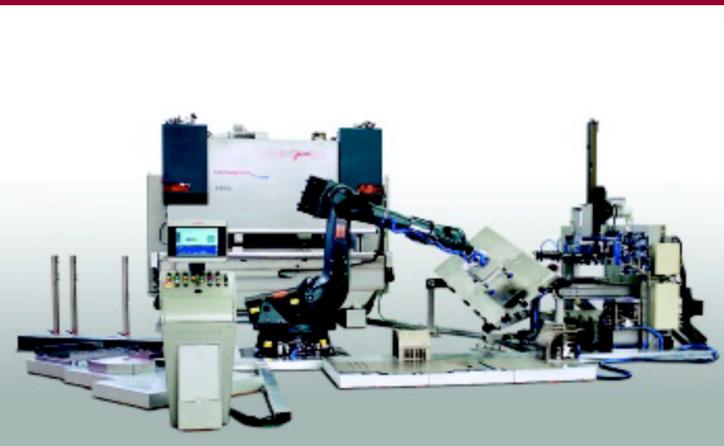


CNC Based Metal Fabrication

Focusing on MULTI AXIS Press Brake
Training Laser and Turret Punch Machining



David Wilson

ISS Institute/TAFE Fellowship

Fellowship funded by OTTE, Victorian Government

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Table of Contents

1. Acknowledgements

- Awarding body ISS Institute
- Fellowship Sponsors
- Fellowship Contacts
- About the Fellow

2. The Fellowship Program

- Aim of Fellowship
- Skills Gaps – Apprentice Training
- Current Training Needs
- Current Training Facilities

3. Australian Context

4. International Context

- Program Content
- College Visits
 - Fullerton
 - Hutchinson
 - Witchita
 -
- Training Programs – FMA – Precision Press Brake Training
- Industry Visits – LVD
 - Production
 - Training
- German Machine Show - EMO

5. Recommendations

- **The Problem**
- **The Solution**
 - Government
 - Industry
 - Business

Professional associations
Education and training
Community
ISS Institute
Further Skill Gaps

Progress Since ISSI Fellowship

- **Conclusion/Restrains**

6. References

7. Attachments

1. Acknowledgements

Awarding Body - International Specialised Skills Institute (ISS Institute)

We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.

Since 1989 International Specialised Skills Institute Inc (ISS Institute), an independent, national organisation, has provided opportunities for Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management.

Carolynne Bourne AM, ISS Institute, CEO, uses her formula to illustrate the links, **skills + knowledge + good design + innovation + communication = competitive edge • good business**

Based on ISS Institute's initial market research in 1990, an important category emerged, that of 'skill deficiency'.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the job, gleaned from published material, or from working and/or study overseas. This is the key area targeted by ISS Institute.

Other ISS definitions are:

- **Skill shortage** is when there is a unmet and recognised demand for labour.
- **Innovation** Creating and meeting new needs with new technical and design styles. [New realities of lifestyle.]
- **Design** is problem solving. From concept to production through to recycling. Design involves every aspect from the way the receptionist answers the phone, when invoices are sent out, where a machine sits on the factory floor, what trees are grown in the

forest suitable for furniture or flooring, to whether the product is orange or blue, round or square, flat packed for export, displayed in a retail outlet and the market research to target customers' needs and wants - creating products or services.

Overseas Skill Acquisition Plan (Fellowship Program)

Skill deficiencies are filled by building global partnerships through our **Overseas Skill Acquisition Plan - Fellowship Program**. Australian Fellows travel overseas, or overseas Fellows travel to Australia.

Upon their return to Australia, Fellows pass on what they have learnt through education and training activities such as workshops, conferences, lecturers, forums, seminars and events developed and implemented by ISS Institute, therein ensuring that for each Fellowship, many benefit - the multiplier effect.

ISS undertakes research, marketing, policy and advocacy.

The findings from the Fellows reports and those acquired through our research and education and training activities are made available to firms, industry, commerce, learning institutions and public authorities through ISS Research Institute's consultancy services – again, the multiplier effect.

ISS Institute operations are directed towards bringing skills (traditional and leading-edge technologies) and knowledge to Australian industries, education and government and, in turn, the community in general - new ways of thinking, new ways of working so as to create innovative products and services for local and global markets.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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Fellowship Sponsor DEST

Department of Education Science and Training

DEST provides national leadership and works in collaboration with the States and Territories, industry, other agencies and the community in support of the Government's objectives. We develop and implement policies to ensure the continuing relevance of education, science and training to contemporary needs and the growing requirement for lifelong learning. We also ensure high quality and value for money in delivering Government funded programs.

Fellowship Contacts and supporters

I travelled to the USA, Belgium and Germany upon receiving my International Specialised Skills Institute/OTTE Fellowship to obtain the comprehensive skills of CNC based manufacturing for the field of metal fabrication focusing on press-brakes, lasers and turret machines.

I was able to gain access to the many organisations because of the immense support of many manufacturing and software companies and the individuals in them who passionately believe that manufacturing in Australia needs a helping hand.

Corporate Bodies

Holmesglen Institute - Holmesglen Institute Management and fellow staff for their various support. Not only for the application, but also in the preparation and duration of my Fellowship.

ISS Institute - selection panel, who shared my passion to improve the training standards for metal fabrication.

AMTIL Australian - Greg Chalker, who has been in regular contact and eagerly awaiting for the training programs to begin.

AIG. Australian Industry Group - Ray Kerrison and his team for their constant assistance.

SSGT Southern Suburbs Group Training - who know how much demand there is for new trainees to fill the void so long overlooked.

