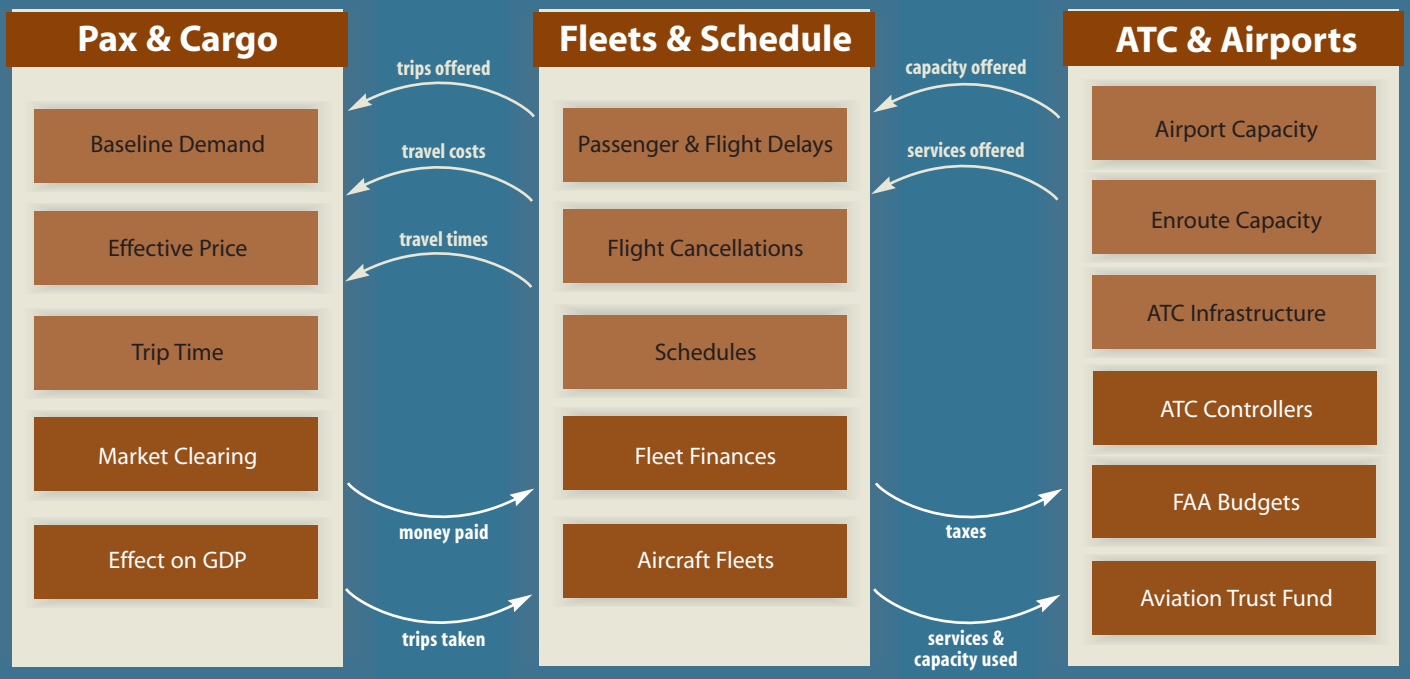
"Explaining what has been accomplished with the NAS Simulator immediately gets into a whole area of technology," Suiter added. "There are lots of operations research models that do things like fly airplanes from point to point. There are lots of the econometric models, which are essentially correlation-type models. But Ventana is very unique in that it is a systemic model — it maps how all these things interact as a tight system. We spend a lot of time trying to determine cause and effect, rather than simply correlation. Things can correlate and still not be causal, which is a weak point in most econometric schemes. You have to isolate the fundamental things that really drive change within the system."

That, however, is easier said than done. In fact, many believed it was impossible in any practical sense. "Initially you start out with everybody saying it can't be done," Suiter said. "Then a few people think, 'Well it would be cool if it could,' so you get something going."

