

## High speed image and data capture

### OBO: Impact test facility

#### Introduction

New Zealand manufacturer and exporter OBO is in the business of making protective gear for field hockey goalies. Based in Palmerston North, the company designs and manufactures a range of padding, masks, helmets, sticks and protective clothing primarily made from closed cell polyethylene foam.

OBO is the market leader in specialist gear for field hockey goalies, with more than 65% worldwide market share, exporting products to 61 countries.

As an innovative and focused company, OBO is continually fine tuning its product range to ensure it offers the very best possible product to its niche client base. The company is also seeking to expand into other product categories where it can apply its experience in agile protection.

#### The challenge

To develop a materials and equipment design testing facility that would enable OBO to gain new insights in materials and design. Testing was needed to duplicate real world situations where hockey, cricket and softballs impact players at speeds in excess of 150km per hour.

The fact that surfaces, equipment, speed and player skills have all improved dramatically over the last fifteen years created some urgency in addressing the impact of these missiles on players.

Desk research carried out by OBO prior to beginning the project indicated that there was little or no relevant test results of this nature available in the public domain. Most similar testing is carried out within the automotive industry (crash test dummies) and the military sector and is specific to the requirements of those industries.

The commercial objective for OBO is to be able to supply world leading protective gear that is effective in shock attenuation and thereby reducing the risk of bruising, concussions and bone breakage in sports people.

OBO approached Nightside Test Design Ltd to provide a solution. Technically the project was a challenging one, making good use of the skills Nightside has developed over the last few years working with laboratory automations and other vision projects.

# OBO



Figure 1: Still images from the high speed camera

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## Technical background

Prior to introducing the new test facility, product testing was mainly carried out in the marketplace by sportspeople using the products – effectively the "did it hurt?" test. A materials testing project on the shock attenuation properties of foam had been carried out in a university laboratory but was not an ongoing programme. Previous testing facilities did not monitor impact as it happened, but rather investigated the damage after the event.

## The solution

Nightside Test Design developed and integrated an effective high speed image and data capture facility as part of OBO's new test laboratory. A high speed cannon was filmed as it fired balls at helmets fitted to a crash test dummy head, with the crucial moment being the point of impact.

## Technical solution

Nightside developed two applications for this project, one to simultaneously capture video and shock attenuation data, the other to view and edit the information gained in the test process.

The equipment installed for testing is a National Instruments CompactDAQ with Speed, Velocity, Acceleration and Load Cell inputs, synchronised with a PCI express Cameralink card connected to a high speed Mikrotron camera (maximum speed 16,000 frames per second).

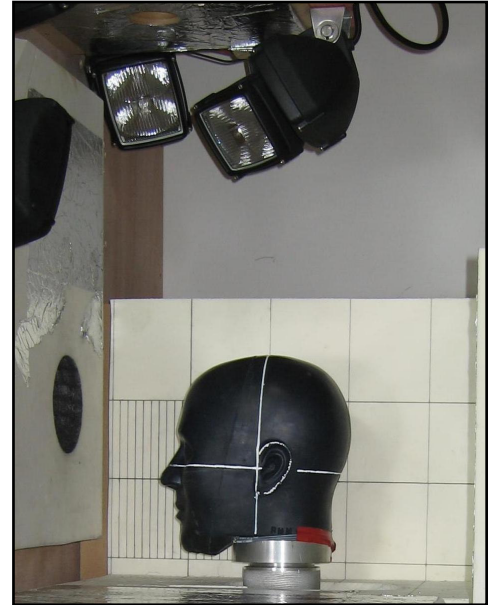


Figure 2: The crash test dummy head setup

The test process involves a high speed ball cannon (controlled by the system software) firing a hockey ball at the helmet, mask, or protective padding being tested. The cannon fires balls at up to 160km/hr (a fast bowler bowls at up to 160km/hr, which equates to 42 metres per sec, while a fast hockey ball travels at approximately 120km/hr).

The shock attenuation of the impact is recorded frame by frame by the high speed camera and other sensors at over 2,000 frames per second, allowing highly detailed analysis of the data and images around the impact zone.

Lighting requirements were particularly important to ensure useful footage was recorded. With a shutter speed of 1/5000th of a second, getting light into the camera required the use of five 100 watt DC halogen lamps located around the test dummy head.

Captured data can be reviewed with the analysis application. This allows the video footage and graphs of other impact sensor data to all be viewed simultaneously, making it possible to determine what is happening to the test item during the impact, and the mode of any failure.

The images and sensor data had to be synchronised exactly, which was made possible by the integration between the National Instruments hardware and the software developed by Nightside.

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## Results

The laboratory is now up and running, and testing a range of materials, OBO products and competitors' products, as well as sports equipment from codes other than hockey.

Project manager Reuben Parr says the system has been very successful in testing a range of helmets and masks from different sporting codes, including cricket, softball and field hockey.

Results show a large difference in the performance of different products, and different materials, for example, polycarbonate face masks proved to be far stronger than the steel wire face masks commonly used in cricket helmets.



Figure 3: National Instruments CompactDAQ

Reuben went on to say “The process of working with Nightside went smoothly, especially given that it was not a straightforward project. It pushed the boundaries of the project team in terms of prior knowledge as there was no available information within the sports equipment arena of companies putting a test facility of this nature in place. Nightside was the only NZ supplier able to provide us with a complete solution rather than just components.”

The ability to simultaneously review the video and sensor data has given OBO some real design insights into how the various face protectors work and why. This knowledge will be used by the company in the design of a new sports mask for hockey, cricket and softball.

Other protective equipment and new high technology materials will also be tested. The test facility will be available to other manufacturers or organisations on a contract basis.

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