- | | |
|----------------------|--|
| Fast CAM (Aust) | - Mark Fagan, who shares my passion for the future of training of our trade. |
| ACRA Machinery | - Jim Georgio /Jeff Beable, who see the need for CNC training Fabrication every day. |
| Elliot's Engineering | - Anthony Elliot, a company with over 100 years of engineering history who cannot find a place to train his staff to world best practice in CNC for fabrication. |

International Fellowship Contacts

- | | |
|------------------------|---|
| Hutchinson College USA | - for graciously allowing me to visit and observe their workshop facilities and training. |
| Wichita College USA | for also graciously allowing me to visit and observe their workshop facilities and training. |
| FMA | - Fabricators, Manufacturers Association for putting on a training course that meets the needs that I was searching for. |
| Shera-Bonnet | - LANTEK - Roger, for using his contacts and introducing me to companies like LVD. |
| LVD | - For sharing with me their passion of the trade for Sheetmetal and for providing me with training in their first class facilities. |

Individuals

Ms Carolyne Bourne AM – CEO, International Specialised Skills Inst.
 Sir James Gobbo AC, CVO, - Patron in Chief, International Skills Inst.
 Bruce McKenzie – CEO, Holmesglen Institute of TAFE
 Jenni Colgan – Associate Director, Holmesglen Institute of TAFE
 Greg Chalker – Australian manufacturing Technology Institute Limited
 Mark Fagan – FastCAM Software
 Roger Bonnet – CEO, Shera-Bonnet Software

My wife Antoinette and son Anthony, for their patience.

About the fellow

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Qualifications: Diploma of Vocational Education and Training
Certificate IV Assessment & Workplace Training
Sheet metal worker First Class

Achievements: Apprentice of the Year Richmond Tafe 1988
World Skills Australian National Titles 2nd place
MTIA Top Sheetmetal Apprentice award 1988

Memberships: Member of Victorian Engineering Senate
Member of Victorian Fabrication Senate
Member of the Victorian Subaru 4wd club since 1993
Member of Victorian Subaru 4wd club Committee

Having worked in the sheetmetal industry for over 20 years David Wilson started his apprenticeship with Galmet Products Pty Ltd in Dandenong after also being offered an apprenticeship in fitting and turning with the large train manufacturer, Commonwealth Engineering also located in Dandenong. David spent almost eight years with Galmet Products and became foreman before he had finished the third year of his apprenticeship.

After leaving Galmet Products Pty Ltd early in 1993, David worked for three different sheetmetal companies gaining experience by working with a variety of senior trades people in a range of different work.

In 1994 David decided to travel to see different things throughout the world. After travelling for several months and visiting 17 countries including the United Kingdom, Europe and Africa it was time to go home and resume his career.

David joined a small company in 1995 called RTK Pty Ltd. RTK grew rapidly over a few years from 6 to over 25 employees. The company was able to achieve this by embracing leading edge technology. After purchasing their first Triumph Laser in the late 1990's RTK Industries

began. It was around this time that David began to realize that to compete in a tough manufacturing environment, technology was the key. By the time David left, RTK Industries was running 2 Trumpf Lasers, the first a Trumpf 3030 machine which was a 3KW flat bed cutting machine with auto sheet load and unload and also a rotary cutting bed for cutting square and round tubing. Also, RTK purchased a Trumpf laser cell 1005, which has 5KW power and 5 axis head has the capacity to cut or weld using laser to extremely high tolerances at a variety of speeds and positions. This machine also uses the latest technology TOPs 800 CAD software which features built in machining plan checks and laser cutting simulations virtually eliminating human error in jigging. In addition to the Laser machines two high precision CNC pressbrakes were used to form the cut parts. Both machines have multi-axis including crowning and Trueform technology

In 2002 David left RTK after almost 8 years, to join Holmesglen Institute of TAFE in the Fabrication and Welding department, a part of Engineering and Electrotechnology. During the 4 years with Holmesglen David has been working as part of a team of people to raise the profile of Fabrication and Welding at Holmesglen. To improve facilities and equipment so that now Holmesglen's fabrication and welding is one of the best equipped training facilities in its field. David continues to push for all training facilities to reach to industry standards in the use of technology available to all.

During his 4 years with Holmesglen David has completed his Certificate IV in Workplace Training, became Senior Educator for the Fabrication and Welding department, completed the Diploma of Vocational Education and Training and, won the ISSI Fellowship to investigate CNC based fabrication focusing on Multi Axis Press Brake Training and Laser and Turret Punch machines.

David's interests outside work include 4 wheel driving and camping with the Subaru 4WD Club of which he has been a member since 1993. He has had a strong association with sport, playing cricket with Berwick Cricket Club and Richmond Cricket Club. Playing junior football at Berwick and recently playing Veteran's football for East Ringwood, winning best and fairest in his first season at the club.

2. The Fellowship Program

Aim of Fellowship

The aim of the fellowship was to research and receive training about the new technologies of computer numeric controlled (CNC) machinery for the fabrication trade.

This research was in the countries that are already advanced in the training of such equipment and included training institutes, specialised forums and leading manufacturers who offered training and the largest engineering technology show in the world.

The fellowship offers a rare and unique opportunity for TAFE teachers and those with a passion for their trade throughout Australia to identify skills gaps within their chosen vocation and to then enhance their skills and knowledge through educational study tours with industry experts and training providers overseas and returning those skills learned to Australia

-

Without the assistance of ISSI to help highlight and bring into focus the issues for the fabrication I feel that the problems may well have been disregarded and we would see no change in the state of training for our next groups of new apprentices and future tradesmen for a few more years yet.

CNC Equipment – Metal Fabrication

The aim of this Fellowship was to develop training methods suitable for use in the fabrication field on modern CNC equipment. There are many varieties of CNC equipment used over a broad range of trades, the focus in this instance was mainly at the processing of flat sheet steel.

