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# INCORPORATING DESIGN WITH CNC PRODUCTION

**Bill Presslor**
ISS Institute/TAFE Fellowship

Fellowship funded by OTTE, Victorian Government

# Design and CNC Production

Bill Presslor

## 1.0 Acknowledgments

Awarding body: International Specialised Skills Institute
Fellowship sponsor: Office of Employment, Training and Tertiary Education (ETTE)
Holmesglen Institute

## 2.0 Introduction

### The Australian Context

Due to the size of the local furniture manufacturing market investment into new and innovative techniques, equipment, and design has been historically very slow. The recent CSIRO report 'Manufacturing Technologies' has identified the need for the industry to develop a manufacturing methodology instead of the cottage industry approach if it is to survive. The ISS has also addressed this issue with there highly successful program Sensational Screens. This program has clearly demonstrated what can be achieved when there is a means provided for collaboration between designers and manufacturers. To further develop this type of program, education needs to prepare graduates with the correct skills in modern production techniques, equipment, and design.

The Australian furnishing industry aim over the next 5 to10 years is to develop capacity to export to all major world markets. The main reasons for this are:

a. To combat the inroads imports are making into the domestic market, especially in the upholstery sector due to tax inconsistencies.

b. Larger markets enable economies of scale thus allowing better product development and production processes and giving greater returns.

c. Export levels are incredibly low compared with overall manufacturing volumes. Therefore, as competition increases and dollar values are competitive the industry has identified an opportunity to become a sustainable Industry from a small base.

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The reduction in levels of protection and the opening of the Australian economy has seen a relatively haphazard adoption of CNC equipment and use by the furnishing industry. The adoption of this sophisticated technology is seen by the industry as fundamental to its future survival and success. However the approach to implementing the use of this equipment needs much more of a holistic approach, rather than the piecemeal approach currently used.

In Australia the use of designers within the furnishing industry has always been minimal. To continue to grow and develop, not only for the domestic market but also for exports, the industry will need to develop a more positive approach to utilising the skills of designers.

## 2.1 International Specialised Skills Institute Inc.

The International Specialised Skills Institute Inc. fills gaps in industries and enterprises where the means of doing so are not available through government programs or Australian TAFE institutes and universities. Operations are directed towards rebuilding specialised skills and knowledge, which are disappearing, or have been lost and brings leading-edge technologies to Australia. The way in which this is achieved is by building global partnerships through the Fellowship program, then the fellow sharing what he/she has learnt overseas through education and training activities – one fellowship; many benefits.

## 2.2 Organisations

The Furnishing Industry Association of Australia (FIAA) is an industry organisation which is state driven with a national representative body. With the commercial kitchen cabinet manufacturers and nursery furniture sectors setting up their own organizations under the national banner the industry has further fragmented. The FIAA represents a portion of the industry, but by no means the majority. The ‘Action Agenda for the furnishing Industry’ was a Federal Government initiative developed to improve the ability of the sector to compete against aggressively priced imports.

The major areas of agenda were building capability, building capacity, innovation and design, market access, IT and the environment. Unfortunately, the Action Agenda has failed to address the issue of design an a manner that will insure any positive change.

This illustrates two of the biggest areas of concern in this industry sector, the lack of design and development input into the production of furniture in Australia and the prevalence of Euro centric copying.

The major controlling factor in the domestic market in Australia is the dominance of a few retail companies and buying groups driving the direction of product output. Branding is being suppressed and price is crucial in buying decisions. I would suggest that in the long term this will be an even greater issue, as dwindling global timber resources become a major issue, especially for small manufacturers. Sourcing materials, especially timber, is likely to become even more of a problem for small enterprises, forcing them into buying groups to be able to compete for the timber supplies that are available.

## 2.4 Fellowship Details

The ISS Institute/TAFE Fellowship was awarded to Bill Presslor to undertake a program of study in the furnishing industry by visiting training and industry facilities in Italy, Germany, Denmark and the United States.

The Sponsors of this fellowship were the Office of Employment, Training and Tertiary Education and Holmesglen Institute.