To build a model like the NAS Strategy Simulator, Ventana Systems starts with the best understanding of the current system. "You talk to the gurus of the system, and

Predicting Performance

The performance of the National Airspace System (NAS) is governed by three interacting sectors: passengers and shippers (pax), fleets of aircraft and their operators, and the system of airports and air traffic control (ATC). Aircraft fleets draw on services of the airports and ATC to provide, in turn, services to passengers and shippers.



Courtesy of Ventana Systems

you create a picture of how they believe things work," said Laura Peterson, president of Ventana Systems. "But instead of that being the end point, which is what happens in 95 or 99 percent of the world's models, we assume that's the starting point."

Then using Vensim software — developed by Ventana Systems — the company sets the model in an environment with ruthless, vigorous automated tests, which determine whether the model:

- explains what was seen and observed about the system;
- follows common sense logic — in other words, passes a reality check, which most econometric models don't; and
- triangulates all information from the experts, the input data and the reality checks.

"What happens as a result of such tests is that, in Sherlock Holmes style, you evolve from your original model — the way people think the system works — to something many steps beyond that, to a very accurate representation of what really happens in the system" said Peterson. "Frankly it is a long journey from the first prototype to something good enough to actually use for strategic decision-making."

FAA Challenges

Developed under the direction of Russell Chew, chief operating officer of the FAA's Air Traffic Organization, the NAS Strategy Simulator's goal was to create a comprehensive model that could handle just about any problem — a simulation that would, in essence, capture the entire aviation sector and all causal interrelationships between various stakeholders.

That meant the model had to include all major air travel constituents in the United States: the passengers, cargo and shippers who want to use air travel; airlines; companies that increasingly buy their own corporate jets; and the air traffic control system itself, which enables safe airplane movement across the country.

In all, because of the complexity, the simulator took 15 months to build before it started to become useful in addressing real situations.

"After having done various kinds of operational and economic analyses over the years — most of which have been aimed at trying to improve performance of the system or produce more value with the investments that we make — our hope was that we might develop a tool that would

prove useful in the future as growing demand places ever increasing loads on the air traffic system," said Norm Fujisaki, director of business planning and development at the FAA's Air Traffic Organization.

"We made a number of assumptions in the past that formed the basis for strategic decisions," he added. "But in many cases, whenever we took a particular action based on those assumptions — and they were all decent assumptions — they failed to take into account the reactions of many other stakeholders in the system. The assumptions were static or fixed, so the end results were often not fully predicted or understood beforehand."

Because of growing delays at the Dallas/Fort Worth (DFW) International Airport, for example, the FAA was asked to introduce new technologies that would increase the throughput capacity for arrivals at that airport, Fujisaki said. After conducting a fairly lengthy operational and economic analysis, the FAA decided there was promising technology that could be deployed to alleviate the problem. After making an investment of several hundred million dollars, the agency increased the throughput capacity at DFW.

Norm Fujisaki, director of business planning and development, FAA Air Traffic Organization

"But as soon as we went operational with the new system, rather than reducing delays, the various carriers at DFW suddenly increased all of their flight schedules," said Fujisaki. "They effectively took immediate advantage of their ability to offer more connections with more cities through DFW. So in the past there were often secondary and tertiary responses that were never really taken into account in the analysis behind a decision to make that kind of sizable investment.

"Having been through that now, we can say, 'Yes, we are smarter. In the future, when we do these kinds of studies, we'll be smart enough to anticipate something like that,'" Fujisaki continued. "But the DFW example is the simplest form of a response from the various stakeholders in this large, nonlinear system. Many situations are far more complicated than that. It is almost like trying to play out a game of chess in your head — there are only so many moves you can anticipate before the number becomes intractable. That's the reason we decided to turn to this kind of strategic modeling."

Tremendous Complexity

One problem the NAS Strategy Simulator addresses is the amount of headroom the FAA has available in various parts of the system. "When people say, 'You are almost out of capacity,' it's not like looking at a freeway and seeing that it is 97 percent full," said Fujisaki. "In this complicated system, we have runways, taxi ways and terminal buildings. We have approach rate constraints, we have navigation fixed constraints, and we have constraints on the amount of traffic you can handle between major metropolitan areas. And we have complications caused by things like the jet stream, which is constantly moving around. Eastbound traffic wants to take advantage of the jet stream, and westbound traffic is trying to avoid it."