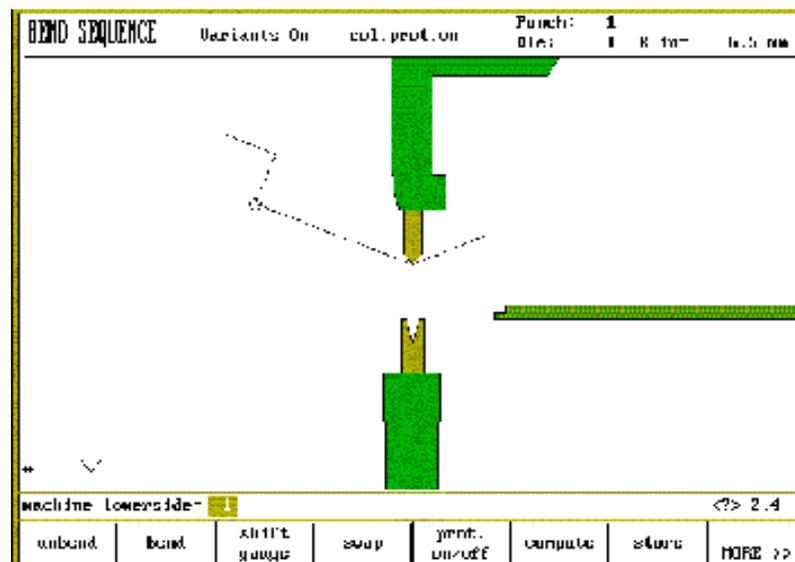
Other CNC equipment for fabrication includes pipe bending machines, robotic welders, cutting saws, routers high pressure water jet and multihead cutters.

Germany and Japan were immediately thought to be good sources of training and information, as they are manufacturers of some of the best quality machines specifically for the fabrication field. This is also true, of the USA with its huge population has a massive demand for metal fabrication manufacturing and therefore a wide variety of training facilities and courses.

Some of the major players for fabrication equipment include AMADA, DELEM, TRUMPH, BYSTRONIC.

AMADA Make an affordable range of quality CNC equipment including – press-brakes, lasers and turret punches.

DELEM Specialise in controllers mostly for press-brake machines, some of these controllers now include 3D graphics to pre-empt what could happen, even before you engage the machine in producing product.



TRUMPH Make a similar range of machines to AMADA, although their cutting and folding capacity in general is much greater, with higher power outputs and faster movements TRUMPH is very highly regarded around the world.

There were difficulties very early on as these companies are rightly focused only on their own products and training is usually done via invitation after purchase of their product.

After many phone calls and emails I realised that being trained at one of these facilities was not likely and would have to find other options.

The FMA (Fabricators and Manufacturing Association in America) with its large membership base runs a large and regular variety of training workshops and courses in all aspects of Fabrication and Manufacturing in order to keep its members on the top of the game.

Skills Gaps – Apprentice Training

It has long been known in the manufacturing and fabrication industry that we do not have enough young people coming into the trade.

Many good young people are pushed on to university or high profile trades like electrical or plumbing because these areas have high profile publicity via housing markets and our “Australian Dream”, and the government support to go with it. Engineering, including fabrication is seen as “Black Art” or “Dirty”, and our historically low level of support from government as well as the low perception many parents and careers teachers have of the trade is a reflection of this belief.

With modern technology including computerised equipment the reality is such that the manufacturing trade is now far more specialised and requires highly trained and highly qualified people to fill these positions.

As well training facilities across the majority of TAFE institutes are in dire need of upgrade and whispers of possible reform needs to desperately gain momentum or funding will end up within the departments with the highest profiles and not necessarily the most needs.

Another pressing problem is that many teachers are now getting close to the age for retirement and this creates another skills gap with new teachers coming into the system very slowly and at times no overlap possible.

We need to have time for new teachers to bring new skills into the aging departments and time for older teachers to mentor younger teachers in training situations and techniques. Also, New equipment to match the current industry requirements and assist skill levels to be shared amongst new and old staff, currently not possible at most training Institutes.

The students as our future trades people and current trades people are the biggest losers in this situation. Their training, while competently delivered, is flawed by the lack of quality equipment that they are exposed too.

Current Training Needs

The fabrication field is one of much diversity, the skills required in the trade can range from manual marking out of developments on the work bench to CAD drawing, from welding parts by hand to robotics or even 5 axis laser welding machines fully automated from manual oxy or plasma cutting to water jet, laser, punch or multi- cutting head profile machines. Hand forming metal parts using hammers, mallets and shaping tools, to pan break benders and now multi axis press break machines.

These are just some of the skills required to survive in the modern world of fabrication as we currently know it. Many of the skills modern fabrication tradesmen have were nurtured by technical schools, before becoming apprenticed through company's, who encouraged development and supported training at TAFE institutes, to learn the diversity of skills required to be a competent and complete tradesman.

Unfortunately with the demise of technical schools and the push for university education, the value of an apprenticeship and its TAFE training, is often seen in our current society as second rate. This has had a noticeable impact on the quality and enthusiasm of young people who now enter the trade.

With the push from government for the shortening of the apprenticeship qualification and the dwindling numbers being trained by industry itself, added to the extensive skill demands on a fabrication tradesman to perform to an high and efficient level, the future looks cloudy.

Current Training Facilities

In 2002 when I first began my teaching in the fabrication field I had arrived fresh from industry where 5.0kw lasers with cutting speeds of 40 mtrs per minute on flat sheet and laser cutting intricate shapes in tube (RHS/SHS) were possible. Press brake bending and forming machines had controllers capable of holding thousands of programs and bending speeds were so fast that it was possible to bend 'hundreds' of bends per hour.

This sort of equipment in the TAFE system was just a dream. Much of the equipment in the vast majority of fabrication training facilities was

many, many years old. Some equipment was un-usable while waiting for funding to be repaired or replaced.

Many apprentices were learning on equipment and using techniques not used in industry for many years. This has caused some backlash from employers who have stated a lack of faith in the training system and its outcomes.

This problem is not isolated amongst TAFE institutes and is of grave concern. There has been whispers around some TAFE's for many years, of the up grading of facilities which is great news.

Hopefully if things start to move soon, equipment will also be part of the new facilities long being talked about.

If not the fabrication industry will very soon be replaced with imported products or worse still, an influx of skilled migrants which will impact heavily on our young people and leave them with no skills and no jobs.

3. The Australian Context

For many years now the pressure from overseas markets has been impacting on our metal fabrication trades. The development of “Global Markets” has meant that Australia, with its small population, is competing with countries like America, China, Germany and Japan.

This competition can be a good thing as product prices are relatively stable whilst countries compete like never before. The down side is that with our relatively higher wages on a worldwide scale, we need to be smarter and faster to create a better and faster product.

Smarter with design we may be, but in today’s mechanical world it is the quality of the machine that is producing your work that can control your destiny. But, and here is the nub of the argument, that machinery must be controlled or programmed by someone.

