The First 50 Years

By Professor Andrew Plummer
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In the beginning...

The Centre for Power Transmission and Motion Control was originally called the Fluid Power Centre, and was established in September 1958 as part of the School of Engineering at the Bath University of Technology. Fifty years later, and with a change of name and a broader remit, the Centre is still thriving, now as part of the Faculty of Engineering and Design at the University of Bath.

When the Centre was founded, the University was based in Ashley Down, Bristol. The first site of the Fluid Power Laboratory was an old coachhouse. The new facilities opened two years later at the current Claverton Down campus with a significant improvement, supplemented in 2002 by a dedicated research building. If East. There have been significant changes since. The Centre’s fifty-year anniversary, but the broad objectives of the Centre have endured. In the first Annual Report in 1971, these objectives were stated as being to provide engineering consultancy and to undertake research in fluid power. The involvement of industry in all of these activities was considered as priority. The balance between activities has shifted through the years with an increasing emphasis on industry, and a diversification beyond fluid power. However, the elements remain the same with the beneficial effects of cross-fertilisation recognised from the early days. The strong commitment to industrial involvement is also unchanged. The Centre was established with a grant of £17,000 from the UK government. The Centre was one of a number of similar bodies provided with “pump priming” funding at that time by the University Grants Committee in response to the Bosworth Report (1969), which sought to improve the training of graduates within manufacturing industry. The Centre was the only one of these bodies to survive five years, let alone fifty years. The founder and first director of the Centre was Ted Bowns, and the success of the Centre owes much to his vision and energy. Following National Service in the Royal Navy as an aircraft engineer, Ted began his academic career in 1953 when he was an Assistant Lecturer at Nottingham and District Technical College. Three years later he took up the role of lecturer at Bristol College of Technology. (left: Ted Bowns (centre), and Martin Levrone, David McCarthy (sitting), with course delegates, 1980).

The Centre’s 50th reunion: Ashley Down, Bristol, today is part of City of Bristol College.

Joining the fledgling Bath University of Technology in 1955, Ted retired in 1987, and was succeeded as Centre Director by Cliff Bournes, recruited from the University of Strathclyde. In 1982 Kevin Edge was appointed Deputy Director. Under Cliff’s leadership, the Centre’s national and international research profile was greatly enhanced. Following Cliff’s retirement as Director in 2005, Kevin acted in the role for a year before the appointment of Andrew Phummar. Patrick Keogh succeeded Kevin as Deputy Director in 2006, after the latter’s appointment as the University’s Deputy Vice-Chancellor and Subsequent reappointment in 2015.

The Centre changed its name to Power Transmission and Motion Control in 1988. This was both to represent the breadth of expertise within the Centre more accurately, and also reflect the changing role of technology, being adopted by industry. Then in the year 2000, the success of the Centre was recognized through the award of the Queen’s Anniversary Prize for Higher and Further Education. Another milestone in 2005 was a successful bid for funds for a new research building to house the Centre’s researchers. Completion of this in 2007 was followed by its official opening by the Duke of Kent the year after. As well as office space, the building houses three laboratories, video-conferencing facilities, a virtual reality suite, a seminar and meeting rooms.
Continuing professional development courses for industrial engineers

The University Grants Committee had recommended that courses should be from one to three months long. In the first academic year 1963/64 a total of 20 students attended courses of nine-weeks' duration. However, companies found it very difficult to release employees for such long periods. The same of one-week modules courses worked at this stage and these were replaced in the final stage of the modules when they were reduced to 4 days duration. The first year of the modules courses the total attendance was 180 delegates. The attendance figures reached a peak in the mid 1960s of over 350 delegates spread over 22 courses.