## 2.5 The Skills Gaps that were researched were:

- Design Education for furniture manufacture
- Computer Numerically Controlled Furniture Production Machinery
- Modern production processes and associated safety standards
- Design/Production collaboration

## 3.0 The Fellowship Program

### 3.1 Introduction

This fellowship program was established through a series of emails, letters, and telephone calls. I was able to establish contacts with the following organisations for a study tour of Italy, Germany, Denmark, United States

**Italy:**

- Rupes – Manufacturer of sanding equipment and dust extraction for the automotive and furnishing industries.
- Domus Academy – An internationally recognized design school
- ACIMALL – The Italian machinery manufacturers association.
- James Irvine – A British born freelance designer working with a range of furniture companies

**Germany:**

- Fachhochschule Rosenheim – The leading German and European school for wood technology
- Werndl Steelcase – A leading European office furniture manufacturer

**Denmark:**

- Danmarks Designskole – Denmarks leading design school
- Rud.Rasmussens Snedkerier – Denmarks most widely known manufacturer of traditional Danish furniture.
- Republic of Fritz Hansen – One of the worlds leading manufacturers of chairs.

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**United States:**

- Purdue University – School of Forest Products and Wood Processing

## 3.2 Host Organisations:

Mr. Ami Hochenburg, Managing Director of Rupes Australia was extremely helpful in setting up contacts with the Italian head office of Rupes. In addition, Erling Christoffersen was invaluable in organising visits to Fritz Hansen and the Danish Design School.

## 3.3 Program Content:

### Rupes

Rupes is an Italian manufacturing firm specialising in sanding and dust extraction equipment. Though heavily involved for years in the automotive industry they have in the past five years expanded their coverage to include virtually any industry using abrasives and dust extraction.

Founded in 1947 Rupes created the first electric sander in 1951, paving the way for modern portable electric power tools. In addition, this company was the forerunner in helping establish safety rules for the working world. Every single design has been developed using new technological solutions that aim to safeguard the health and physical safety of the operator.

### Issues and Challenges

Control of the innovative technology applied to power tool production is similar to other manufacturing processes. Product development and the management of the components that make up finished products are a very high priority for this company. Rupes research and development for new product is carried out by highly trained specialised staff in both technical and design fields. The development of Rupes as a world leader in sanding processes is clearly demonstrated in their continued growth, with 3 Italian manufacturing units and distribution to over 60 countries worldwide.

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Rupes operate like many small to medium sized companies in Italy, they have a thorough understanding of their market and do not attempt to try and do everything related to their products. Although they have there own production facilities for many of the components they use for finished products, they still use specialised firms for plastic components.

## Domus Academy

Domus Academy is a privately funded institute specializing in design courses with an international reputation as a design "think tank." Established in 1982 as a post-graduate school and a cultural laboratory of research in the design field, Domus was the first school of its type in Italy. Historically, most designers in Italy came from Architecture courses, as pre 1983 virtually no other design training existed.

The activity of Domus Academy is conceived by staff as a vast laboratory set up to research and explore future scenarios. The presence of multidisciplinary teams, the international community of students, and the research that is typical of Italian design are the key components of the work and study carried out at the Domus Academy. The education area has developed a fairly unique approach, individual skills and discipline based skills are not delivered or built through pre-set methods, they are developed as projects in relation to a specific content. In addition to running yearly courses and a Masters program, Domus Academy also offers a range of courses that vary by theme, level of commitment and length.

### Issues and Challenges

Carolynne Bourne's visit to Domus Academy in 2002 opened the door for my visit to Domus. The Academy is interested in working with ISS to develop future projects and fellowships that will benefit both organisations.
Domus Academy has a number of very positive attributes, including the ability to provide a forum for discussion and it's role as a "think tank" for the design industry. The connection between the staff of this institute and outside professional designers gives this school a definite edge over it's competition as far as recruiting students and establishing the networks so vital to success in this or any other endeavour.
The down side for this organisation is the tendency to lean towards elitism.
Italy has only recently addressed design education through government funded programs, and design education is almost non existent in the primary and secondary system.

## ACIMALL

ACIMALL ( the Italian Wood Working Machinery and Tools Manufacturers Association ) has the role of promoting knowledge of Italian technology throughout the world and to provide the member companies with qualified support concerning the main corporate issues. The 2001 Annual report of ACIMALL records 18,392,000 € (AUD$33,105.600) of Italian wood working machinery sales to Australia. This is the second highest figure from all Asian countries behind China. Imports of wood working machinery from Italy had remained static for the previous five years, but dropped 20% in the period of this report, as did most other Asian countries with the exception of China that rose 20% during the same period.