The FAA also has additional complexities from major growth in the number of regional jets. Average aircraft size steadily decreased over the last 12 to 15 years because airlines are moving toward smaller aircraft. Even if small aircraft, by seat, are a little more expensive to operate, they give airlines greater flexibility in putting the aircraft where it's needed. This allows them to increase frequency of service, which helps them capture greater market share because travelers like having many flight schedules to choose from.

"But for the FAA, it's a problem because the more airlines move toward smaller aircraft, the more aircraft we have to handle to service a given level of passenger traffic," said Fujisaki. "Additionally the speed of these regional jets is not exactly in the same category as a larger aircraft. So if you can imagine going down the freeway and having a few slow cars mixed in there, it adds a lot of complexity to the controller's job."

The number of high-end business aircraft is also increasing. Some estimates forecast about 7,000 new corporate-owned business jets in the next 10 years. Currently there are about 7,000 commercial aircraft in the United States, so the trend toward corporate ownership of private jets could, in effect, double the number of aircraft the system must handle.

Moreover, modern, high-performance business jets are designed to cruise at higher altitudes than commercial planes — they like to fly around 41,000 feet rather than 31,000 feet to 37,000 feet, because that is where they operate most efficiently. To get to 41,000 feet, however,

they must cut through commercial traffic. "Again using freeway analogy, when you have people who zip across all these lanes, it just perturbs the whole flow," said Fujisaki. "That is just one of the many complexities introduced by all these new aircraft. And in the future, we can expect even more challenges like that."

Among other complexities, the model tracks the growing demand and how airlines will service that demand. In statistical terms, this boils down to seat miles, how those seat miles are provided and the parameters of the aircraft fleet. "We have information about trip lengths, number of trips and airplanes, which is what we care about. In the past, we paid too much attention to how many people wanted to travel," explained Fujisaki. "We were just focused on airplanes. Now we understand that the number of people who want to travel influences how many airplanes we have to service."

Based on this, the model also allows the FAA to look at how it provides air traffic control services, and how the airport community provides concrete and runway capacity to various system users. It also allows prediction of fees and taxes that go into the trust fund from which all FAA air traffic operations are financed. For example, ticket taxes make up a sizable portion of the money going into the trust fund.

"So lower ticket prices mean more people want to travel, which means more flights and more workload for us," said Fujisaki. "But at the same time, because now tickets are costing less than half of what they were before, our revenue is going down while our workload is going up on a unit basis. How do we provide those services? How much does it cost us? How much do we drain out of the trust fund to support those services? That's the sort of thing that we now have greater insight into through using the model."

Changing Focus

After using the model for only a few months, Fujisaki notes that management viewpoints are shifting. "The entire thinking process has changed," he said. "Before, people would be very narrowly focused. Their whole mindset was based on fixed, very static kinds of assumptions. Now more people are saying, 'You know, it is a much broader or wider system we are living in. If we take this action, what will happen?' It is an interesting time we are moving into."

Peterson of Ventana Systems echoes that sentiment, saying that she believes strategic models allow a whole new level of dialogue to occur between stakeholders. "A term we like to use was first coined during a brainstorming session a number of years ago by the Harvard Dean of Education: 'instrumentation for democracy,'" she said. "With strategic modeling, a certain dialogue capability becomes possible that simply hasn't occurred with other kinds of modeling in the past."

"Models tell you the quality of the data, its value, and provide strategic guidance for what information an organization should be collecting."

— *Laura Peterson, president, Ventana Systems*

One factor impacting these taxes is the expansion of low-cost airlines. "If I recall correctly, prior to 9/11, the low-cost carrier industry had about a 9 percent penetration of the market," said Fujisaki. "They now have about a 21 percent penetration. It is very dramatic. But what is significant for us as a service provider is that this changes all ticket prices, and therefore, the ticket taxes we collect."

