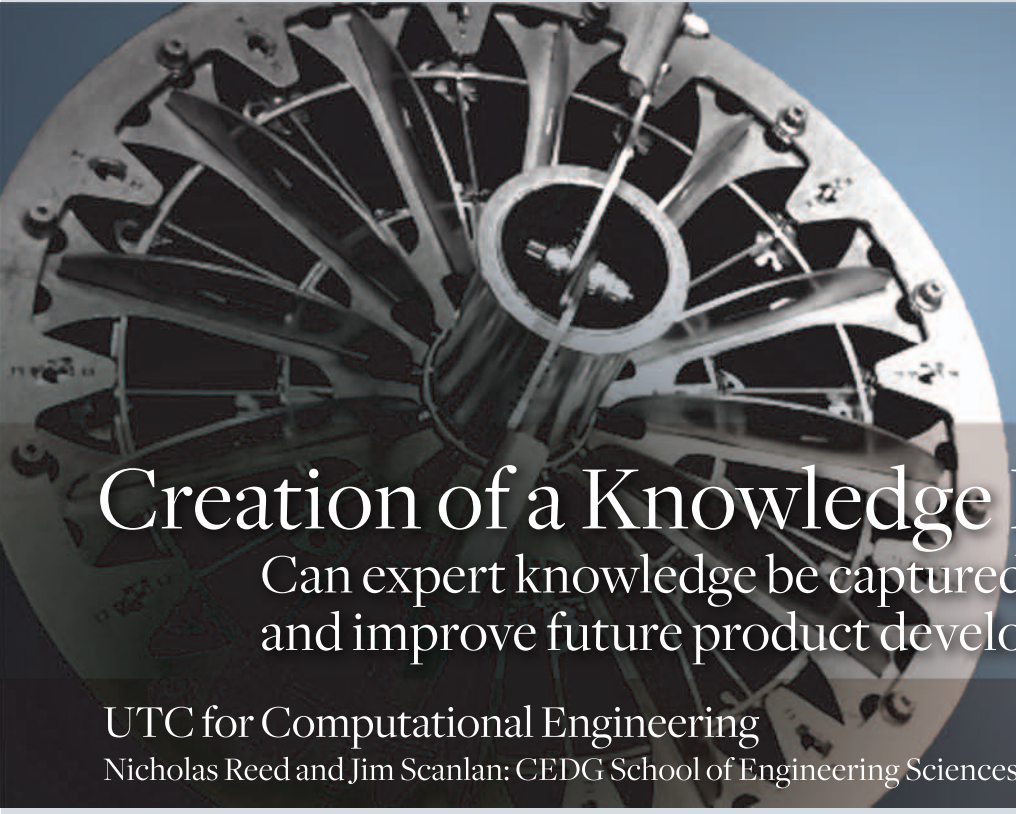

UNIVERSITY OF Southampton

School of Engineering Sciences

Creation of a Knowledge Based System:

Can expert knowledge be captured and redeployed to accelerate and improve future product development?

UTC for Computational Engineering

Nicholas Reed and Jim Scanlan: CEDG School of Engineering Sciences

Supporting Rapid scale up

Rolls-Royce has recently created a new capability known internally as Pro-Laser technology. This technology encompasses a revolutionary new design and manufacturing methodology, coupling unique design philosophy with the precision manufacturing capability of laser cut sheet metal and press brake manufacture, see **Fig.1,2 and 3**.

The aim of this research is to capture and redeploy technology specific design knowledge, in order to support future product design. Pro-Laser technology enables the rapid design and manufacture of high precision fixtures and parts. Using captured knowledge this project will improve and accelerate new product design, minimising the lead times of fixtures and minimising the reliance of highly specialised engineers, supporting rapid market growth.

Knowledge Based Engineering

Knowledge based engineering represents one of the key developments in the future of engineering. As the post-industrial economy becomes knowledge driven, innovation is increasingly emphasised as a company's competitive edge and knowledge becomes an increasingly critical asset. Many companies are now investing heavily in managing their intellectual capital both to insure against loss and to maximise the return on their knowledge.

The system framework

To manage Pro-Laser's knowledge an IT system was proposed that would store all knowledge and understanding associated with previous designs and provide a single point source for designers wishing to access this knowledge. The intention is to provide new designers with the knowledge or previous designs to produce new designs quicker.