Currently the training for high quality machinery will usually take place off-shore in a centre dedicated to training to cater for a specific machine. The publicity about the “Skills Shortage” that has been running across the media for the last year and a half, has now highlighted the fact that has been long recognised by the metal fabricators of Australia, that is; we need to “up skill” our workforce if we want to compete on the world stage. This is one of the major problems facing the industry; ‘to compete, we need to be more efficient with the use of the machinery’ that trades peoples in the metal fabrication manufacturing industry use everyday.

As a trade teacher, it has been frustrating to see that much of the training is at the shop-floor, a hand-down from one operator to another and a learn via your mistakes approach.

It is my belief that to be part of the trade in this era apprentices should be using the very latest (and possibly the best technologically advanced equipment available to be not - level but leading -) equipment that is available in many workplaces today.

TAFE’s in general have issues with not only the cost but also the floor space required by such equipment, as well as the ability of staff with the skills to be able to understand and use the machinery, as in the workplace and to then relay those skills. Hand skills are still the basis of our tradesman but technology is now a major tool that must be embraced.

3. The International Context

Program Content

Initially to gain an idea as to what was being taught in countries other than Australia, My itinerary was in place to visit 3 Technical Colleges in America.

There were also two different training courses run on Pressbrake Operation, one by FMA (Fabricator & Manufacturers of America) and one by AMADA, one of the larger and more well respected machining manufacturers for fabrication around the world.

Next on my itinerary was Belgium in order to visit the company LVD. Although I had very little knowledge of LVD, they were well renowned for their dedication to training, quality and innovation for the fabrication trades, especially sheetmetal.

From LVD in Belgium, Germany was the next destination for the largest machine show in the world – EMO.

There was also the opportunity through contacts with ACRA Machinery in Dandenong Victoria, to visit Turkey for some training on Pressbrakes with the DELEM Controller, which is amongst the more common control unit used around the world for CNC and NC controlled pressbrake machines. Unfortunately due to time and money restraints and the cancellation of one of the training courses, the original trip schedule was reduced by several days.–The cancellation by AMADA of its Pressbrake Training course was disappointing. Also, Fullerton College, who are located very near by the AMADA Training Centre and another point of interest, contacted me only a few days before departure to tell me that there would not be anyone available on campus to see me around my expected visit date. So there was a late change of plans and I did not get to visit that area of L.A. However I did visit the Colleges that are listed below.

Findings

College Visits

Although I have travelled quite extensively before setting out on my fellowship, I had never been to America. So it was with apprehension that I set out to gather information from “This Great Nation” and “World Super Power” known as the USA and to drive a vehicle on the wrong side of the road. It was to my surprise and amusement the things that I discovered.

Hutchinson Community College and Area Vocational School

Hutchinson Community College is located 40 miles north from Wichita in the relatively rural township of Hutchinson in the state of Kansas.

Upon entry into the grounds there was notable pride on display as the presentation of the College that reminded me of Holmesglen TAFE in Melbourne.

Official introductions were made after many previous email conversations. The Chairperson of Department of Technology & Public Safety at Hutchinson Community College is Martha Gatton. She is also the co-ordinator of the Shears Technology Centre under which banner the Welding Technology Department is located. Martha introduced me to her team which included courses such as, Computer Drafting Technology, Heating Ventilation and Air Conditioning, Electronic Engineering Technology, Machine Technology and Manufacturing Engineering Technology.

Dave Fitzgeralds co-ordinates the Welding Technology Department is one of the success stories of the team He was running a welding business locally before being convinced to become a teacher in order to give back to his trade some of what he had learnt. From a welding program that was barely surviving and struggling to fill places he built a course into one that people now travel from much further a field and that now has a waiting list of people wishing to attend.

He achieved this in several ways:

1. Forming a Council Advisory Board of local business people who had a vested interest in the trade, who met regularly and many of whom employed people straight out from their training once they had graduated and were deemed competent and job ready.
2. By upgrading the equipment that was in the training facility, trainees were more likely to be using the same equipment once they moved out into the workforce.
3. The introduction of CAD and CAM. Computer aided drafting and computer aided manufacture. As industry grows to meet competition the C.A.M. side of our trade is expanding rapidly. By introducing students to this equipment it gives them a stepping stone so that they have some grounding and comprehension of the way the industry is heading.
4. A much more rigorous system of accountability was introduced in regards to marking and attendances. Students attendance hours were logged via a clock system, failure to attend on time or three absences from class were followed up with a please explain and cancellation of their course was the end result. Students were more motivated to be punctual and participate in class.

Welding Classes

After a general tour of facilities and discussions on training some time was spent looking at teacher resources and student projects, it was interesting to note that the vast majority of training was at a certificate level and not at apprentice level as industry bodies in the USA do not seem to encourage the apprentice style system although it does exist. Those that do manage to be signed on as an apprentice have to undertake training in their own time and after work hours.

This will no doubt cause problems in years to come as the US may suffer a lack of skilled tradesmen in future years. We can only hope that Australian apprentice training does not follow the lead of the USA as we do with so many other things.

Wichita Area Technical College

Wichita Area Technical College is located fairly centrally to the township of Wichita, only a few kilometres from the towns centre. First impressions were of a training facility with little fanfare.

The buildings for the various training areas were all separated from each other with no covered walkways or landscaping in between, which gave the impression of isolation of all the trades that were on offer.

The purpose of the visit was to see the Applied and Engineering Technologies Centre that included Mechanical Engineering, CNC plus Welding and Fabrication, this section of Wichita Area Technical College was under the control of Dean, George Gray.

I was delighted to have a tour of the Applied and Engineering Technologies Training Facilities. We visited the Mechanical Engineering wing and the Computer Numeric Controlled (CNC) laboratory. This area of Wichita's training facilities had only just completed an upgrade. This upgrade had included the setting up of a Hass training facility. Wichita had received six new CNC Hass machining centres including lathes, mills and 5 AXIS machines. This was an impressive training facility and after being introduced to Chris Cosby, who is the instructor on this equipment, a good amount of time was spent learning about his methods of training.

