A West Midlands Advanced Metal Forming Centre ?

By

Malcolm S Loveday[1] , Alan Collins[2] and Richard Hall[3]

1. Materials Centre, National Physical Laboratory,
Teddington, TW11 0LW.

2. The Competitiveness Centre, University of Wolverhampton,
Telford Campus, Shropshire, TF2 9NT.

3. School of Engineering and the Built Environment, University of Wolverhampton,
Telford Campus, Shropshire, TF2 9NT.

July 2001

Project 6 NMW 4-14

ABSTRACT

The industrial support for a Metal Forming & Fabrication Centre in the West Midlands Region is considered alongside the proposals for relocation of some of the NPL Metal Working Facilities together with some equipment from other organisations.

The proposal for a Midlands Centre of Expertise is viewed in context with other recent developments occurring in the UK metals forming and processing sector.

ISSN 1473 - 2734

National Physical Laboratory
Teddington, Middlesex, UK, TW11 0LW

ACKNOWLEDGEMENT
The UK Department of Trade & Industry, EID Division, is acknowledged for financial support under the *'Support for Materials Metrology'* programme.

Approved on behalf of Managing Director, NPL,
by Dr C Lea, Head, Materials Centre

CONTENTS

1. INTRODUCTION

It was originally proposed to move the NPL Metal Working facilities from Building 15 into the new NPL Laboratory currently being built by the LASER Consortium (John Laing & SERCO) under a Private Finance Initiative(PFI) scheme for the Department of Trade & Industry. As the building progressed it became apparent that the Engineering Industries Directorate of the DTI were unlikely to continue funding for materials research in the metals forming sector. Thus it no longer seemed sensible to move the two rolling mills, the draw bench and other associated forging equipment into the new building. Therefore before merely disposing the equipment, staff at NPL felt that the responsible action was to evaluate whether there existed a need for the facilities elsewhere in the UK; so that the equipment could continue to be used for research purposes for the benefit of UK plc. The existing NPL Mechanical Working Laboratory which was built in 1962 is shown in Figure 1, and a list of the equipment is given in Annex 1.

The funding for this work was provided by EID, Department of Trade & Industry, under the Materials measurement programme. The Project also covered an evaluation of a novel 3 Cone Rolling Machine (3CRM), Figure 2, together with Finite Element analysis of the deformation processes occurring in the 3CRM, which is being undertaken at the University of Wolverhampton; details of this latter work will be given in a separate report.

2. BACKGROUND: The current status of the UK Metal Forming Industry

At the present time the UK Metals Forming and Processing industry is in a considerably state of flux due to a variety of reasons, some of which are given below (*not in order of priority*) :

1) The un-competitiveness of the UK market sector due to the relative strength of the £,
2) The lack of investment over many years resulting in out of date equipment, in particular as compared with Germany, Italy & Spain.
3) The weakness of UK employment legislation resulting in preferential down-sizing in the UK by International companies with plant in the UK and in mainland Europe, eg CORUS,
4) The worldwide over capacity in the automotive sector,
5) The 'talking down' of the relative importance of the manufacturing sector as a proportion of the Gross Domestic Product (GDP), which is currently reported to be ~ 20 % ,with out taking into account the out-sourcing of crucial and intimately linked parts of the sector over the last ten years, or so, eg, accounts, security, catering, research & testing, design, computer support etc. These now appear in Government statistics counted separately as part of the service sector. Research published by Warwick University indicates that if these outsourced parts of the industry are included, then the manufacturing sector remains at approximately 30% of the GDP, although only 14% of the workforce is now ascribed directly to the manufacturing sector.
6) The relatively high cost of wages in the UK compared with Eastern European block and Indian sub-continent countries.
7) Stringent environmental legislation relating to climate levy, health and safely, and ground pollution.

