

## The Business Times Weekend

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# Father of GIS

by *Kenneth James*

**Jack Dangermond says geographic information systems can change world for the better.**

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PASSION and purpose led Jack Dangermond to co-found the Environmental Systems Research Institute (ESRI) with his wife, Laura, in 1969. In the four decades since then, the ESRI president and CEO has had the satisfaction of seeing the discipline he pioneered, geographic information systems (GIS), transform the way people plan cities, position business outlets and even handle disasters.

But never was his life's passion more poignantly applied than in late 2001, when the 9/11 destruction of New York City's World Trade Center Twin Towers shook America and the world.

"It was the most wretched thing that's ever happened to us," he says soberly.

Mr Dangermond, 65, is talking to BT on the sidelines of an international GIS conference co-organised and hosted by the Singapore Land Authority. Coming in half an hour late because of an urgent phone call, he is profusely apologetic, and graciously stays on well into his lunch appointment to complete our conversation.

We chat at length about the revolution in geography-based analysis that GIS has made possible for governments, environmental scientists and corporations.

But the application of GIS in disaster recovery clearly touches a chord.

Says Mr Dangermond: "We face this often in catastrophes. When disasters hit ... tsunamis, hurricanes, whatever ... we have always provided our software available for free."

It never got more personal than 9/11. He recalls: "Our office in New York City was in the Woolworth building, which was a couple of blocks from the Towers. When (the hijacked passenger planes) hit, our people were looking

out the window as (the attack) destroyed the buildings."

### **Double whammy**

In a hugely unfortunate coincidence, the city's Office of Emergency Management, "the emergency control centre for the city", as Mr Dangermond points out, was a victim of the attack. The office was housed in the nearby WTC Building 7. It collapsed after debris from the North Tower ignited fires in the 47-storey building.

"So our people went into action. Ultimately, we had 43 people in New York who stood up a new command centre with maps, and we volunteered for, I think it was about three or four weeks, 7 by 24, making maps. And ... I don't know if this is really anything you want to print, but the maps were dealing with disaster recovery. You know, simple things like showing where we could put all the dead bodies, and morgues, and routing trucks, and moving junk out ... it was not a beautiful sight."

And a sad post-script: "Most of the people that worked on that disaster changed jobs. They worked so hard, in such an awful situation, it just burned them out. They left our company, they left our field."

Quite a different kind of disaster was the recent BP oil spill in the Gulf of Mexico, a commercial calamity with catastrophic environmental consequences. Mr Dangermond is able to see the good along with the bad in this unfortunate situation. "BP called us - they were already a customer - and asked if we would stand up a large server farm for managing all of the measurement information that was coming in: the sensor data, the aircraft information, the satellite pictures, the samples they were gathering.

"The results of that data were shared with the public agencies like National Guard and Coast Guard, and the people that were actually managing the spill in the field. So that gave

situational awareness to what was happening.

"The government and BP were able to direct forces, to actually deal with the oil spill ... like put out booms, and put out hay for clean-up as the oil moved around. So it became a decision support and resource allocation tool."

It wasn't smooth going, he concedes. "Like all disasters, everybody's pointing fingers at everybody else. You know, 'You should have done better here', 'you should have done better there'. But frankly, GIS really helped BP and the government manage this very difficult situation."

Of course, most GIS-based work is less spectacular, though often no less useful. Mr Dangermond explains: "We build a generic software product called ArcGIS. It's kind of a set of server and desktop and mobile device tools that people build applications on top of. They build layers of geography – not just electronic maps, they're actually geographic intelligence."

"The relationships and connections between all the objects on the maps are encapsulated within the database. And you can then overlay these maps and compare them."

"So, for example, there's a famous area in the United States where there's a lot of breast cancer. That's one map: density of breast cancer. And then there's another layer which deals with environmental contamination. If you overlay these two maps on top of each other, you can see the correlation between one and the other. This is a kind of obvious thing, but it's invisible to most people."

### **Mix & match**

Different organisations overlay different maps for their own purposes. "So oil companies use it to find where best to drill for oil, mining companies manipulate this data to help them find out where and how to manage the extraction of minerals. Environmental agencies track change in the environment, from global warming to sea surface temperature, all the way down to pollution and contamination within local areas."