The tour continued through the traditional fitting and machining section before an introduction to Terry Smith, Instructor and Chair of the Welding and Construction section of Wichita's training facilities.

After already having visited some well maintained and very new facilities it was quite an eye opener to see facilities that were very much like many of our TAFE Colleges in Victoria. The workshop was tidy but the equipment was old and very well used, teachers had to work hard to keep all of the equipment and machinery running. Terry has been a teacher for over 20 years at Wichita and tells a similar story of many who have been part of the training profession for many years.

The story of the difficulties in the battle for funding is similar to the many stories of Welding and Fabricating Colleges in Australia. Therefore there is much the same pressure on existing equipment and on staff to maintain it.

The College had managed to get funding for one new machine only a few years earlier, this was of interest as it was a CNC Plasma Cutting Machine and was fairly large in the small workshop facility. This machine was chosen for the fabrication area with little or no input from the teaching staff. The CNC Plasma machine was in good condition but had been rarely used in the time since its arrival a few years earlier due to software and teacher training issues.

Time pressures for normal classes and lack of CNC knowledge were among a few of the reasons for difficulty to bring the machines into mainstream training. This was frustrating as it was the some of the only new equipment received for many years and it could not be used effectively and it also covered a large area of valuable floor space.

“These issues could also end up in any training facility which does not have staff who are efficient on such equipment.”

The visit to both Hutchinson Community College and Wichita Area Technical College highlights many of the difficulties teachers in the Fabricating field are facing. On one hand there is a constant theme of funding of new technology and upgrading of equipment, the other is the training and support to bring the trainer up to speed on the new technology, which is essential if it has been put into place on the workshop floor.

Training Programs – (Fabricators & Manufacturers Assoc.) FMA Precision Press Brake Training

Fabricators & Manufacturers Association International (FMA) based in America have a wide variety of training programs set up to help keep its members in front of their opposition and up to or better than world standards. FMA had several training courses of interest for the Fabrication field, but the one of most interest was the “Precision Press Brake Operation Workshop”.

The course was held at Kellogg West, California State Polytechnic University at Pomona in California.

California State Polytechnic University is located approximately 2 hours drive east of Los Angeles, just next to the main East-West Pomona Freeway. At the time of the Precision Press Brake training course it was term break and there was no opportunity to be able to access or even visit any of the facilities in the engineering training facilities. This was a major disappointment as it was potentially another opportunity to compare workshop facilities.

The course runs over one and a half days and Steve Benson was the lecturer/instructor. Steve Benson has been a leading expert for many years and regularly conducts workshops on sheetmetal, fabrication and forming. He is the author of many books including: Introduction to precision Press Brake (1991), Press Brake Technology (1997), Lasers, Punches, Press Brakes & Shears (2001), as well as others. He is also a contributing writer for “The Fabricator” and “The Fabricator.com”, which are managed by the FMA. As well also is a contributing writer for “Forming and Fabricating – Society of Manufacturing Engineers, and the International Sheetmetal Review – United Kingdom.

The fact that Benson has won many awards for his work and is the author of “The Precision Sheetmetal Chronicle” ;

www.asmachronicle.com/chronicle.htm –

the worlds first on-line E-Magazine for the precision sheetmetal trade meant that his skills and expertise made him a very appropriate choice to visit, despite the timing difficulties.

The staff on location at the course came from a diverse range of backgrounds, trade skills and locations. The course begins with the history of Press Brakes, with pictures of older models and tooling before moving through to modern CNC equipment.

Then a considerable amount of time is dedicated to the mathematics behind Press Brake bending. This covers material thicknesses involved for tonnage pressures for hydraulic machines. Also inside or outside measurements calculating bend angles and “K”-factor calculations and the calculation of “V”-Die size to suit material thickness and required bend radius. Mathematics proved to be a large section of the training provided, learning/refreshing on trigonometry and the use of algebra for the working out of degrees, angles and bend allowances.

Training was conducted on the use of scientific calculators and conversion charts.

Air bending, bottom bending, coining and bumping were terms discussed as to bending techniques and strategies to be considered when choosing both the machine to do the job, but also tooling, with questions as to whether it can withstand the tonnage requirements to finish the job.

Air Bending technique is where the material to be formed is bent using the 3 point method. Example:

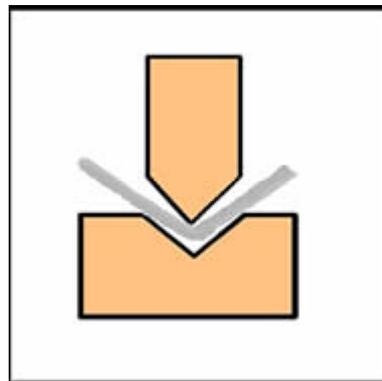
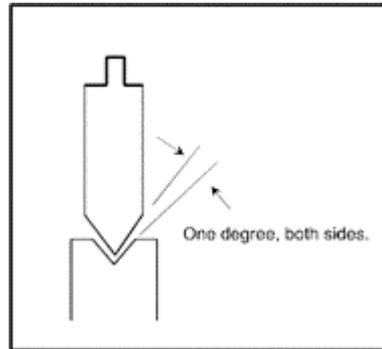


Diagram of Air Bending

Bottom Bending is where the material being formed is pressed into tooling that is the required shape of the finished part and after springback, holds the required shape. Example:



Picture 90° Bend in Required Tooling

Tonneage Required is 3-4 x Air Bend

Coining is the technique of pressing the material under huge power until the material de-stresses and holds the required shape. Panels of cars would use this type of method as the part should be exact everytime. Tonneage required could be 7-8 x more than air bending.

Bumping is the use of several shallow bends to produce the required shape. This method is good for forming radius bends.

Industry Visits – LVD

After finishing my visits to Hutchinson and Wichita Colleges and completing my training course organised by FMA on Pressbrake Training it was now time to leave the USA to see how it was done in Europe.

I was now heading for Belgium for an industry visit and training with the company LVD. LVD is a proud company based in Belgium with approximately 1,000 people employed world wide, specialising in CNC equipment for the Fabrication trade.