Accessed through a standard internet explorer page, a dedicated system has been created utilising the latest '.NET' technologies. The system integrates both knowledge capture and its reuse in a form that will scale up to a distributed system potentially

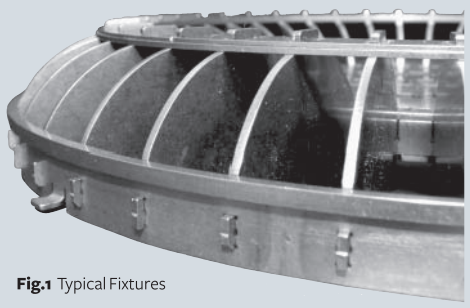

Fig.1 Typical Fixtures

serving many clients. Currently the system consists of three different cores that provide support for designers, these are: the methodology, knowledge database and CAD orientated toolkit, illustrated schematically in **Fig.4**.

The knowledge database is a SQL driven database storing codified information and rich media about previous designs, including the design drivers, requirements and materials together with relevant CAD files, photographs and video files. Data is currently input via a custom form and the files uploaded individually. A "Google" like search allows users to search and retrieve required information on existing information.

The methodology was derived from the experiences of the existing designers; following time spent discussing past designs and observing their approaches to new designs. This represents a best practise methodology to design and manufacture using Pro-Laser technology and is intended to guide new users through the design process.

The toolkit is to encompass a series of different tools, primarily within the CAD engine, to support and accelerate future design work. Initially experiments were completed on full product parameterisation, but more value was seen by parameterising the most commonly used parts and creating user defined features. These allow users to drag and drop existing geometry into their new designs.