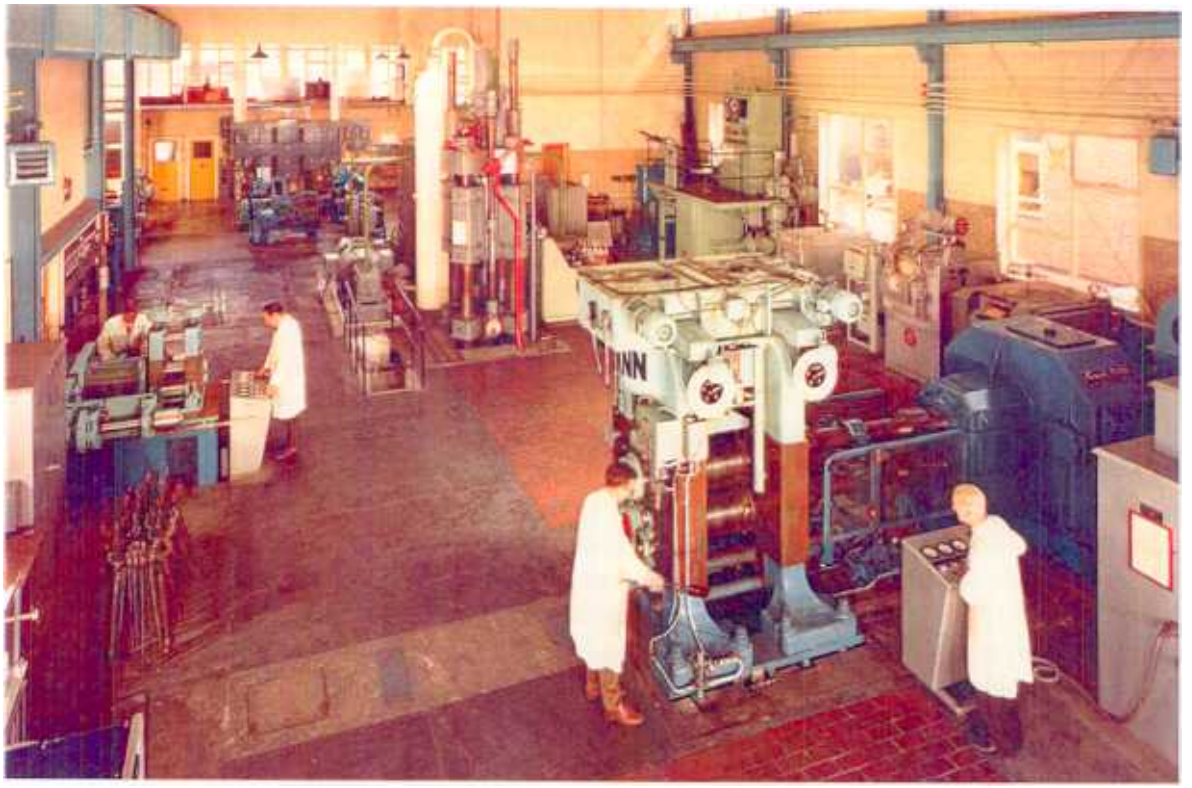

Figure 1. The NPL Mechanical Working Laboratory. The two high 260 ton hot rolling mill is in the foreground, and the 50 ton precision cold rolling mill is on the left hand side. *(NPL Photo CS/C 241)*

It has been suggested that primary processing of bulk steel, glass or polymers will be down-sized considerably in the UK, however it is still apparent that the UK can provide highly skilled and well motivated work force which may be employed for manufacturing products with high added value e.g. automotive and aerospace products. It should be noted that the development of businesses with high value added products is incorporated into Advantage West Midlands Economic Strategy. It is also recognised that advanced research is essential to maintain the competitive edge of UK companies in a world market. The UK still appears to be able to attract inward investment from American and Pacific rim companies providing them with a gateway into the European market.

There have been some well publicised examples of re-structuring of the metals sector, including preferential down sizing by CORUS in the UK, closure by Ford of car assembly lines, and the recent calling in of receivers to United Engineering Forgers (UEF), the largest automotive forging component company in the UK. However some of these actions have been partially off-set by major investment in engine plant manufacturing lines, by Ford in Essex.

Against this background there has been considerable soul searching in the UK by Industry, Government (DTI) and Academia concerning future research needs for the metal forming and processing sector.

At the time that this NPL Project was initiated, independently the UK Steel Association, the Non-Ferrous Metals Alliance, CORUS UK and Confederation of British Metal Formers (CBM) secured funding from the DTI (Metals Directorate) to commission Quo-Tec Ltd to undertake an investigation '*Does the UK Need a Metals Centre of Excellence*' [Waterman, 2001], and a number of recommendations emerged from this consultation exercise, see Appendix 2. However, it is pertinent to note that it was identified that there was a need for a 'Virtual Centre' to co-ordinate the expertise distributed through out the country. It was envisaged that it would comprise of a small office staffed with ~ 10 people, and probably located in the South Yorkshire region on the Waverley site, near Sheffield airport. It was suggested that there would be symbiotic benefits of being alongside the new Boeing–Sheffield University Technology Centre focussing of Titanium alloys, and near the probable site for the new CORUS Research Laboratory.

It was noted in the report that the metals casting industries are well served by the Casting Development Centre in Sheffield, complimented by the IRC at Birmingham University and the Oxford University Business &Science Park at Begbroke, north of Oxford. However, it was observed that there is no equivalent Centre for the Metal Forming sector.
The three CORUS Research Laboratories in the UK, namely The Welsh Laboratories at Port Talbot, the Swinden Laboratory at Rotherham and the Teesside Laboratory, which together employ ~ 1200 staff, are all to be shut down and it is proposed to build a new laboratory, on the Waverley site in Sheffield housing ~400 staff, although as yet no formal announcements have been made concerning the timescale of this rationalisation.

The Welsh Development Agency, in conjunction with Swansea and Cardiff Universities and local industry are also in the process of planning a new Manufacturing Technology Centre, probably to be located in the Port Talbot area, but again, as yet, no formal announcements have been made.

Bearing in mind this background, when NPL were approached in the summer of 2000, by John Metcalfe, the Managing Director of Tube Technologies Ltd, and a former Technical Director of Tube Investments Ltd, inquiring whether NPL could provide a home for the second generation prototype 3 Cone Rolling Machine, Figure 3, [Metcalfe, 1993], it was decided to investigate the possibility of establishing a Metal Forming Centre. It would be sensible to base such a Centre in the West Midlands, in the heartland of the metals forming industries, and accommodate various items of metals working and forming equipment which are currently being disposed from NPL and other establishments. It is important to recognise that if this R&D equipment is lost it is unlikely to ever be possible to obtain or develop it again in the UK. The loss of the equipment will therefore create a void never to be filled again which will thus deny UK research workers of the tools to undertake problem solving and innovative investigations to assist the competitiveness of the related industries for the future.