At LVD I was introduced to Lieven Vanhoenacker who had worked at the company for over 15 years. He spent the day showing all aspects of their manufacturing facilities from construction through to assembly, maintenance, electronics and research and development. It was of great interest to find out that LVD had initiated some of the great advancements in Pressbrake Machinery Technologies. The crowning table and laser bending angle measurements are some of the more readily used items available today.

The crowning table is the ability of the machined base or which the bottom V-Die or Block rests upon to adjust either manually or automatically to ensure that the bending of material is uniform across the entire bend.



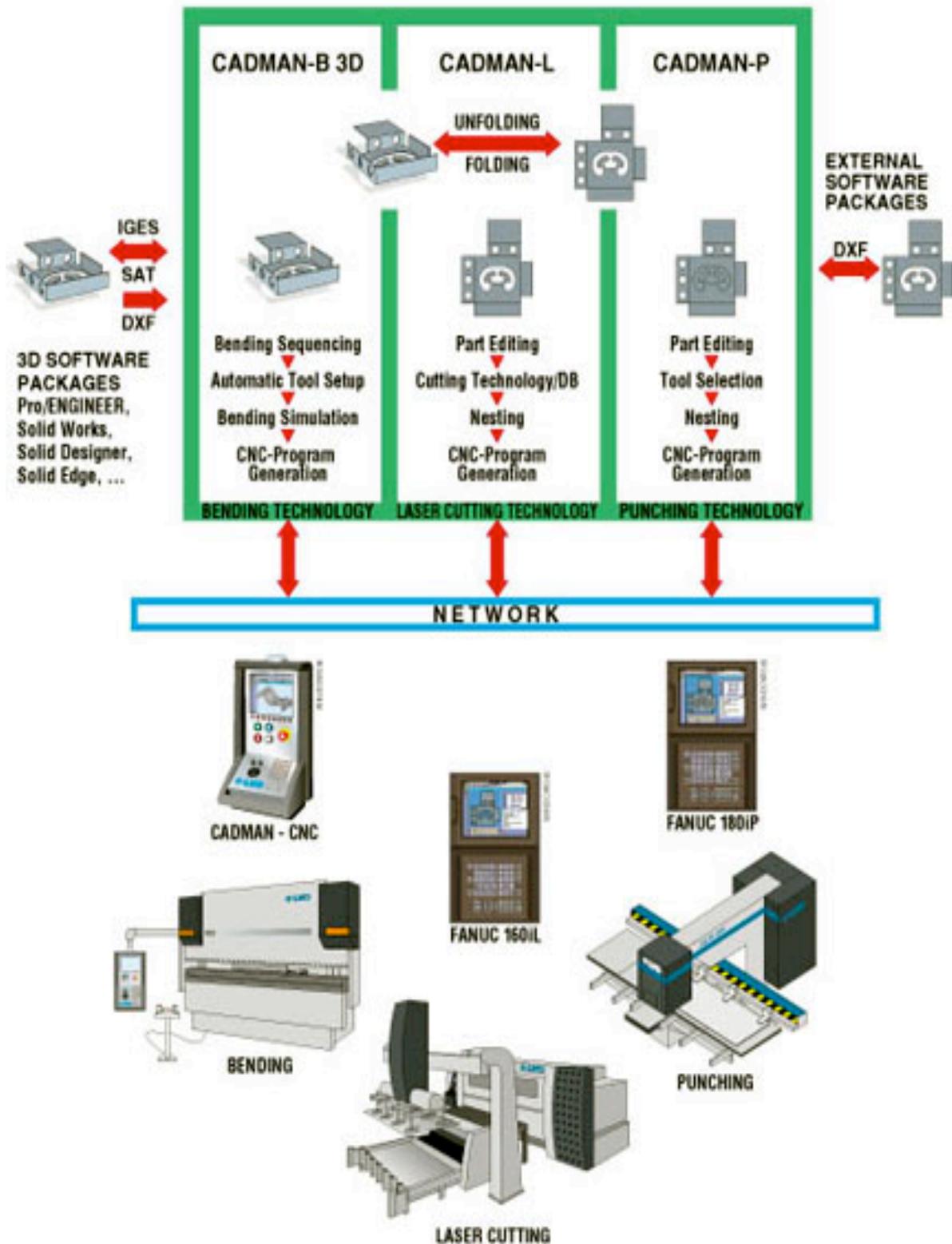
LVD/Strippit Easy-Form laser at work

LVD backs up the level of service to the fabrication field by having their own training centre located in a building separate to the main production facility. The training unit has three main instructors with several training rooms for different applications. The training facility is very well set up with machinery, tooling, lecture and CAD rooms as well as a small café, centrally located to encourage a relaxed training atmosphere. I had the privilege to be invited to spend the day there and work with two of their trainers.

The first part of the day was spent using the software called CADMAN. I have some background in using this software as it uses the Lantek System as its base system. The Lantek Software Package is used world wide for use on lasers and punching machines, it can be used (as it is at Holmesglen Institute and some other software companies) as a foundation software with a few variations to suit specific needs. FAB-Works Software is one of the variations; it marries up to another software called CAM-Works, used for the fitting and machining trades. LVD uses Lantek in a similar way but the package that it has put together is called CADMAN.

The two main software's run by LVD are CADMAN-L, for use with laser cutting machines and CADMan-P for use with Punching Machines. It was great to have the opportunity to learn from people who use the software on a daily basis, and to also have to them impart their knowledge to people in a learning environment and with answers to any questions that came their way.

Cadman Software



The afternoon was spent in the training workshop on the various pieces of equipment set up in the facility.

The training workshop was set up so that after you had used the programming software, you were able to set up from the CAD training room right out to the machining that you were trying to program. There is a top of the range press break with a full range of tooling also fitted with laser form, the latest technology for bending accuracy. Laser form is a small device located on the main bed of bending machine that as you are folding “uses symmetrical measurements at the front and back of the die to find the exact bend angle. Strait lines composed of multiple points are projected onto the work piece and vertical portion of the die. Measurement calculations are made every 20 milliseconds.” The sensing device transmits information to the CNC unit where it recalculates the correct depth adjustments to obtain the correct angle. The bending progress does not stop as measurements are taken thereby retaining time efficiency. The system does not require recalibration after each set-up and bends ranging from 45 to 150 degrees can be made.