Machinery imported into Australia is principally from Italy, Germany, Japan, Taiwan and the United States of America. In 2001 Italy and Germany clearly led the race in imports to Australia. This report does not provide data on machinery types imported but it is the opinion of the author that more basic machinery would be purchased from Italian companies. This is due to the lower cost and more plentiful Italian basic-machine manufacturers.

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While no specific data is available, it is likely that the supply of CNC machinery from Germany and Italy is somewhat equal. Of the other importing countries, Japan and the United States have a smaller share of the CNC market.

### Issues and Challenges

ACIMALL faces many of the same challenges that most member based organisations are confronted with. As global trade increases, the effects of the manufacturing boom in emerging countries is being felt throughout Europe and North America. The increased output from Asia and Eastern Europe where wage costs are low is having an impact on most manufacturing sectors. Over the last 50 years, most major furniture manufacturing machinery was produced by countries including Italy, Germany, Japan and the United States.
The increased production, and to a large part the improved quality of equipment produced in countries such as China and Taiwan will almost certainly continue to have an impact.

## James Irvine

James Irvine was born in London, England, in 1958. Trained as a furniture designer at the Royal College of Art in London, he graduated in 1984. Since then he has been based in Milan. He was a member of the Olivetti design studio until 1993 and also a partner of Sottsass Association until 1997. For the year of 1988 he lived in Tokyo and worked in the Toshiba design studio. Today Irvine's studio designs industrial products for companies such as Canon, Artemide, and Whirpool. In 1999 he designed the new Mercedes Benz city bus fleet for Hannover. In the furniture field his first client was Cappellini. He works today with international companies including B&B Italia and Magis.

#### Issues and Challenges

One important reason for my visit to James' studio was to further develop ISS's network of contacts. James has been highly successful in establishing himself in the Italian design scene, not an easy task for someone not originally from Italy. I met with James to discuss the possibility of his being involved with future programs developed by ISS Institute.

In the years he has lived in Milan, James Irvine has been able to establish an extensive network of contacts through a broad range of industries. His current work covers a range of objects in fields as diverse as furniture to shoes. James currently employs two assistants in his studio.

An issue that he raised in discussions was the prevalence of well known designers to take on assistants while offering them little financial reward for their efforts.

## Fachhochschule Rosenheim

The Rosenheim Institute of Applied Sciences is Germany's and arguably the world's leading institute for technical training and education in the woodworking industries. This institute has an enormous range of equipment and machinery, provided in many instances by the generosity of the German machinery and products manufacturers. Facilities include a sawmill and tooling shop, panel manufacturing shop, machine shop, CNC workshops, CAD laboratories, furniture testing laboratory, veneer and wood bending facilities. Currently some 500 full time students are enrolled at the institute in both wood technology and wood engineering courses.

## Issues and Challenges

Historically the German industry has had a world-recognised reputation for producing highly efficient technicians. As a world leader in technical training for the wood related industries Rosenheim Institute has recognised that technical expertise alone will not be adequate to combat the competition of low cost imports. In Europe and the rest of the developed world most countries recognise the Italian industry as their main competition from primarily a design stand point. To overcome this phenomenon the German industry views the development of new training for design in the furnishing industry as crucial to their future success. At present specific design education for the furniture industry is addressed through university level Industrial Design courses.

A situation that has been identified as not adequately meeting the industries needs. It is believed by the industry that a greater focus needs to be aimed at providing design training for technical and engineering students as well.

### Werndl Steelcase

Werndl Steelcase is a large manufacturing firm originally German owned, but recently acquired by a British firm. Their production facilities are highly automated and use a vast range of CNC machining centres to produce a huge range of office furniture. Steelcase produce office furniture from a range of materials primarily manufactured board, but also including solid wood, plastics, steel and aluminium, acrylic sheet, and glass. The company produces approximately one million dollars worth of product every day and is a prime example of high end use of technology. In spite of the huge volumes many orders are small and the company has the ability to provide custom designed and manufactured office layouts.

### Issues and Challenges

Quality control and flexibility remain a prime consideration for most large volume manufacturers like Werndl Steelcase. Great lengths are pursued by this company to achieve consistent results as one means of reducing costs, while improving production. While the use of solid wood is diminishing every effort is made to recover as much as possible from every single piece. This attitude and production philosophy is applied to all materials and processes.

