

ADVANTAGE

Airport anchor safely grounds planes

There were red faces at Sydney's Mascot airport at the beginning of the year when a cargo plane unloading an expensive experimental four-wheel drive vehicle suddenly up-ended with its tail on the ground and its nose in the air. Fortunately no one was hurt, but there was damage to the plane and the four wheel drive.

All of that drama could have been avoided by a product being developed by Gilmore Engineers.

Gilmore Engineers were commissioned by AIAI Pty Ltd of Brisbane to design a flush-mounted anchor point (FMAP) at the Brisbane International Airport to be used mainly by Boeing, Airbus and McDonnell Douglas freighter aircraft. (see photograph)

"The new product is designed specifically to hold aircraft loading or unloading cargo and during high winds." Gilmore Engineers President, Dr Duncan B Gilmore said.

"There have been numerous instances of light aircraft being lifted like toys in strong winds, but it is also possible for much larger aircraft to have the nose or even the entire aircraft lifted during a storm or cyclone causing considerable damage," Dr Gilmore said.



The Flush Mounted Anchor Point designed by Gilmore Engineers bolted into the tarmac at Brisbane International Airport prevents cargo planes from an unscheduled lift-off in high winds.

The new product is designed to be bolted into airport pavements to tie down the aircraft.

"From an Engineering perspective, the maximum tie-down loads and the general shape of the anchor point were known factors. What needed to be determined was the material and dimensions of the anchor point to ensure it had sufficient strength over its lifetime.

This was done largely using Finite Element Stress Analysis. An image from the analysis is shown in an accompanying article on Finite Element Analysis.

"The material was selected on the basis of strength, cost, corrosion resistance and permissible manufacturing method. AISI 4140 steel was the best compromise, especially because it is available in large round bars. This allowed

components to be machined from high quality bar stock, largely eliminating material quality concerns," Dr Gilmore said.

With this problem resolved, there were still other concerns including the remote possibility that the pavement might give way.

To resolve this problem, Gilmore Engineers again used Finite Element Analysis to model the entire slab with lifting loads applied at various locations.

But there was one further constraint to be overcome. The anchor point could not allow the collection of debris which could be sucked into an engine or blown around by jet blasts creating an additional hazard.

"The anchor point had to be smooth and flush with the surface

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The future is here

The New Product Division of Gilmore Engineers Pty Ltd is undergoing a major facelift, with a new name and a new website.

The Division is now known as engineering3000, or "e3k" for short, with the new website at www.e3k.com.

Dr Duncan B Gilmore, President Gilmore Engineers said the decision to change the name shows Gilmore Engineers' desire to look to the future – to the year 3000.

"Engineering3000 is designed to project the image and credentials of Gilmore's entrepreneurial engineers, and their capability to design,

develop and commercialise new and innovative products, using new technologies, into this millennium.

"One such new technology now offered is Computational Fluid Dynamics (CFD)."

"It's a new name, new website, and new look, but Engineering3000 will continue to provide the same reputation for expertise, integrity and experience as its parent company Gilmore Engineers Pty Ltd.

"We urge all of our valued clients to bookmark our new site www.e3k.com as well as our original website www.gilmore-engineers.com," Dr Gilmore said.

▶ Airport anchor safely grounds planes cont...

of the pavement. Gilmore Engineers' solution was to place a lid over the recess where the anchor ring was housed, with the lid being tied to the anchor housing by a wire cable preventing it from being lost or sucked into an engine," Dr Gilmore said.

"The design documentation in this case consisted not just of the component geometry and material specifications, but given the hefty price tag of the machinery to be restrained, Gilmore Engineers provided considerable detail on the installation, inspection, maintenance and placement of the anchor," he said.

"To ensure that the anchor points would hold down a large aircraft

in a severe storm, the product was successfully put through static strength testing to twice its rated load," Dr Gilmore said.

