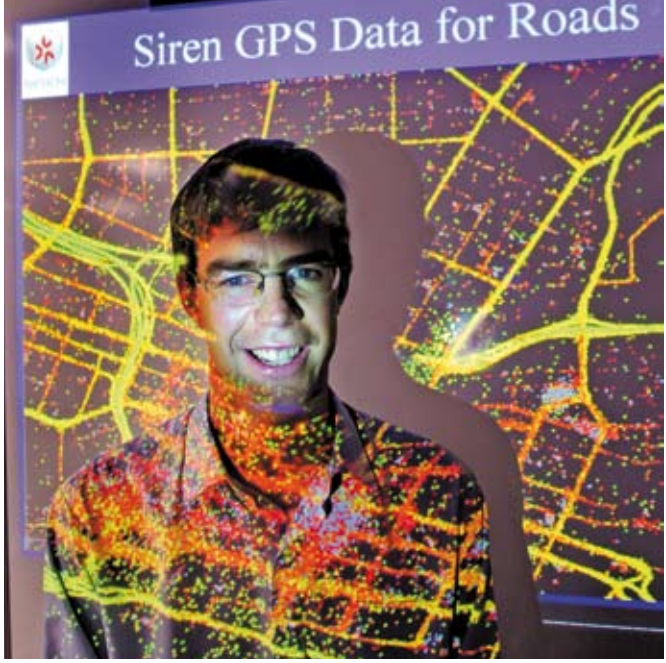
Emergency siren racing

Jenny Rankine talks with an Auckland researcher who helped export New Zealand mathematics solutions around the world.



When an ambulance passes, siren blaring, most people think of those for whom it races through suddenly still streets.

Dr Andrew Mason, in the Department of Engineering Science at the University of Auckland, also thinks of how he can improve the optimisation mathematics behind ambulance scheduling so that it gets to its destination in time to save lives. For the last five years, most of his research has been dedicated to this task.

It all started with a chance meeting at a rostering conference in 1998. "St John wanted help with their rostering problems. Once I started, it became clear that we needed mathematical tools to work out how many staff were needed. With Shane Henderson I coded a simulation in C++ that we called BARTSim - Better Ambulance Rostering Technology Simulation - a pun on Bart Simpson."

"It used Geographic Information Systems-style visualisations to provide managers with a view of their problem they'd never seen before," he says. Loaded on a PC, it showed tiny flashing ambulances travelling through city streets, picking up and dropping off patients before returning to base.

"It was a real breakthrough. When we first showed St John they were impressed - they had GIS systems for dispatch but not for data analysis. Today GIS tools are commonplace." The simulation never actually answered the rostering question, but it did help St John with decisions about where to locate and how to run their bases.

In the same year Mason co-founded Optimal Decision Technologies, now called the Optima Corporation, which initially concentrated on rostering optimisations for Air New Zealand. The ambulance simulation sat on Mason's shelf until he was invited to tender for a similar project for the Melbourne Metropolitan Ambulance Service (MAS) in 2001. The University of Auckland licensed the simulation to Optima and they won the tender.

"Once we got into the guts of the Melbourne system we realised it was far more complicated than Auckland," he says. "They would often send two, three or even four vehicles to an accident; there were around five times as many calls, vehicles and roads. We made big changes to BARTSim, and it was renamed SIREN - Simulation for Improving Response-times of Emergency Networks." Mason and Optima had found a niche for optimisation research products that no one else supplied.

Optima developed the simulation into SIREN Predict, and sold it to emergency services in Australia, Denmark, Canada and the UK. It also developed another product, SIREN Live, which solves optimisation problems interactively in real time for dispatchers, taking into account vehicle locations, types and status, base and standby locations, staff shifts and call information.

"The beauty with tackling Melbourne's complex system first is that any other city has been relatively straightforward," says Mason. As Optima's Research Director, his goal is to reduce the time taken to implement Siren for a new city, including the effort it takes to build and calibrate the road network.

"Twenty years ago, finding how long it took to travel from A to B was virtually impossible. Now, fully-detailed road maps are readily available in most industrialised countries." Mason is currently using Global Positioning System (GPS) data to extract the speed at which ambulances travel with and without lights and sirens at different times of the day.

"It's like laying electronic breadcrumbs every 30 seconds; we have to do a probabilistic analysis to determine the most likely routes the vehicle took. We've come up with a new algorithm for that."

Optima has developed different ways to represent the data, for example, with the dots coloured by speed. "Inside tunnels, GPS units can't reach the satellites, so maps scatter high speed dots in nearby suburban streets. I'm working out how to clean up these position errors as well as errors in the road networks that cities provide."

Fourth year and Masters students in Engineering Science also work on these problems. "My fourth year and Masters students from last year are both now working at Optima." Mason is working with Shane Henderson, now at Cornell University in the USA, to improve the optimisation strategies in SIREN Live.

This unique work was recognised at the 2006 Price Waterhouse Coopers Hi-Tech Awards in November, when Optima accepted the Enatel NZ Hi-Tech Innovation of the Year award for Optima's SIREN products.

Users can watch ambulances travelling between callouts, bases and hospitals in Siren's virtual city. Below: Andrew Mason.
Photo by Geoff Dale, courtesy of the University of Auckland.

See also
www.esc.auckland.ac.nz/Mason or www.TheOptimaCorporation.com