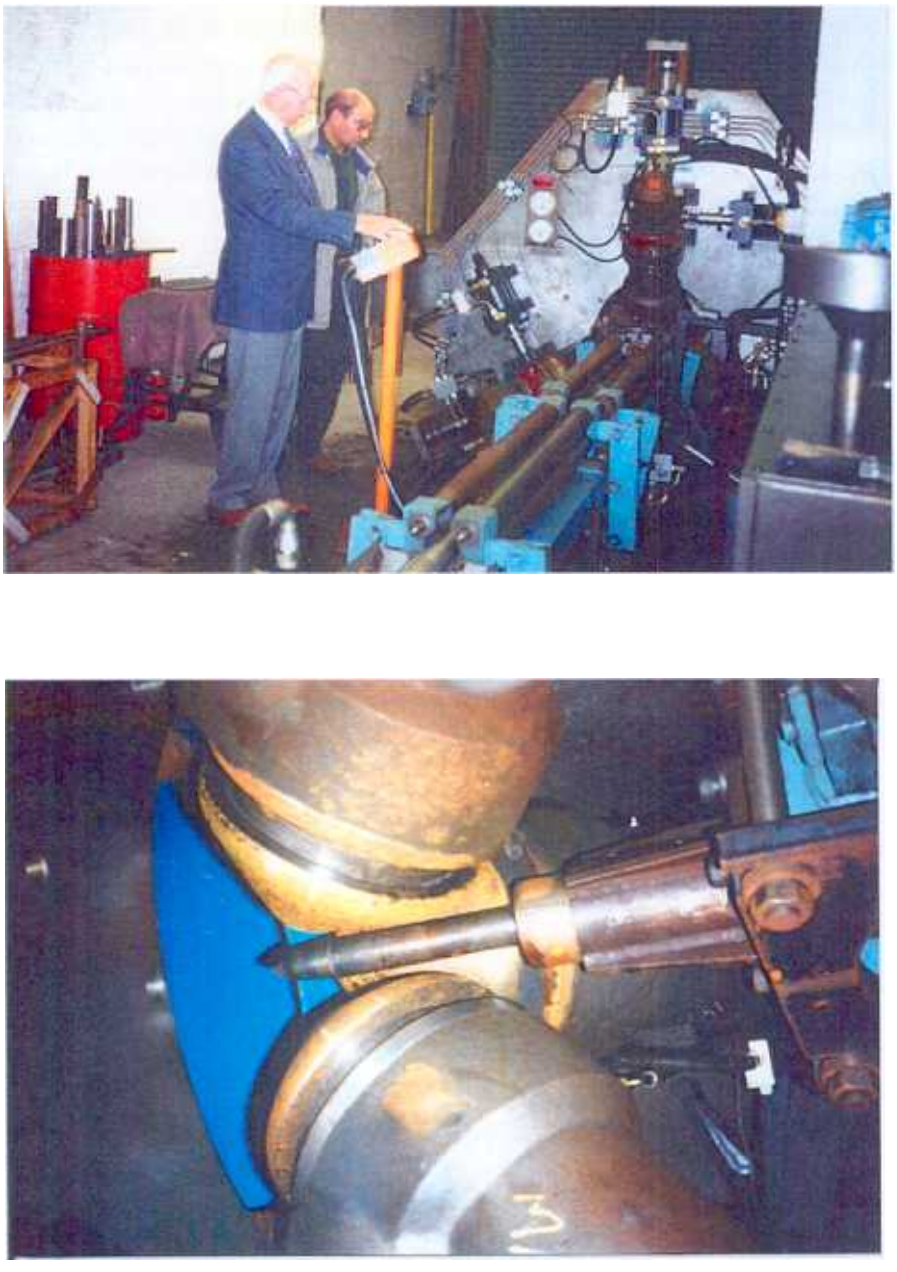

Figure 2 Second Generation 3 Cone Tube and Rod Rolling Machine, courtesy Tube Technology Ltd.

3. SCOPE OF PRESENT INVESTIGATION

3.1 Introduction

The scope of the present investigation specified that consideration should be given to the establishment of an Industrial Advanced Metal Forming Centre which could be used by a consortium of SME's for development purposes for manufacture of specialised products and Academics for research purposes. As part of this project it is proposed to undertake a feasibility study to determine whether such a Centre would be viable. It is envisaged that it would necessitate a Consortium of the majority of Universities in the UK with an interest in metal working processes(see Appendix 3), being brought together with perhaps the NPL in collaboration with the CBM(Confederation of British Metalforming) or DERA (now QinetiQ) , or some other organisations, acting as independent managers. It would be sensible to locate such a Centre in the Midlands, perhaps towards the Welsh borders to qualify for a 40% EU development grant something similar to the Innovative Product Development Centre established at the Telford Campus by Wolverhampton University, see Appendix 4. If such a Centre were established it could house the Prototype 3CRM and the 2-High 260 Ton Hot Rolling Machine from NPL and other ancillary metal working equipment which cannot be accommodated in the new NPL building.
If a Centre is established under the partial jurisdiction of the CBM, NPL, QinetiQ or other similar organisations, consideration should also be given to using the Centre as a regional dissemination or technology transfer base from which itinerate staff could operate in order to improve industry's awareness of their existence.

As part of the Project it was decided to review the UK Facilities for Metal Working Research, and to commission the Competitiveness Centre at University of Wolverhampton to make some preliminary sounding amongst the region's metal forming industries to gauge the likely support for such a Centre. In addition the value of the metals working sector in the West Midlands regional economy was assessed and a rudimentary business plan for a Centre was prepared including an estimate of the start-up costs likely to be involved.

It should be noted that in a previous NPL Report *'A Strategic Review & Business Case for Materials Processing Facility for the Centre for Materials Measurement & Technology, NPL' [Richards, 1998]* produced under a DTI funded programme, it was stated that 'The strategic case for a general, centralised and flexible Materials Processing Facility (at NPL) is very strong.' It was further noted that 'third party funding levels will not of themselves provide commercial justification', i.e. support from central funding agencies was be essential.

4. FINDINGS

4.1 New Product Introduction:

One of the present problems experienced in the metal forming companies is the lead-time to produce new products, particularly high volume products. This involves production of computer aided designs of the final (desired) product. This design is then used by the process of manufacturing engineer to design the manufacturing processes needed to shape the metal into the form of the product. This will involve computer simulations of how the metal will flow within rolls and dies. These simulations are only as good as the materials properties and the quality of the software used; which rely upon the quality of the characteristics of the materials which are input into the simulation (such as flow stress, friction parameters, heat transfer coefficients etc.). These essential parameters are obtained from necessary test equipment which should be housed in this new centre.