### Denmark's Designskole

Currently recognised as a leader in design education, since it's inception in 1875 as the School of Drawing for Women, the current Danish School of Design has had a specific focus on design.

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The schools focus on the interaction between different working methods, experimentation with different media and workmanship has led to Danish design being internationally recognised, both as an identifiable style and as an important movement in 20th century design.
Furniture courses are offered through the Institute of Spatial and Furniture Design. The current course, though presently being restructured, is a five year program.

A new course to be offered after September 2003 will focus on a student finishing the basic three year course of study, then electing a specialisation for a further two years.

## Issues and Challenges

During his time in Australia on an ISS Fellowship Erling christoffersen was able to have a great deal of influence on many young Australian Designers. His involvement in lecture and workshops organised through ISS has had a very positive effect. His help in organising factory and school visits for me during my time in Denmark was extremely valuable.
The challenges facing the Danish Design School are in reality less formidable than what faces the industry in coming years. Issues concerning internal policies and politics are likely to be more easily resolved than the global issues concerning the environment and world production. If the school is able to continue developing new areas of exploration, research and development and design focus they should be able to continue as a prominent provider of design education.

## Rud. Rasmussens

Rud.Rasmussen is one of Denmarks most highly respected manufacturers of traditional Danish furniture. Specialising in the work of notable designers including Hans Wagner and Professor Karre Klint the entire range of furniture they produce has the simple functional qualities and air of timelessness that is the hallmark of Danish design.

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This organisation produces highly crafted individual pieces of furniture for a niche market, much of the work in solid timber, but all products are recognised designs from Denmaks most famous designers.

### **Issues and Challenges**:

The challenges facing Rud. Rasmussen are in many ways similar to the challenges faced by much of the Australian furniture industry. Small companies relying on solid timber supplies will face difficulties in acquiring materials in the next ten years as global timber supplies in exotic species continue to disappear. In addition this business relies very heavily on having highly skilled craftsman with a broad range of traditional skills to produce their products.

### **Republic of Fritz Hansen**

Fritz Hansen has a world-wide reputation for both design and production capabilities. They're new production facility located some 40 kilometres from Copenhagen was commissioned some five years ago at a cost of nearly 60million USD. This facility is without doubt one of the most impressive and highly automated production facilities in the world. Utilising the latest technology in CNC equipment, electronics, robotics and assembly techniques the company employs some 300 people in this setting. Production processes tend to be highly automated with sophisticated computer controlled manufacture more akin to automotive industry vehicle assembly lines than what we in Australia are familiar with in the furnishing industry.

### **Issues and Challenges**

Fritz Hansen is a prime example of the continuing success of the Danish industry. Design driven, this company produces between 250,000-300,000 chairs per year. All of the companies production focuses on design icons, with many world famous Danish designers featured including Arn Jacobsen and Hans Wagner. Though primarily focusing on chair production the company also produces tables and some office furniture. Nearly 85% of the company's production is exported as opposed to 15% consumed by the domestic market. This fact is another example of how the Danes have remained competitive in the global market. Though possessing limited natural resources such as timber, they have carefully targeted a market that allows them to compete through a design focus as opposed to producing high volumes of low priced furniture.

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## Purdue University

Purdue University is a large American university located in West Lafayette, Indiana. This university has a long history of involvement with the forest products and wood processing industry in the U.S.
Rado Gazo is presently an Associate Professor of Wood Processing/Industrial Engineering at Purdue University where he teaches several classes including Secondary Wood Products Manufacturing, Furniture Design for CNC Manufacturing and Properties of Wood. When not in a classroom, he conducts research and extension activities in value-added wood products manufacturing and industrial engineering areas. Professor Gazo makes significant contributions towards student recruitment and building up of Purdue's Wood Products Manufacturing Technology undergraduate program.

## Issues and Challenges

Purdue's Wood products lab has had a long history of research into furniture testing and materials properties. One major identifiable issue for the Wood Products area at Purdue has been the lack of design integration with CNC training. Rado has been instrumental in developing a CNC Design program to help alleviate this problem. The program developed focuses on production with CNC Point to Point Routers, but should also provide assistance with development for all CNC machines.