Mr Dangermond identifies four major segments of application users. "One of them is in government. And the biggest government users are local government, like here in Singapore. They use it in all the different departments: transportation, planning, redevelopment and so on."

And since Singapore is "a city and a state and a nation all in one" there are national applications like defence and security.

The second big market is academia. "Virtually every big university in the world uses our tools to teach geography but also to teach spatial thinking."

More recently, business has got in on the GIS act as well. "So people like General Motors, for example, locate their retail stores for car sales based on territories and they do territory optimisation using GIS. All the large retail chains in my country, like Walgreens, Target, Wal-Mart, McDonald's, Starbucks, Nike, they're all my customers. They manage their geographic information to be able to make better decisions: Where should I locate my store? Who are my customers? What are the demographics of the market so I can better locate a bank? And by doing that, they're more successful."

"Big companies like FedEx and DHL and others do the same thing. They figure out how to route on the roads using complex algorithms. Not simple point-to-point routing, but complex, time-space optimisations, using GIS."

"And I guess the fourth area is utilities: electrical utilities, water utilities, telephone utilities."

It's a market that ESRI has grown over the years, and, not surprisingly, it is the dominant player. One of the largest privately held companies worldwide, ESRI has, by one estimate, more than 300,000 customers.

All of which has made the famously frugal Jack Dangermond a very rich man. Last year, he was included in the Forbes 400 list of richest Americans, with an estimated net worth of US\$2 billion.

It's a far cry from his Harvard University student days, when time spent in a lab for computer graphics and spatial analysis led to an epiphany. "What lingered in my mind there was the idea that we can not only use computers to display geography but more importantly do analytics," he recalls.

Before long, he was back in California, all of 24 years old, married and – with a US\$5,000 loan from his mother, the only time he has ever borrowed – head of his own company, ESRI.

He says of his wife and co-founder Laura: "She was a social scientist. But her main philosophy was trying to bring rational thinking and

rational analysis to the way people made decisions. And I remember in school having that very discussion with her – that we could actually take all of this quantitative analytic work and apply it to environmental planning and make a better world.”

### **Rational thrust**

Well, not in such grand terms, he quickly qualifies, but “the environmental movement was just starting, and we certainly thought about the idea of bringing rational thinking to the discourse of environmental issues”.

“So very modestly, we started ESRI. We helped design a little land plan for a developer, we designed a land-use map for a government agency, we helped Venezuela locate a new town in a forest. All of these were project-driven, but each of those engagements, we used our own little home-made software to be able to enrich or bring quantitative thinking to the problem solving.”

The breakthrough came in 1980 when a colleague, Scott Morehouse, suggested rewriting the software to make it a product rather than a service. “And that first came out in 1981, called ArcInfo. And ArcInfo was the first commercial GIS. We sold about four systems the first year, and then gradually sold 11, and then 17, and then 25 ... and then hundreds and thousands, and tens of thousands.”

Meanwhile, computers were evolving, and the software along with it. “Right now, what’s occurring is, we’re moving all of GIS onto the Web,” Mr Dangermond says. “It’s a new generation of technology that’s emerging, and it’s Web-oriented and it’s mobile-oriented. So on my mobile device now, I can download on

my iPhone a full version of ArcGIS for iPhones – and it’s free.

“And this has implications for democracy, for example, or open government. It’s connecting citizens with their government more effectively.”

This raises the question of just where Singapore is on the GIS curve. Mr Dangermond is positive: “GIS in Singapore has been adopted extensively by most of the agencies – military, water, housing, urban redevelopment, transportation – and they’ve done a very good job. I’d say it’s above normal for any metropolitan city in the world. You hold high standards here.”

Asked if more could be done, he replies immediately: “Yes, you can be doing better. You need to begin to think about a national GIS – a kind of enterprise system that cuts across all the different departments. And the technology that allows that to occur is Web services. So, linking the different map services together so that you see a cross-cutting GIS for the entire country – that will be valuable.”

Singapore’s initiative to develop a collaborative environment for geospatial information, dubbed SG-SPACE, is an excellent move in that direction. “It’s fantastic what they’ve done,” Mr Dangermond enthuses. “I’d say it’s edge-cutting.”

He offers this proposal: “Now that you have the foundation, why not open up more public participation using geography and maps as a language to communicate between government and citizens? Citizen-driven government – it’s something that would be very exciting to begin to explore.