Even with the usage of the latest computer simulations there is still a very important need to obtain good experimental data which these simulations rely upon. The simulations also need to be verified by experimental tests to validate the quality of the numerical calculations. Once the final die design has been determined, prototype dies for the process have to be manufactured and tested. In many companies this is performed by taking the existing manufacturing line out of service, which can be extremely costly. If the prototyping and problem solving can be performed in this metal forming centre (off-line) prior to installing in the actual production line, there are obvious cost savings, reducing the on-costs of product introduction. This in turn will improve the competitiveness of our UK industries.

4.1.1 Research & Development:

Research work will also be carried out in the centre by Universities in the West Midlands region, which will lead to new techniques and findings which will enable novel manufacturing techniques to be made available particularly to the automotive and aerospace industry. One example of this is the work of Professors Hall & Mihsein,(1999) [1], in collaboration with the University of Aalen, Germany, where a novel process (that of Hydro-forming of complex tubes) was perfected to metal form the BMW 5 and 7 series rear suspension carrier from aluminium alloy. This has given BWM the edge not only with their manufacturing process but also with their product design, through this novel manufacturing process.

4.2 Existing UK Facilities

At the outset of the exercise it was decided to briefly prepare an inventory of current and recently closed down metal working facilities in the UK, since if there is a clear over-provision of research facilities it would be extremely difficult to justify the establishment of a new Centre and the current surplus equipment could be legitimately disposed. Informal inquiries revealed the information shown in Table 1 relating to the provision of Hot Rolling Mill available for research investigations in the UK. Some of the information relating to the specifications of the mills may only be approximate, and it is possible that other facilities exist somewhere in the UK but they are not widely publicised. Independent decisions taken in the last few years by a number of organisations (some not listed in Table 1) have resulted in

a significant decline in the research facilities available in the UK for hot rolling. A number of establishments also still have smaller precision cold rolling mills e.g. NPL & Incotest, etc.
It is clear from examination of the information given in Table 1 that apart from the small instrumented mill at Sheffield University, and the flat mill at QinetiQ, Farnborough, (which may also be under threat for commercial / space saving pressures as the establishment now come entirely into the commercial market place) there are now very few facilities available for research workers in the UK. Both Alcan & CORUS retain in-house research mills, but they are not generally available to the wider research community.

In addition the NPL Mechanical Working Laboratory, Building 15, houses a number of other items of metal forming equipment, including a 50 ton precision cold rolling mill incorporating a Shear Force Sensor making it a unique facility in the UK. There is also a wire drawing bench, a drop forging hammer and a 750 ton extrusion press. The latter press is probably beyond economic repair however it is currently being used a compression machine in conjunction with the NPL Big Friction Rig, Figure 3, which is one of the recent success stories from the DTI Materials processing Programme, (Brooks et al, 2001).

Figure 3. The Big Friction Rig at NPL, interfaced to the 7MN press, used for measurement of friction coefficients under forging conditions.

It is hoped that the Big Friction Rig will be retained at NPL, interfaced to one of the large presses in Force Section. However if this proves impossible it is another of the items that could usefully accommodated in a Regional Metal Forming & Fabrication Centre.

It should be noted that at the time of writing this report, the 260 ton hot rolling mill at NPL has been dismantled by Burton and Smith in a careful manner and put into temporary storage at a cost of over £10k, which has been paid by the DTI as part of the NPL relocation expenses. It will therefore be possible to rebuild the mill at a new location at some time in the future provided funding for the storage costs are forthcoming; otherwise it also will be scrapped.

Reference	Location	Specification	Status
1	NPL	260 ton Mann, with eight sets of rolls, including flats, rounds & gothic sections	(now dismantled & in storage) 2001
2	Swansea University	~ 250 ton flat rolls	Scrapped, 2000
3	AEA Technology, Harwell	~ 250 ton, flat & rod mill	Scrapped , ~1998
4	Birmingham University	~ 200 ton flat mill & 50 precision mill	Scrapped. ~ 1993
5	QinetiQ, Farnborough (formerly DERA / RAE)	~ 200 ton flat mill	Still available, mainly used for Aluminium alloys
6	Sheffield University	50 ton Hille mill ('SMART')	Instrumented mill, Operational
7	IncoTest, Hereford	Marshal Richards multispeed reversing two high, 250mm wide, 460 mm dia. rolls	Out of action, Un-instrumented, Could be re-commissioned if needed
	RESTRICTED ACCESS	**COMMERCIAL**	**MILLS**
8	CORUS, Swinden Lab.	~ 200 ton	To be scrapped ? 2002
9	CORUS, Teesside Lab.	~250 ton	To be transferred to new Sheffield Lab ? 2002
10	ALCAN, Banbury	~ 150 ton, flat rolls	Operational

TABLE 1. Summary of Hot Rolling Research Mills in the UK

4.3 West Midland Industrial Support

Examination of the customer base of Advanced Technology Centres clearly demonstrate that for the symbiotic relationship to work effectively, the geographical proximity of industrial partners is a significant factor. Since it is apparent that provision will probably be available for Metals Research Centres in the South Yorkshire & South Wales regions, it therefore became apparent that it would be sensible to consider the West Midlands as a natural location for a new Centre of Expertise focussing on Forging, Metal Forming and Fabrication. The Competitiveness Centre at Wolverhampton University were therefore commissioned to evaluate a) the strength of the local economy in the metals forming sector, & b) the support likely to be forthcoming from local industry for underpinning a new Centre of Expertise.

Figure 4. West Midlands Region

The West Midlands region encompasses the area shown in Figure 4. Within the area a total of 2.4 million are employed and the Gross Domestic Product of the Region is approximately £60 billion of which ~10-15% is created by the Metals Forming and Processing Sector. There are a large number of Small Manufacturing Enterprises covering the forging, whiteware goods, automotive, and general engineering supply chains. Further details of the contribution to the economy of the region are given in Appendix 5.