The pneumatic course was always the largest in numbers despite good support from the pneumatic manufacturers. From the first 14 delegates the number gradually reduced until they were dropped entirely in 1964. The hydraulic courses remained the mainstay of the courses, but of course the syllabus content has changed substantially over the years. An electrical drive course was one of the outcomes of a substantial Masters Training Package grant in 1966. Another product of this funding was a possible distance learning CD course that provided an introduction to hydraulics. A drop in annual delegate numbers in the mid 1970s led to a double figure was reversed, and after 1979 the CPO course continue to successfully provide specialist education in hydraulics, electrical drives, control systems and dynamic simulation. For example, in 1977 150 delegates were taught over ten (shorter) day courses, including basic courses for Airframe and Engine Maintenance and simulations and lubrication P
test the first 10 years...
Research

The research activities of the Centre have both strengthened and broadened significantly since the early days. There were four main areas of interest referred to in the first report: hydrostatic transmission dynamics; hydraulic stepping motors; the dynamics of hydrostatic bearings; and dynamics of pneumatic systems. Trials began in 1972 on gear, vane and piston pumps to discover the causes of noise, with a view to improving future designs. By 1974 there were ten full-time research staff and students working within the centre.

Within the next five years the research activities expanded to include the measurement and characterisation of contamination in hydraulic systems; transmission and alternation of fluid borne noise; increasing the efficiency of pneumatic systems and simulation of soft power and hydraulic transmissions. Over the following years all of these activities grew and were supported by major grants from a variety of sources, with the "Computer aided design of fluid power systems" started in 1979 in a project sponsored by the Ministry of Defence from their recently established Central research Authority for the Royal Navy at Fareham. The use of computer-aided design has been an important activity within the Centre from that time. The Hydraulic Automatic Simulation Package (HASP) developed into the simulation package RainFlo. When Dirtydye, developer of RainFlo, left the Centre in 1993 to join Boeing, he was instrumental in commercialising the package as HASP+; now a very widely used Siemens product. Much of the Centre's research over the last three decades has included simulation as an integral part, and RainFlo along with several other commercial tools are now in use.

Other significant research areas have included magneto-rheological bearing dynamics and control, and real-time dynamics. New methods for producing fluid borne noise were developed, now sold commercially to the software tool RainFlo. Throughout the 1980s, the government funded Engineering Design Centre in Fluid Power Systems provided a focus for research into fluid design. In 1990, the Engineering and Physical Sciences Research Council introduced its new Reform Grant scheme, designed to support major research groups. PTMC was one of the first groups nationwide to receive this funding, which was renewed for a further five years in 2004. Several other major research groups have grown out of work started in PTMC, including the E3 (Engineering for Ergonomics and Education) and Manufacturing Research Centre from 2001 and 2011, and automotive powertrain developments in the 1990s, which formed part of the Automotive and Vehicle Research Centre, which has since developed the E3 Engineering Institute for Advanced Automotive Propulsion. A few current professors in the Department: out of their early research work in the Fluid Power Centre, as well as Hammar and Heggel, these are Chris Beattie, Dan Allwood and Maryke McManus.

New research directions include piezoelectric actuators, smart materials, robotics and autonomy, complementing our continuing fluid power interests for designing quieter, smarter and more efficient hydraulic and mechanical machines.
Staff

To the CFD course delegates, the ‘face’ of the Centre is the course organiser. The first Course Supervisor, Ken Fosker, retired in 1983 and was succeeded by John Beattie. Peter Chaple took over in 1983 as the Centre Manager for 14 years, before taking up a professional position in Norway. For 15 years from 1986 the courses were run by Matt Bickel. His duties were subsumed within the role of Technical Manager, a position which was filled by Michael Scholze in December 2007. Following a major revamp of three of the courses, Michael left to work for Continental in Germany, and was replaced by Jens Kölner in 2014, who continued the course redevelopment. Jens is also responsible for managing the Centre’s consultancy activities.