LVD’s training/research facility and staff have the capacity to manufacture almost any part on site to assist with customer’s enquiries or just to trouble shoot and assist their clients.

Equipment set up at LVD’s training facility is a laser cutting machine with a fully automated loading and unloading device. With this machine it is possible to load multiple programs and match various materials to them. The machine can load the required material onto its cutting bed, cut the full program before unloading onto a table for an operator to package if required.

Training at LVD

Software training in training rooms for CADMAN-L for laser or CADMAN-P for turret punching are softwares developed by LVD using Lantek software as the master component. LVD uses Lantek CAD package and has made some changes to suit the needs of their machinery and clientele. LVD also has its own software for bending and forming specially developed for their Pressbrake systems.

LVD prides itself with being innovative and leading the field for technology advancements and the 3D bending software only available for their own brand of Pressbrake machines with LVDs' control unit. The software that LVD has developed has been fine-tuned over many years and is user friendly and simple to use. Offering a full view in computer generated graphics of the machine being used means an operator can bend complex parts and visualise any problems that may occur. This saves time and money as complex parts can be folded in an incorrect order then rendering them as scrap if unforeseen problems are encountered.



Facilities at LVD's, USA training Center

German Machine Show

EMO;

Possibly the largest machinery display in the world happens every two years in Germany at EMO.

The technology on offer at the Fair Grounds in Hannover is not only awe inspiring but also exhausting. With over 35 pavilions available to be set up with the best equipment the world has to offer, this show is a definite point of interest if you are in need of state of the art equipment. Many of the worlds leading machinery makers were on display, some of which hired out pavilions that were twice the size of the Melbourne Exhibition Center (Jeff's Shed). Of the machinery on display, much was CNC driven and the vast majority was for lathes, mills and 5 Axis cutters. Fabrication had two display halls and for the most part was not on as grand a scale as some of its fitting and machining cousins, although one company certainly did make a statement. The aim of any machine show is to sell the product on display and triumph were there in force. With more than enough staff to discuss and answer any queries you might have, Triumphs display was very impressive, with a self loading and unload laser cutter working cutting parts. There was a robot unloading, sorting and stacking the cut items so that another robot could select and fold parts in the Multi Axis Press Brake before stacking parts ready for a worker to weld and complete the item. With such technology running it was easy to see that hired labour was greatly reduced with only the need for a programmer, process operator and qualified welder to complete the fabrication process.



Also on show were many software/CAD/CAM companies as well as a strong showing for safety items which is now a must for any factory/machinery operating such equipment. One such company with a strong presence is from Australia, called Laser Safe.

Laser Safe Pty Ltd is a small company from Perth, Western Australia who started in 1998. Laser Safe is now World renowned for its dedication to research and development for Safety Guarding for Pressbrakes and other metal manufacturing machines. This is clearly evident by the swell in numbers of metal manufacturing machines on display from all parts of the world at EMO and the huge variety of manufacturing companies who have entrusted the services of Laser Safe guarding on their machines.

This show was very intense and well worth a visit, anyone thinking of attending should be prepared for lots of information and even more walking.

5. Recommendations

Since returning from my fellowship there has been some movement across many training providers. Government is allowing more money to flow into training and via grants some colleges are investing back into the fabrication field. New faces are now being seen across many institutes as some contracts are being offered to attract teacher's into permanent jobs and not just part time work, as has happened previously. Most TAFE colleges in engineering are talking and sharing information, this is not only a combined effort for teaching resources, but equipment and machinery knowledge is also helping to make the technology transition easier.

As recently as June Holmesglen Institute hosted one of the regular Engineering Senate meetings. I was asked to give a tour and demonstration of our facilities and equipment to a group of Co-ordinators and Managers from the other institutes from all around Victoria. This was a great opportunity to present to other TAFE's, and show them the technology available and what is possible to teach in a TAFE situation.

As a follow on from that demonstration one of the institutes who attended rang to organize another meeting to discuss Press Brake technology and what to look for. The Manager, Co-ordinator and one teacher arrived for another demonstration and discussion. We discussed CNC controls, sizes and tonnage; tools and capabilities and safety in a school environment as well as relevance of such equipment in industry in a modern manufacturing workshop.

This has shown me that my extra work and effort to be on and a part of both the Engineering and Fabrication Senates is starting to bear fruit and others are joining the push to take us to the next level of education.

The following recommendations are based on what I have seen and heard while on my Fellowship Program.

- More must be done to attract young people into the trade environment. University is not the answer to all of our nation's lifestyle choices.
- Industry must make a bigger effort to nurture not capitalize on younger people who do enter the metal trades.
- Training institutes and facilities across Australia should have the capability/capacity to access machinery and equipment that is offered and used in a modern work environment.
- More needs to be done to attract and make room for younger teacher's with current industry skills to come into TAFE institutes so

that modern equipment may be utilized more efficiently for training purposes.

- Younger teachers will need mentoring in the early transition from industry to the TAFE environment.
- If younger teachers are to be attracted into TAFE jobs then full contracts need to be more readily available rather than sessional, part-time work be the only option.

The Problem

The problem facing the Fabrication trade is complex and exists at many different levels. Over the last 10-15 years there has been a constant decline of apprentice numbers or new blood coming into the trade of Fabrication. This can partly be attributed to the push by both parents and secondary school teachers/careers teachers who encourage all students to aim for a university education after high school. The I.T. boom of the late 90's and the "Big Money" on offer was enough to send a feeding frenzy of people trying to get into these courses. The trades' reputation of being a "Black" trade or dirty/blue collar job certainly has helped in keeping people away.

Money is always a motivator and the prospect of doing an apprenticeship for 4 years on very low wages is not as appealing as it once was. Employers in today's' cut throat environment are also conscious of productivity, so today's' good young prospect for the trade, must now come into the workforce, (many of whom have little or no experience with engineering machinery or equipment) and be productive with very little support or training. The school of thought by some employers about young employees is 'sink or swim'. The demise of the technical school in Victoria now means that few people making the transition from school into full-time trade related work have hand skills of the same age group as 15-20 years ago.