The likely support by local industry for a new Metals Forming Research Centre was gauged by a telephone survey following and initial letter, to approximately 300 companies, which

highlighted the concept of the Centre. To date 45 companies were followed up by a telephone survey to provide a response to the two prime questions:

1) Can you envisage that a Regional Metal Forming Centre would be of benefit to your company or industry?

2) If so would you actively support it?

In excess of 20% of the respondents answered possibly to both questions, their response being conditional on the exact nature and activities of the Centre.

It was concluded that an initiative in the area of metal forming, if correctly structured and meeting the specific needs of the "Customers", could be well received by a significant proportion of businesses engaged in the metal forming related sectors and that the economic benefits to the Region could be significant. Further details of the survey are given in Appendix 6.

4.4 Provisional Costs for a New Centre

Expenditure : (Renting a building)

Item	Year 1	Year 2	Year 3	Year 4
Transport & storage of 260 ton mill	~£10k			
Preparation of detailed business plan, reviewing build / rent options, design layout of facility	~£25k			
Preparation of grant applications	~£10k			
Rent & rates		£58k	£58k	£60k
Rent of skills /. Facilities from the Competitiveness Centre, eg Admin support, FE Analysis, machine shop, prototyping etc		£10k	£20k	£30k
Transferring and re-commissioning equipment		£122k		
Management & admin support		£15k	£ 30k	£35k
'Salesman'		£30k	£45k	£45k
Technicians		£10k	£20k	£40k
Research associates			£30k	£60k
Consumables a) Engineering b) Administration		£10k £3k	£20k £7k	£30k £10k
Marketing		£25k	£35k	£25k
Totals :	**£45k**	**£283**	**£265**	**£335**

Note1: The overheads have been provisionally costed at 50% of direct labour costs.
Note 2 : The purchase / new build option would probably cost an initial outlay of ~£2 million, but would reduce the annual running costs by ~£50k pa.

It is envisaged that a building to accommodate the proposed Metals Forming Centre would need to be a workshop approximately 15 x 25 m with an overhead crane with a ~5 tons SWL, together with some associate office accommodation.
It should be noted that the costs given in the above Table should be regarded as the minimum costs likely to be involved, and the figures are less than those given in Appendix 7, since the phasing of the employment of the staff has been taken into account and no provision has been included for purchase of new capital equipment.

Projected Income

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Industrial Contracts		£5k	£20k	£60k	£70k
EPSRC Projects			£40K	£70k	£80k
DTI Research Projects			£50k	£100k	£120k
European projects			£25K	£75K	£100k
Totals		**£5k**	**£135k**	**£285k**	**£370k**

Shortfall

Clearly if this Centre is to be viable, then the short fall in the cash flow would need to be off-set by pump priming funding in the form of grants or loans, preferable from government of European sources.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
RDA/ DTI Pump priming ?	£45k	£278k	£130k		
Profit	-	-	-	£20k	£35k

Thus the total start up investment required is £453k over a three year period.

5. RECOMMENDATIONS

This Report should be circulated widely for comment to potential stakeholders.

2 A meeting should be convened with representatives from Universities interested in Metal Forming to discuss potential support.

3 Discussions should be held with potential funding agencies, including the DTI and the West Midlands Development agency.

4 Funding should be sought for a Detailed Feasibilty Study which should include the preparation of a detailed business plan, specific information concerning possible locations, and firm estimates for moving and re-commissioning appropriate equipment.

5 Funding must be found to cover the temporary storage of relevant equipment, eg the NPL Rolling Mill etc.

6. CONCLUDING REMARKS

The preliminary feasibility studies for a regional Advanced Metal Forming Centre based in the West Midlands indicate that such a Centre could be justified and could be self supporting in the space of about four years. The costs involved are a small fraction of the Regional GDP attributable to the Metals forming and processing sector and would help to keep the sector competitive in the global world market.
It is important that such a **Centre of Expertise** should compliment other existing, or planned, centres elsewhere in the UK, and should be available to University, Industrial and research organisations alike.

It is important that a new centre is driven by existing and perceived new industrial needs and should therefore accommodate equipment that can address those needs, thus the centre layout should be designed around a flexible working environment and may need to acquire additional equipment to undertake research in new area, e.g. hydro-forming, fabrication of nano-strengthened materials as well as housing basic metal forming and processing facilities.
It is proposed that the issue should be pursued as a matter of urgency so that the surplus metal forming equipment from NPL and elsewhere may continue to be of benefit to UK plc.

7. ACKNOWLEDGEMENTS

The financial support of the Engineering Industries Directorate, DTI, under the *Materials Measurements Programme* is acknowledged
Constructive discussions with Prof. Richard Hall, Dept Engineering & the Built Environment, Wolverhampton University have been held throughout this investigation. The help of John Metcalfe of Tube Technologies Ltd is acknowledged for help in identifying relevant companies to contact for the market survey. The staff of The Competitiveness Centre, namely Sally sweet, Mike Simpson and Christine Phillips are thanked for the help with the surveys. Helpful comments on the draft manuscript have been provided by Dr Peter Quested, NPL.

8. REFERENCES

Bauer, H, Mihsein, M, Andreas, H, Hall, F.R. (1999) ,*Production Safety for Hydroforming Products by using FEA Techniques.*' NAFEMS World Congress '99, Newport USA, Volume 1, p. 475 – 484, ISBN 1 874376 25 5

Brooks, M., Loveday, M.S. and Gee, M.G. *'NPL Friction Measurement Methods: Data Assessment and a Simple Database'* NPL Report MATC (A) 13, Pub:NPL, June 2001.

Metcalfe,J *'Rolling Mill'* UK Patent GB 2 238 500 B , May 1993.

Richards, B.P. *'Materials Processing Facility for CMMT: A Strategic Review & Business Case'* NPL Report CMMT (D) 154. , July 1998.