"As a result of the work by Gilmore Engineers, the Brisbane Airport Corporation specified these anchor points in their tender documents for an airport upgrade, and two anchor points were installed by AIAI Pty Ltd.

These units are being monitored for their long-term environmental performance, and the information gained from the monitoring will be added Gilmore Engineers' materials performance database.

The Olympic Athlete Foot Force Sensor for Kayaks, designed and engineered by Gilmore Engineers continues to be a winner, not only for Australia's Olympic kayakers, but now for Gilmore Engineers.

In a field as competitive as an Olympics final, Gilmore Engineers have been awarded a certificate of High Commendation in the the Institution of Engineers Queensland Division 2001 Excellence Awards.

"It recognises the effort of our Research and Development team in Concept Generation and Detailed Engineering Design," Gilmore Engineers President Dr Duncan B Gilmore said.

The nylon and stainless steel footpad sensor was developed for the Queensland Academy of Sport and later adopted by the Australian Institute of Sport.

By measuring the forces applied to the foot bars of the kayak, it provided coaches with biomechanical information on the timing between the upper body paddle action and the subsequent application of leg force through each stroke allowing them to improve training for our elite kayakers.

"We were enormously proud of the part we played in our Olympic kayakers' success, and we are equally proud of the effort of our engineers. Recognition by The Institution of Engineers is as good as an Olympic medal," he said.

2001 EXCELLENCE AWARD

FAILURE ANALYSIS – A Case for Sherlock Holmes

If Sherlock Holmes were alive and well and snooping around the Queensland Clunies Ross Centre at Brisbane Technology Park, Gilmore Engineers might have made him an offer to be part of the company's Failure Analysis Division.

The world's greatest detective had all the qualities of a great engineer. He had a quick and enquiring mind, the ability to initiate suitable tests and lines of investigation, an ability to direct other professionals, and he had the highest levels of written and oral communications skills.

All of those assets are required when investigators turn to Gilmore Engineers to discover how and why a product has failed, tragically often causing loss of life or property.

Like Sherlock Holmes, Gilmore Engineers have done their share of criminal investigations.

Gilmore Engineer's Failure Analysis Division has also been asked to examine the causes of crane collapses, motor vehicle accidents, fires, the failure of products as diverse as furniture, swimming pool heating systems, engines, tyres and consumer goods. As well, our engineers have been asked to offer expert opinion for intellectual property (copyright and patents) cases, and provide product liability reviews and experimental testing.

Company President, Dr Duncan B Gilmore has been preparing failure analysis reports for 25 years, formally establishing the Failure Analysis Division of Gilmore Engineers Pty Ltd to complement the New Product Division.

Dr Gilmore said over the past 16 years the Division had conducted more than 700 cases of failure analyses investigations for litigation, mediation and system design review.

"Typically, a project begins with a briefing document, with a contract outlining what will be performed for either a fixed or estimated cost, and an estimated timescale, followed by further discussions and meetings," Dr Gilmore said.

"In most cases, the evidence is examined in our office, on site or in a laboratory. Advanced computational analysis is a speciality of Gilmore Engineers, but most investigations also involve taking measurements, devising specific tests, examining photographs, desktop examination of evidence or a critique of existing reports," he said.

Ironically, the analytical tools used in the Failure Analysis Division are the same as those used by our New Product Division to design advanced

products, but they are often put to work in reverse to establish why they failed.

"The quality of investigation is only as good as the quality of the investigator. Gilmore Engineers prides itself on the experience and expertise of its personnel with investigations led and reports written by engineers with PhD and Masters qualifications," Dr Gilmore said.

"Clients can have the engineers of their choice, and if required, senior personnel are available to make verbal presentations in any forum.

"The skills and flexibility of Gilmore Engineers' highly qualified personnel enables the Company to offer its services not only throughout the Pacific Rim but on a worldwide basis.