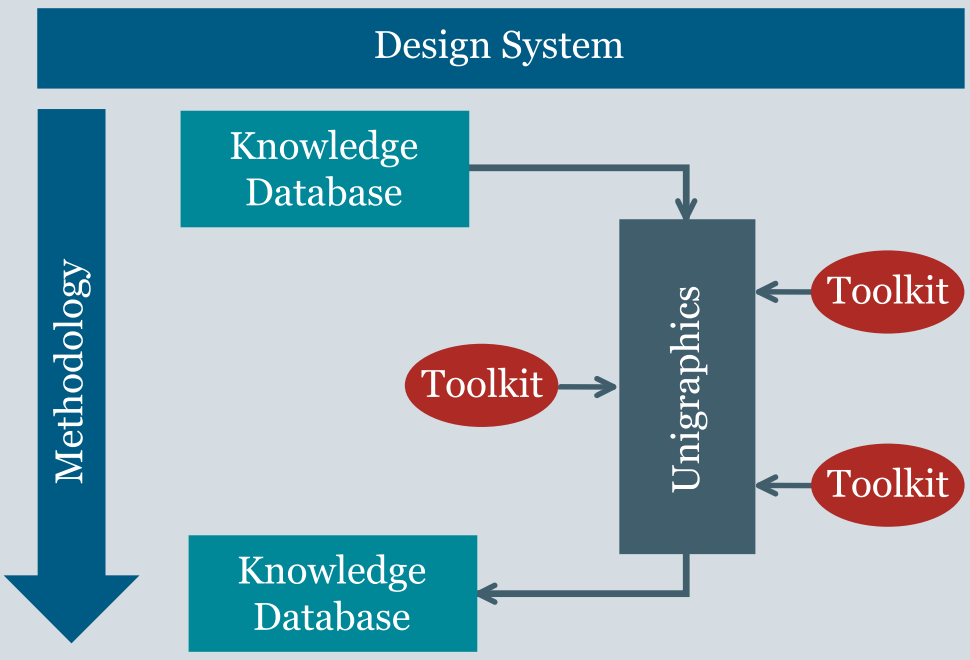

Fig.4 Schematic illustration of the system framework

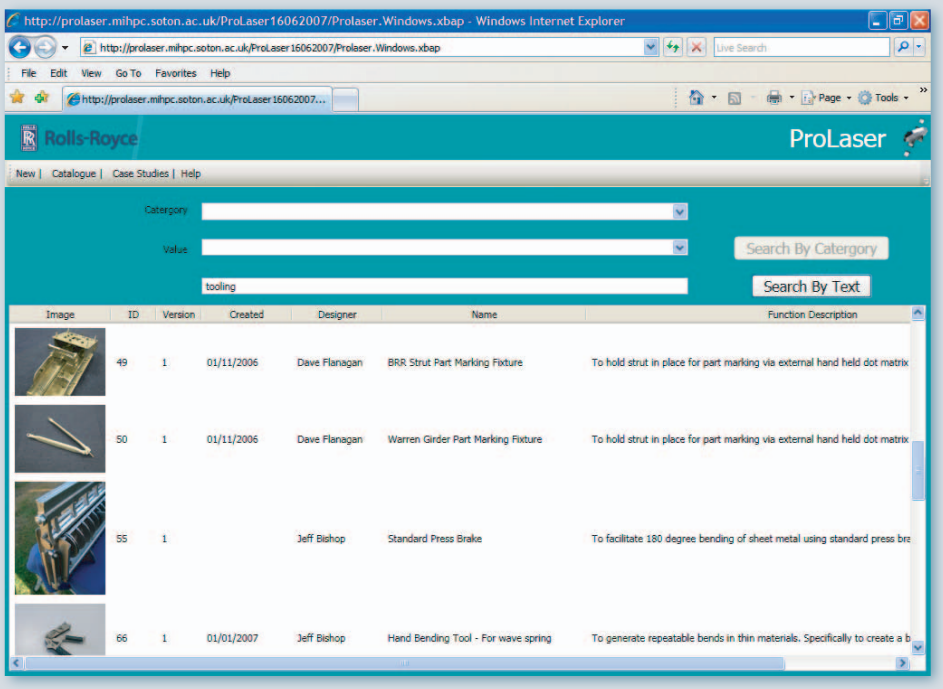

Fig.5 Screenshot of the system showing the Knowledge Database

Fig.2 Typical Fixtures

Early Research

Several critical milestones were set out for the first year:

- Definition of Design System Architecture
- Design system populated with critical mass of Pro-Laser features
- Demonstration of design system capability

Initially all three cores of the system were developed in isolation, and time was spent understanding the required functionality of each component before the architecture was formally defined. In summer 2007, an early demonstrator was deployed to the Pro-Laser Sheffield office and **Fig.5** shows a screenshot of the system, illustrating some of the rich media stored.

Following implementation, a weeklong formal trial of the system was conducted. Engineers from outside of Pro-Laser were asked to design a solution to a problem using the knowledge provided by the system. The same task was given to existing designers and the relative approaches and designs compared. The week was a successful demonstration of the system capability, but highlighted the need for easily accessible tools specific to Pro-Laser technology within UniGraphics and the need for better integration and a more proactive role in the designer's work flow.

Future Work

Moving forward the design system will be redesigned and rebuilt in line with the adopted methodology. This will guide users through the design method, and will capture knowledge concurrently with the design process. Additional intelligence will also be embedded within the system to pro-actively return relevant past designs that may aid and support the designers. Given the current critical mass of knowledge in the database, future research will examine additional means of retrieving targeted data using additional intelligent tools such as functional design tags and a user driven thesaurus.

The most focused area of research will be that of the toolkit. The intention is to advance the user defined features to include design specific knowledge. i.e. to embed additional data to support a designers use of the feature in the most efficient way. This is likely to require a degree of material testing of the features and subsequent coding of this data as a semi intelligent tool.

To date, all milestones have been met successfully, the system is in place, and currently demonstrates full capability. Most importantly it is in use by designers, providing continuous feedback to improve its usability. Moving forward, it is vital that the system is rebuilt to provide concurrent and more intelligent support for designers.

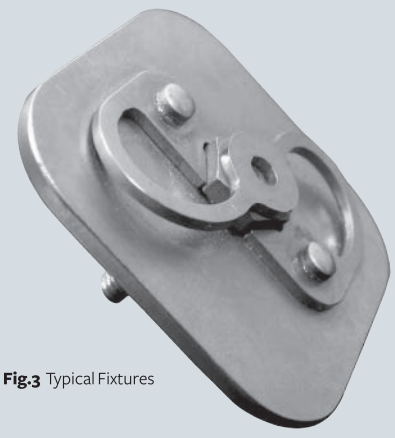

Fig.3 Typical Fixtures

www.soton.ac.uk/ses/research/ced/posters.html | email: nreed@soton.ac.uk

Computational Engineering & Design Group, University of Southampton, SO17 1BJ, U.K.