Waterman, N.A. *'Does the UK need a metals centre of excellence?'* Report of an investigation prepared for the DTI by Quo-Tec Ltd, February 2001.

APPENDIX 1. Metal Working Facitities Currently at NPL.

March 2001 .

Rolling :

1) **260 Tonne Hot Rolling Mill**
   2 High Rolls, Albert Mann
   16 inch diameter rolls, maximum width ~ 20 inches
   Approximately seven sets of rolls, including flat, round and gothic profiles.

2) **50 Tonne Stann Mann cold rolling mill**
   2 high or 4 high configuration,
   One flat roll instrumented with Jesuit shear force probe with inductive slip rings (unique in the UK)
   Several sets of rolls, including flat and round profiles.
3) **Electric driven small rolls, (W.A Robertson)**
4) **Bench mounted roll**

Forging

1) **Massey 5cwt drop forging hammer**
2) **Small hydraulic press 50 tons**

Extrusion

700 ton high rate Fielding vertical press, for extrusion up to 1350°C ram speed 0 – 250mm/s with a range of die sets.

Wire Drawing

Electric driven bench, with dies from 3mm down to 0.125mm

Gas Torch work bench

Heat Treatment Ovens

Miscellaneous tools, tongs, die sets etc.

Overhead crane spanning the laboratory

Notes:

1) The Fielding press is now rather old and would really require refurbishing with a modern hydraulic control system. It may not be economic to justify its relocation.

2) The 260 tonne Hot Rolling mill will cost approximately ~ £60k to relocate, including replacing the electrical control system to comply with IEEE regulations (based on estimate supplied by Arronquote Ltd, October 1998)
3) The heat treatment ovens would need the linings dismantled and rebuilt; it may not be an economic proposition to move them
4) The original proposed dimensions for the mechanical working and processing laboratory in the new NPL Laboratory was approximately 12m x 15m , not including offices. This would have accommodated most of the equipment listed above except for the fielding extrusion press, however space was allocated for a smaller ~300 ton hydraulic press, but funding was not forthcoming. This press would have also required a separate plant room to accommodate the pumps.

Consideration should be given to accommodating the 3 Cone Rolling Mill and some additional equipment from other organisations.

APPENDIX 2.

Paraphrased Finding from the Quo-Tec Report *'Does the UK Need a Metals Centre of Excellence ?' February 2001*

[Compiled by Malcolm S Loveday, NPL, July 2001]

INTRODUCTION

Quo-Tec Ltd conducted a countywide consultation exercise during the Autumn of 2000, and obtained over 100 responses from over 100 individuals including industrialists, academics, consultants, representatives from Trade Associations, civil servants and others from Research & Trade Organisations (RTO's) and Regional Development Agencies (RDA's). A discussion meeting was held at the Olympia Hotel, Kensington, London to present the preliminary findings in January 2001, which was attended by approximately sixty delegates. Presentations at the meeting highlighted the following:

- Declining industrial R& D base in the traditional metals sector.
- Comparison with Fraunhofer, Max Plank, Virtual (NL) , NCEMT(USA) & other Centres overseas.
- Recent Initiatives including IRC's, Faraday, LINK, DERA (QinetiQ) , IMPETUS (Sheffield) etc.
- The impact of out-sourcing various aspect of manufacturing , including research & testing,short supply of qualified process engineers & inadequate training programmes.

FINDINGS

The findings of the industrial consultation exercise indicated that:

1. 92 constructive responses were received, 30 no response,
2. Is there a need for a Centre? : a) 84% yes, if it fills gaps and does not compete of duplicate existing centres.
   b) 60% support the need for a 'Virtual' centre to co-ordinate existing expertise and to provide a single point of contact as an Advisory Centre.
3. A Centre for Innovative Processing of Metals into Finished Components & Products could be established probably in the Sheffield area with shared facilities sponsored by co-located companies.
4. A Centre for Improved Efficiency & Safety of Process Plant & Equipment would be worthwhile investigating with support from a Regional development Agency.
5. A centre to transfer aerospace metals technology into an 'Aids for Independent Living' merited further investigation and is being championed by Prof. George Smith, from Oxford University.
6. It was noted that although there is a successful centre for the casting sector (the Casting Development Centre, Sheffield), there is not the equivalent for the Forging and Metal Forming sector.
7. A number of delegates support the view that such centres would receive better support from industry if there were genuine **Centres of Expertise** rather than self proclaimed Centres of Excellence.

APPENDIX 3.
UK Universities involved with Metal Forming Research

It is believed that the following Universities, most of whom are members, together with NPL of UK Forgenet, undertake research related to metals forming:

Bath
Birmingham
Bristol
Cambridge
Imperial College
Leeds
Leicester
Nottingham
Oxford
Sheffield
Strathclyde
Swansea
Wolverhampton

APPENDIX 4. Innovative Product Development Centre, University of Wolverhampton, Telford Campus.

fact file

Innovative Product Development Centre

The Innovative Product Development Centre (IPDC) is part of the University of Wolverhampton's Innovation and Technology Transfer strategy, which aims to assist companies in the West Midlands to become more competitive. Housed in purpose-built Telford Campus premises within the School of Engineering and the Built Environment – the IPDC's specific aim is to encourage companies to take commercial advantage of advanced rapid product development and manufacturing technologies.

Wealth of experience

The Centre combines state-of-the-art computer-aided design and rapid product manufacturing with reverse engineering capabilities and offers access to the most modern software, rapid prototyping, CNC machinery and metrology equipment.

Managed and supported by a team with a wealth of experience in product development and manufacture – in both Small to Medium sized Enterprises (SME) and larger organisations – the Centre encompasses a full range of technology transfer and innovation activities and also offers seminars, demonstrations, consultancy and equipment hire.

Project partners

These activities will not only call upon the expertise within IPDC, but also that of its partners; BPTA, TCAT and other University Schools and Departments.