There have been several members of academic staff who have worked within the Centre many years. The founder director, Ted Broad was completed 20 years. Frank Belforte, also one of the founder members and the mainstay of the work in Hinuma has completed 20 years after 16 years. Derek Longmore joined in 1980, retiring after 20 years. Another early recruit was Peter Chaple in 1989, but he slipped away for a six year break in industry before rejoining in 1993 and serving another 14 years. Other early recruits include Kevin Edgar and Derek Taylor who joined as postgraduates in 1971 and 1972 respectively. Although Kevin started earlier than Derek, he has a slightly shorter period working within the Centre because he also returned to industry briefly after gaining his doctorate. Kevin moved into university management full time in 2000, and Derek retired in 2011. David McCordall was another of the founder members who also completed 21 years service, and Nick Vaughan left in 2002 after 24 years. Nigel Johnston and Patrick Keating were both appointed as lecturers in 1989, and are still here, but Nigel’s association goes back longer as he was a researcher for several years beforehand. Likewise, Joe Doonan rejoined from industry in 1989 following an earlier period of research. Nanda Sabhikaya also joined the Centre over 20 years ago, but returned to Turkey for a 12 year period to manage a shipping company, and then again to take up a Chair at Binghamton University in 2013. Although Andrew Plumtree only joined 12 years ago, his association goes back to 1997, when he started his PhD in the Centre. Roger Ngwempa was appointed from INSA Lyon 16 years ago. In the last 10 years there has been a significant influx of new staff. Andy Hills (appointed a little over 10 years ago) and Jon de Bals both have PhDs from Bistol and are now Senior Lecturers, as is Reiman Iwarabu who was appointed to support the integrated Mechanical and Electrical Engineering degree when it relaunched a decade ago. Lecturer Alan Munro is a leading expert in underwater robotics and sensing, and Min Pan, Nicola Bailey and Irima Georgiadi are probationary lecturers with interests in fluid power and robotics. Long service is not confined to the academic staff. Chris Wease and Jane Phillip both managed 13 years as Centre Secretary, and Cillian Bawsent has now been with us for 10 years. Andy Gallway was a technician within the Centre from 1972 until retirement nearly 40 years later, after which Alan Jetted and now Graham Reale became our Senior Technician. And Experimental Officer Bernad Rix, who looks after the CFD course labs as well as many other tasks, has now been with us for 20 years.
Fluid Power Centre staff from 30 years ago
Industrial links

Close contact with industry has been maintained throughout the life of the Centre. An Industrial Advisory Committee was established which held its first meeting in March 1989. A Consortium of 12 companies was formed in 1989 to allow easy access to the Centre’s training courses and expertise, and has existed ever since at a similar size. Research projects have almost always taken place with the collaboration of one or more industrial partners. Consultancy contracts have also provided excellent learning opportunities as well as some welcome income.

Last but not least, industry has often supplied equipment to the Centre on beneficial terms and there have been many instances of generous donations. Collaborative and donors over the past 10 years include Parker, Moog, Airbus, Rolls-Royce, Inmos, Renishaw, Cobham, Babcock, MHI, JLG, MOLINS, Dynomatic, John Diesel, Caterpillar, Niftylift, and Janga Land Power amongst many others. Links with other external organisations have also been very strong, particularly the British Fluid Power Association, the MHI, and Standards organisations (BSI and BSI).

International symposium and networks

International links were also a feature of the early years, with the 1974 annual report highlighting exchange visits and other contacts with twelve countries, including China, Japan and the USA as well as continental Europe. The international dimension has been maintained and strengthened ever since. Notably, the Centre was a founder member of the Fluid Power Centre of Europe (FPCE), a grouping of the leading European research laboratories, and instrumental in the merger of FPCE with Fluid Power Network International to form the Global Fluid Power Society. Launched at its PhD Symposium in South America in 2015, the GFPS has Directors from the USA, Europe and Asia. Andrew Pumfrey was elected Chair for a 4-year term in 2016.