He cites flights from Providence, R.I., to Washington, D.C., as an example — Southwest Airlines began operating that route about three years ago, and within one year of their entry, all fares on that route by all carriers went down to less than half their previous costs. This not only changes the amount the FAA receives for each passenger, it changes the number of passengers flying as well. One key factor that influences passenger demand is ticket prices.

And as far as Peterson is concerned, that is all for the better. She argues that in some cases, there aren't strong enough headlights to look ahead and understand what is transpiring in the world. "Talking broadly about our work at Ventana, we are trying to create a structure by which you can routinely anticipate the consequences of various actions to allow more informed dialogue around what you really want to achieve," she said. "And I believe part of the reason IT has been marginalized to date in the area of strategy is that it honestly hasn't been good enough."

Ron Suiter, president of Suiter and Associates Inc., a key contributor to the NAS Strategy Simulator

Peterson described one Ventana study, which found that at the top level, when people make key strategic decisions, they often are simply guessing. Historically they have about 50/50 odds of being right. However, if you introduce something like a workable strategic model, these odds change dramatically. Decision-makers can be right more often, and organizations and even countries could achieve their goals more frequently. So in the big picture, according to Peterson, strategic modeling could ultimately change how fundamental resources are used for the country, or for society.

"As the technology of strategic models progresses, it is not an unrealistic expectation that we can actually change the nature of our society," said Peterson. "And quite frankly, that is the reason we are now working in the government space, as well as in the corporate space. We want to make sure that as this technology takes hold in the private sector, the government also understands and is aware of it. That way government can take measures to control the technology in the ways it needs to be controlled. We like the U.S. government mostly for reasons centered around visibility. But in a year or so, we'd also like to do something with a state application — something that has been a broad, intractable problem in the past. And we would like these government applications to be studied and understood so people begin to recognize what is now possible with this technology."

Looking to the Future

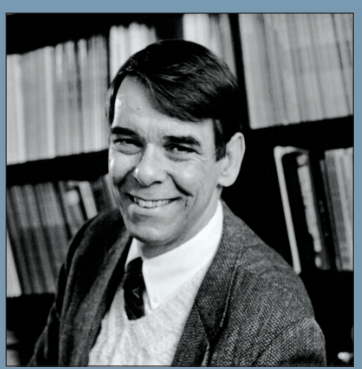
Andersen shares a similar view — that this kind of strategic modeling is the way of the future. For that reason, modeling is one key focus of the Department of Public Administration and Policy at SUNY at Albany. "When we train people going out from our program, there are a couple of modeling courses every manager going into public service would have to take," Andersen said. "We actually have a sort of modeling and statistics core. So we think this topic is pretty important in general here."

Widespread use of strategic modeling may be many years away in federal agencies, or in state and local jurisdictions. In fact, there is a long way to go even before such models prove themselves and gain wide acceptance. Moreover, the speed with which they do prove themselves depends in good measure on the quality of models built in the next few years.

A few poor models will tend to reinforce the notion that it is virtually impossible to build strategic simulations that work. On the other hand, a few good ones like the FAA's NAS Strategy Simulator will go a long way in proving the technology.

But whatever happens, strategic modeling is something CIOs, and others who manage IT information processes, must keep on the radar screen — and perhaps anticipate sooner or later for one simple reason: Historic data is the life blood of most of these models.

Down the line, routine information captured by IT applications will likely be some of the most precious resources an organization prossesses. Exactly what information will prove the most valuable, however, is difficult to predict beforehand. "That's one thing simulation models do — they actually answer the question of how much data should be kept and what data is valuable," said Peterson. "Models tell you the quality of the data, its value, and provide strategic guidance for what information an organization should be collecting."



David Andersen, distinguished service professor of Public Administration and Information Science, State University of New York at Albany

So until strategic models become commonplace, CIOs should perhaps consider digital information in a new light — as a resource that one day may be valuable for reasons that right now may not be apparent.