To find out how to gain access to these facilities, please see the contact details on the reverse of this leaflet.

Range of manufacturing

The SLS Sinterstation Rapid Prototyping machine is a radical new development in Time Compression Technology, capable of producing complete components in just a few hours.

The SLS Sinterstation 2500 Plus

Raw material, usually a nylon powder, is selectively sintered, layer by layer, by a CO_2 laser, to form a complete solid structure of remarkable resolution and surface definition.

The machine only needs a CAD type file of data to create an extraordinary and often complex item – in flexible, solid or even metal form – that would often be impossible to produce by conventional means.

The number of potential applications is immense and includes rapid tooling, new product prototypes and medical uses.

Multi-Axis CNC Machining Centres

the competitiveness centre

UNIVERSITY OF WOLVERHAMPTON

European Regional Development Fund

nnc hi

fact file

CNC machining centres

The Centre also boasts a variety of four and five axis CNC machining centres fully-equipped with the most advanced form of tooling, probing, component loading and control software.

The four axis machine is believed to be the only machine in the country that, during the cutting process, allows Nitrogen to be used as a coolant to further enhance the technological capabilities.

The CNC Turning capabilities include multi-station live tooling, which enables the machining of features in different axes without part removal. Parts can be both automatically loaded or unloaded by robot or, for large volume production uses, material can be automatically bar fed.

Multi Station CNC Turning Centre

Wire and die sinking

There are both wire and die sinking multi-axis EDM (Electrodischarge Machines) capable of cutting fine features on hard metals to produce the punches, dies and mould tooling used, for example, in the injection moulding, forging and presswork industries.

Computer-aided design

A library of computer-aided design and manufacturing software complements the range of CNC equipment and facilitates NC code generation for all of the Centre's machines.

Reverse engineering

The Centre houses the most advanced IMS Merlin CNC Co-ordinate measuring machine – with its 3D non-contact scanning head – which allows all

Multi-Axis Wire EDM Machine

surface features to be quickly digitised and transported to a CAD file.

The data it produces can then be used, for example, in finite element analysis work or sent to the rapid prototyping machine to replicate the original part (reverse engineering).

Merlin CNC Co-ordinate Measuring Machine

For further information on the expertise and facilities of the IPDC, or to arrange a visit, please contact Dr. Alan J. Collins or Mike Simpson.

Telford University Campus, Priorslee
Telford, Shropshire TF2 9NT
Tel: 01902 321780/323933
Fax: 01902 323843
E-mail: ipdc@wlv.ac.uk
http://www.competitiveness-centre.co.uk

the competitiveness centre

APPENDIX 5.

Value of Metal Working Sector to the West Midlands Economy

Prepared by

Dr Alan Collins,

The Competitiveness Centre, University of Wolverhampton

INTRODUCTION

The original terms of reference were to estimate the monetary value of the metal working sector into product types e.g. Automotive, Aerospace, White Ware Goods & others within the West Midlands Region. This level of detail is not readily accessible from sources such as The Office for National Statistics, neither are the forecasts for the next five and ten years. This draft report therefore details the importance of four metal working related sectors to the regional economy.

METALS, PROCESSING and PRODUCTS

Though there is now very little primary production of iron and steel in the West Midlands, but the region still remains the UK's main concentration of metalworking and metal based industries. The metal-based processing and products industries employ 140, 000 people, which is 6% of the total employment within the area (circa. 2,400,000). The level of employment in the sector is little changed over the last decade.

The metal processing and products sector has 11 ' high point' industries within the region, the top three are:

SIC * CODE	INDUSTRY	% of UK INDUSTRY	REGIONAL EMPLOYMENT
28400	Forging pressing and roll forming of metal	41.3	16700
28740	Manufacture of fasteners screw machine products, chains & springs	41.3	7400
28510	Treatment and coating of metals	33.6	9300

*SIC = Statistics Information Centre

AUTOMOTIVE (SIC 3410)

Despite the movement of the automotive industry away from the region it remains the core of the UK automotive sector. Approximately 20 per. cent of UK employment manufacturing cars, i.e. 16300 jobs are located in the region. This sector is heavily supported by the metal processing and products sector.
Note: The region has a strong presence in all automotive related industries which employs some 120,000 people in the region.

INDUSTRIAL EQUIPMENT

This sector also relies heavily on the regions metal processing skills, the sector includes 19 industries and employs some 90,000 people, which has again remained unchanged over the last decade.

WHITE GOODS- DOMESTIC APPLIANCES (SIC29710)

Just Over 7400 people are employed in the West Midlands in this sector.

CONCLUSION

The above metal processing related sectors account for in excess of 250,000 jobs (ignoring automotive related industries) in the region approximately 10% of employment. The value of the sectors to the region can be estimated using either the average gross domestic product per. employee of £25,000 or the manufacturing gross domestic product of £38,000. This gives a GDP for the sectors of between £6.25billion and £9.5 billion, some 10% to 16% of the regions GDP of £60 billion.
Because of the nature of the sectors the true figure is likely to be some where between the extremes.
Advantage West Midlands internal economic reports are to be made available to the investigation and may be the source of more detailed information.

APPENDIX 6.

MARKET SURVEY – West Midlands REGIONAL METAL FORMING CENTRE

Prepared by

Dr Alan Collins,

The Competitiveness Centre, University of Wolverhampton

INTRODUCTION

Some 300 plus companies have been contacted with regards to the Regional Metal Forming Centre. To date 45 have responded to the telephone survey on the desirability of the Centre. As with all surveys of this type it has proved to be difficult to initially engage with the companies. However, there were companies that showed a positive interest in a 'metal forming' Centre.

RESULTS

The response to the two prime questions:

3) Can you envisage that a Regional Metal Forming Centre would be of benefit to your company or industry?