"Our Engineers would be able to tell the good Sherlock Holmes, the work done at Gilmore Engineers is always exacting, often pains-taking, and arduous, but rarely elementary," Dr Gilmore said.

Registered Research Agency

Research and Development are at the heart of new products, and now Gilmore Engineers Pty Ltd is a Registered Research Agency (RRA).

This certification is given by AusIndustry, the Industry Research and Development Board, effective from 30 January, 2001 (registration number 34439).

This enables Gilmore Engineers to carry out "contracted" Research and Development which enables significant taxation benefits for any company incorporated in Australia.

These companies are nominally entitled to tax concessions from 125% to 175%, in addition to other benefits, on every dollar spent on eligible R&D.

FEA – Now and in the Future

One of the world's leading experts in Finite Element Analysis passed on the benefit of years of experience and knowledge to a large group of 85 professional engineers in Brisbane recently.

Mr Vince Adams (pictured), Founder and President of WyzeTek Inc, Illinois, USA, was the keynote speaker at the Finite Element Analysis Workshop "FEA Now" at the Queensland Clunies Ross Centre in Brisbane Technology Park.

The Workshop, organised by the Mechanical Branch of The Institution of Engineers Australia, Queensland Division, and supported by the Queensland Manufacturing Institute, attracted strong interest.

Dr Agnew was also one of the organisers and Workshop speakers, delivering a presentation of practical case studies on Finite Element Analysis. These included two key

examples of FEA that Gilmore Engineers had undertaken over the past few years including the aircraft tie down (described in detail in this issue), and hydraulic tensioning bolts used in the nuclear power industry - a specialist application using advanced non-linear FEA techniques.

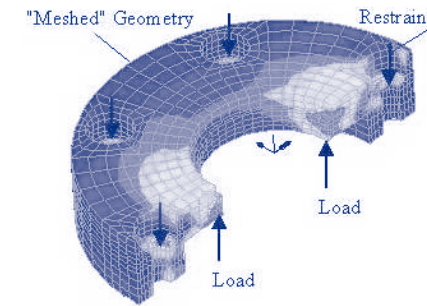
"One of the focuses of the workshop was the implementation of the technology into industry such as managerial resistance and the necessity for internal company communication between analysts and other design team members," Dr Agnew said.

One of the outcomes from the workshop was that Finite Element Analysis had become an essential tool for engineers working in design and failure analysis.

"It's as vital to our work today as calculators were some fifteen to twenty years ago," Dr Agnew said.



Mr Vince Adams, WyzeTek Inc, keynote speaker at the "FEA Now" workshop.



Aircraft tie down mesh

Putting Value into Products

One of the continuing challenges in New Product Development is the need to keep manufacturing costs down and market sales up.

The solution to that challenge is Value Engineering (VE), a concept pioneered by the Japanese, but now adopted by many Western companies.

Value Engineering is a marriage of the Japanese philosophy of continuous improvement known as "kaizen", and the crusade for building long-term market share and sales.

Dr Nicholas Agnew, Manager of Gilmore Engineers' New Products Division said one way of approaching Value Engineering was to set a competitive market price for a product, then develop costs to ensure they make a profit.

"The more common alternative is the reverse strategy of determining production costs, then adding a reasonable profit margin," Dr Agnew said.

Dr Agnew said Value Engineering was developed in stages.

"Firstly, you need to compare allowable production costs with estimated costs based on current operations," he said.

"It is essential to have an analytical engineering approach to New Product Development and expertise in analysis, design, materials, and manufacturing technology.

"Marketing experts evaluate changes in the market place and provide continuous feedback on the effects of any consumer tradeoffs. This involves the management of marketing risk.

"When you have calculated the net deviation in production cost with design feedback, you make refinements as necessary," Dr Agnew said.

"There has to be a continuous revaluation of pricing and production cost through the life cycle of the product." Dr Agnew said.

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Services

Research and Development
Engineering Failure Analysis
Technical Project Management and
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