Some Proposed Solutions

Government

Governments have finally decided it is time for a culture shift and with much the talked about “Skills Shortage”, politicians are getting behind and encouraging younger people back into all traditional trades which should boost the pool of talent to choose from. This is great news but the government must do more. Education in Australia is in great need of support. In 1998 the Metals and Engineering Training Package was brought into being. Learning outcomes were replaced by a competency based system of education. These competencies were developed by industry for industry and little to no thought was given to how the education system could use them in a learning environment. As the package was set up for assessment in industry, you could be assessed as “you can do the task, or you couldn’t”. Therefore the educators were left on their own to develop ways to bring students to the level of competence for assessment. This has been a huge problem as no two training facilities were teaching the same thing, or even using the same competencies. With the forming of the Victorian Branch of the Fabrication Senate over the last 18 months to 2 years there has been a coming together and some agreements have been reached on how and what level competency has been achieved. However, there has been no contact with other states and as we are teaching to a national competency system, this can only be a disaster in the near future. We need common ground and uniformity across the nation if we want our trades people to at least have a level playing field.

Industry

Industry now must stand up and shoulder more of the burden. For too long now profits have been the main focus. Industry should now be trying to nurture our future tradesmen and make our trades more appealing. We need to give young people a go, and not have unreasonable pressures on new entrants into our trades, let them find their feet and give them every opportunity to receive training, and not learn via the “suck it and see” approach which is potentially dangerous and does not present the candidate any recognisable qualification.

We no longer have the government protecting our resources or utilities as the world has now dictated that all businesses should show a profit. As this is the case we now no longer have companies like the SEC or Gas and Fuel to nurture and encourage new entrants into a good trade career. Industry must now stand up, give a young person with potential a go and support them because without lots of effort many younger people in today's terms are very easily swayed to easier lifestyles.

Professional associations

Being part of the Victorian Engineering and Fabrication Senate has shown that there are people putting in a considerable effort trying as best they can to improve and rectify problems created many years earlier.

The unfortunate fact is, that there are fewer full time teachers in the engineering trades teaching fraternity. As experienced teachers are retiring and leaving the system, they are replaced with well qualified people from industry but who lack teacher training and who are only employed on a sessional/part-time basis. This leaves an ever increasing burden on full time staff who must carry not only the burden of their own classes but also enquiries, enrolments, resulting and audit requirements and, as the government no longer produces teaching/learner resources, staff must produce these as well. Teaching resources are of great concern on a national level if we want our courses to be consistent with all other states.

Education and training

With the Federal Government now conceding that we need to reinstate technical colleges there are other things that are also falling into place. It has been mentioned many times in recent years about our ageing population, this is also true in our trade schools or TAFE colleges. It is expected that up to 70% of teachers could retire over the next 3 to 5 years, this of course is of great concern as many years of experience will suddenly just vanish. On the flip side this is also of great benefit as now opportunities that had previously not existed will now start to appear for new or younger blood to make the transition into TAFE. Opportunities have been very difficult to find over the last 10 – 15 years as vacancies for such jobs have not existed and training grounds for new trade

teachers have long closed. These new and younger tradesmen making the transition also bring with them the newer and more technologically friendly skills that are found in many modern workplaces, but not necessarily in training facilities.

Along with lower apprentice numbers and the problems mentioned the poor state of training facilities across many TAFE Institutes should also be considered. Holmesglen Institute has just completed 50% of an upgrade in the engineering wing. This is the first time in over 20 years that those facilities have had a make over to keep them to current standards. Unfortunately very few institutes are willing to upgrade their trade facilities. This has a large impact on training and the impression of people looking to enter the trade is also influenced by the condition of these facilities. If young people and their parents are looking for a future career and visit these places in trying to make a decision, certainly some modern workshops, which are like food kitchens, are not well represented.

As a TAFE teacher the Action Plan that I put into place since becoming a teacher was to bring as much of the modern workshop approach into the training environment as possible.

I have spent and are still spending many hours in trying to develop a training course for not only apprentices, but also current employees wishing to be able to be trained and to use equipment that their employer may or may not have (or is not game to allow that apprentice or employee to use).

At Holmesglen 2nd and 3rd year apprentices are learning to use a CNC Press Brake, with a wider variety of materials to use with a good range of tooling.

Third year apprentices can now access a computer aided manufacturer process where by they can program a sheetmetal part on a choice of CAD softwares, Lantek or FastCAM. Once the part has been programmed it is then nested into a sheet of the desired size and thickness before setting up the machining process. Once this is done the file is electronically sent to the laser/punch combination machine for cutting. The cut part is programmed into the CNC Press Brake for bending and forming before the final process of welding and grinding takes place to complete the part. This is the process that is used in industry everyday, but up until now has not been able to be replicated by most of our training providers in order to produce highly skilled tradespeople.

Progress Since Completion of ISS Institute/ Fellowship

Since completing my Fellowship there has been some movement across many training providers. Government is allowing more money to flow into training and via grants some colleges are investing back into the fabrication field. New faces are now being seen across many institutes as some contracts are being offered to attract teachers into permanent jobs and not just part time work, as has happened previously. Most TAFE colleges in engineering are talking and sharing information.

This is not only a combined effort of teaching resources, but also of knowledge of new and modern manufacturing equipment and machinery which is also helping to make the technology transition easier. For both the new to teaching in a training environment and those with many years of TAFE behind them. In the long term I would like to see all TAFE's working and sharing together for the good of the manufacturing industry and those who work in it.

Conclusion/Restrains

There is no magic wand, but a combined effort from Government and industry must be found to return our manufacturing industry to a level to keep and maintain a competitive edge over the rest of the world.

Thinking smarter and not working harder is a key and must be a starting point for the change and shift in culture that is required.

This will surely be possible although government funding of education in Australia compared to many overseas educational funding models must surely be looked at if we really do wish to stay competitive on the world stage.

6. References

www.asmachronicle.com/chronicle.htm

- LVD Group
- Laser Safe Pty Ltd