4) If so would you actively support it?

were as follows:

Question	Yes	No	Possibly	Total
1)	12	23	10	45
2)	10	27	8	45

Only 8 companies responded yes to both questions. They were:

Brookes (Pressings) Ltd.
Corus
Leslie Group
McMillan Conroy Machinery
Pressfab Sections LTD
Richco Steel Services
W H Tildesley
Yeoman Pressings LTD

Those that responded **no** to both questions (approx. 50%) were characterised by companies that:

) Could not identify with the activities of the Centre.

2) Were inward looking because:

   i. They were struggling to survive.
   ii. They believed they know everything appropriate to their processes.
   iii They had a competitive advantage that they believed could be eroded by participating in such an initiative.

In excess of 20% of the respondents answered possibly to both questions, their response being conditional on the exact nature and activities of the Centre.

CONCLUSIONS

An initiative in the area of metal forming, if correctly structured and meeting the specific needs of the "Customers", could be well received by a significant proportion of businesses engaged in the metal forming related sectors. However, the market needs would have to be researched in more detail. As with other initiatives the benefits of true "cluster" activities would need developing with both the companies and participating "organisations", initially on a one to one basis. The difficulties and extended time scales of such activities should not be under estimated, however the economic benefits to the Region could be significant.

APPENDIX 7.
PROVISIONAL BUSINESS PLAN

Prepared by
Dr Alan Collins,
The Competitiveness Centre, University of Wolverhampton

INTRODUCTION

Attached is a provisional business plan, based on relocating and commissioning the NPL equipment within rented accommodation. The plan is based on the proposed Centre developing " true cluster" activities within the Metal Forming Sector. The assumption has been made that existing Competitiveness Centre activities are complimentary to that of the proposed Metal Forming & Fabrication Centre in that they are targeting the same customer base. Therefore some resources, particularly in the area of Management, Administration and Technical Support could be shared.
The synergies between The Competitiveness Centre, The Metal Forming Centre and the Die Casting Centre and their proposed links to other Centres of Excellence and the emerging SBS's via The Rover Task Force Corridor Initiatives would result in a powerful consolidated approach to assisting the Metal Forming Sectors with the Region.

RELOCATION AND COMMISSIONING COSTS – CAPITAL EQUIPMENT

These are based on figures provided by NPL. The total cost with contingencies is ~£122,000.

Consideration should be given to making a provision for an additional capital spend because of:

i. The age and condition of the existing equipment at NPL.

ii. The diverse nature of the metal forming sectors. With appropriate facilities the " possible supporters of the Centre", see Draft Market Survey, (Appendix 6), could be converted into active participants.

An additional market survey should be undertaken to specify the additional capital expenditure to meet the Sector's needs.

Other capital equipment associated with administration, design, prototyping, Finite Element Analysis and metal machining are available within the Competitiveness Centre and could be made available to the Metal Forming Centre. Such facilities would have to be available to the Metal forming Centre either internally or from a third party. These

facilities have been costed into the annual budget as Rented Equipment Costs of £30,000 per. annum.

ACCOMODATION COSTS

These are based on rented accommodation using figures from Wolverhampton Science Park Ltd. Other commercial rates would be similar within the Wolverhampton /Black Country area.
Direct Rent and rates amount to circa £58,000 per. annum.

A dedicated separate build would cost several million pounds. The possibility exists of incorporating the Metal Forming Centre's accommodation requirements within phase 3 of the Science Parks Development, either as a dedicated tenant or as a contributor to the capital build with a reduced accommodation cost.

The alternatives and sources of funding should be further pursued

STAFFING

The staffing levels are based on the Centre facilitating, participating and encouraging true " Cluster Activities" in the Metal Forming Sector. The economic benefits of clusters are well documented. However, before those benefits can be achieved it is also recognised that in general, within traditional sectors, there has to be a change in the " mind set" of companies and organisations involved in the sector. This requires a team that is dedicated to promoting and delivering cluster activities.

The Competitiveness Centre is engaged in " Cluster Development" in related sectors such as the Advanced Engineering Cluster and could therefore encompass the Metal Forming Sector. Management and Administrative support has therefore been costed on a shared basis (50:50) at £34000 per annum. This would have to be increased to £70,000 per annum if separate staffing was deemed appropriate.

Experience has shown that engaging with companies is the most difficult aspect of providing support to companies both large and small. The best approach is the direct contact with companies via a "Salesman". Again the Competitiveness Centre is engaged in this activity and would be able to support. However, a dedicated person has been allocated to this role specifically for the Metal Forming Centre, at £45000 per. annum inclusive of all on costs such as travel.

Two Associates have been costed into the programme at a total cost of £60,000 per. annum. They would be responsible for the technical development of the Centre's activities particularly those associated with the Development of Cluster activities but also in the area of research - such as 3 Cone Rolling etc. These associates would be assisted by two Centre Technicians (Cost £ 40,000 per. annum).

MARKETING

A promotional budget of £50,000 per. annum has been allocated, for Brochures, Advertising and other promotional activities including Web site development.

CONSUMABLES

Technical consumable materials, etc have provisionally been costed at £30,000 per annum.

Administrative consumables have been costed at £10,000 per. year.

OVERHEADS

These have provisionally been costed at 50% of direct labour costs.

SUMMARY

Initial set up costs i.e. relocation and commissioning have been costed at circa £122, 000 a provision of up to M£0.5 should be made for the purchase of additional capital equipment to meet the diverse needs of the sector. Provisional annual costs are circa. £480,000 per. annum based on the integration of the Management of the Competitiveness Centre. To develop a "true cluster activity" within the metal forming sector is estimated will take 3 years. Therefore a total funding package of circa. M£1.6 to M2.1 over the first three years is required to pump prime the activity, which is an extremely small fraction of the GDP of the sector in the region. Beyond the initial three years it is envisaged the Centre would be self-financing.

AJC March 27 2001