# FELLOWSHIP CONCLUSIONS

## Lack of Design in Development of Furniture Products

The furnishing industry in Australia has many similarities to its European counterparts, but it also faces many of the same challenges, namely cheaper imports and skill shortages. Most European countries have responded differently to the issues facing the global market place, but as a generalisation most have responded by developing strategies for dealing with the big picture issues such as waste minimisation and waste management as well other environmental issues like timber resources. The vast majority of companies utilise a range of materials, with little production focusing on solid timber.

The German furniture industry has always prided itself on the building of quality products, with a reputation of providing excellent technicians for their industry. The German industry has identified furniture design as a key issue to remaining competitive in the global market. Their use of technology is the key to their current competitive edge, but they are very much aware that this fact alone will not insure their success in the future. Like most other European countries, the German industry recognise that their chief competitor in the furniture industry is taught through university level industrial design courses, which often lacks the focus and technical expertise that the industry requires.

The Italian furniture industry remains the model that most European countries look to as leaders. With a well-developed system of sub contracting and product development the Italian industry remains buoyant, with a long history of close involvement with designers the Italian industry should continue to prosper. Much of the furniture marketed from Italy relies on specialised production techniques for components that are generally sub contracted to other companies. This production model should also suit the shorter development and selling cycles we are now encountering in Australia. However, few Australian companies have gone down the path of this model. Closer cooperation and shared use of facilities and equipment could enhance the production capabilities of the Australian industry.

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Denmark has a number of challenges for their industry, including natural resources ( timber ) environmental waste management and a relatively small population. However, the long history of a design focus in the Danish industry has enabled there top manufacturers to continue to prosper by targeting markets where there high labour costs and lack of resources have not been problem.

# Recommendations

### For the TAFE System

- The current development of furniture design at the certificate level is likely to be inadequate to meet the needs of industry. To insure the industry moves forward in the future, future development of more relevant courses is essential. The current offering of a few subjects in an industrial design program will never succeed in providing the skills that the industry needs. Likewise the Diploma of Arts in Furniture Design is a course to prepare craft workers for self employed careers and will never be able to provide the necessary skills for the industry. In my opinion there are two types of programs that need to be developed to solve this dilemma:

- A Masters Level program. This type of program exits in overseas models and the ISS Institute is also in a position to advise on this course. To take advantage of the skill base that currently exists further training could be provided to past graduates to develop the necessary skills. ISS Institute has developed and innovative model for “Master” level training which has been developed in consultation with key representatives of many trades areas and in regard to overseas models. The ISS Institute model requires the support of government to take it to a nationally accredited course.

- Develop a furniture design course that is relevant to the industry. To achieve this the course would need to include an internship in the industry ( practical work placement ) that would provide students with a better understanding of the Australian industry and some much needed real world experience. To be successful the course would need to cover areas such as product development, quality systems, management training etc, as well as a range of design subjects and projects.

- Such a course would also be attractive to full fee paying international students as presently this type of course does not exist anywhere. This type of course would need to carry a degree qualification and could be a two plus two type of program, two years study at the TAFE level and two at the higher education level.

- A greater focus on Design Education for primary and secondary students. To effect any meaningful cultural change will requite a focus on education through the entire system.

- Include design appreciation as a part of the apprenticeship training. Though it can not be expected that apprentices will be designers, an understanding of the design process should be part of all training for manufacture.

**For the Furnishing Industry**

One of the major issues the furnishing industry is facing concerns the dilemma of engineering versus design. Although engineers are needed by the industry to help with optimising production processes using current technology, this fact alone will not ensure the continued development of the industry.

The Australian industry has demonstrated a fairly haphazard approach to CNC equipment with many small manufacturers purchasing expensive equipment that is vastly under utilised. Instead of forming partnerships and consortiums that are able to share the use of machines or processes, many companies have been reluctant to embrace this approach. Preferring to believe that they have some "secrets" that no other organisation would have. Due to this type of attitude much of the current use of technology is ineffective due to a lack of understanding of equipment and processes. Even the effective use of technology will not in itself enable companies to compete with low cost imports, an issue that is not unique to Australia.

Most successful manufacturers in Europe andNorth America have already discovered that they can not compete with the low cost production items being produced in Asia due to labour, taxation and infrastructure costs.

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To enable the industry to move forward and prosper in the future adopting a more integrated approach focusing on design and specific niche markets is likely to be the way most companies achieve a measure of success.