The Centre has always welcomed PhD students and visiting scholars from around the world. One example is Hongyong Yang, who was awarded the Derek Prichard Prize in 1999, and went on to direct both the National Centre for Electrohydrodynamics: Control and the State Key Lab for Fluid Power Transmission and Mechatronics at Zhejiang University. Another is Kim Stokke, who arrived as a visiting professor for a year in 2001, and went on to play a critical role in the resurgence of fluid power research in the US as Director of the National Science Foundation Engineering Research Center for Compact and Efficient Fluid Power (2005-2017).

In 1989 the Centre organised a one-day Workshop on Pumps. From that modest start, the Bath International Fluid Power Workshop became an annual event of three-day’s duration. The format continued for the Power Transmission and Motion Control Workshop (at first Symposium) from 1998, and the Bath ASME Fluid Power and Motion Control Symposium from 2003. It attracts researchers and practitioners from all over the world and provides a forum for the discussion and dissemination of the latest developments in the field. The adoption of the Symposium by the American Society of Mechanical Engineers as its main forum for the dissemination of fluid power research is in recognition of the event’s reputation as the leading research conference in the field. In 2004 and 2011 the Bath ASME Symposium was held in Hollywood and in Nashville (Washington) respectively, alongside ASME’s Dynamic Systems and Control Conference. However the UK event really found its year when held as a standalone event in Sarasota (Florida) in 2013, Chicago in 2015, and back in Sarasota in 2017. On even years the event in Bath continues to promote genuine discussion and community networking, as well as attracting papers from leading researchers. With 113 submissions and 70 accepted papers, the 2018 event will be the largest ever FPSC Symposium in the UK, but we hope to maintain its informal, friendly atmosphere.

Bob Koski was a great supporter of the Symposium over many years, as well as successfully expounding fluid power research and education in the US. We were delighted that he made it to the 2008 Symposium shortly before his death, and was able to see the award of the 2007 and 2009 ASME Koski Medal. The first of these went to Wolfgang Backé, another long-time supporter of the Symposium, and in many ways the founding father of European fluid power research.
Past, present and future

The success of the Centre over its 50 year life is undoubtedly due to the dedication of its staff, most of whom have not been mentioned here. This includes all the research students and research officers, technical support and secretarial staff. For the future, the Centre will continue to engage in research and teaching activities in the realm of power transmission and motion control, embracing new technologies, techniques and applications, and further to contributing to scientific knowledge, well-being and wealth creation.

Acknowledgement: This description is in part based on ‘The First Twenty-five Years’ by Nick Vaughan (Fluid Power Centre Annual Report, 2003).

Fluid power workshop to Bath/ASME Fluid power and motion control symposium

30th Symposium, 1997
20th Symposium, 2007

20th Symposium, 2007. Andy Edge receiving an honorary degree.

Directors: Ted Bevan (98-07), C M Burrell (02-05), Ken Edge (Acting, 05-06), Andrew Rimmer (06-07)
Symposia best paper prizes
As voted for by the delegates

2017
Oleksandr Trakanyian, Andreas Novotny and Andreas Noack-Mark
First Power Squash Center, Harvard University, USA

2018
Tian Yu, Andrew Plummer, Payman Azizian, Dennis Welsh, Floyd Zehwalt and David Weller
Carisystems Ltd, Birmingham, Birmingham, UK

2019
Johannes Schneider, Mike Hockley and Herbert Barta
B&K Instruments Ltd, UK and PowerDrive and Control, RWTH Aachen University, Germany

2020
Joshua Zimmerman and Moritz Kanzigynov
Hudding University, Sweden

2021
Joshua Zimmerman and Moritz Kanzigynov
Hudding University, Sweden

2022
Henrik O. Petersen, Andreas H. Hansen and Thomas Pedersen
Aerotech, Denmark

2023
Matthias Friese, Jochen Ohl and Thomas Hahn
Universitatsklinikum Heidelberg, Germany

2024
Michael Gaisbauer
University of Innsbruck, Austria

2025
Chaoqun Huang
Technical University of Hamburg-Harburg, Germany

2026
Dan Uhr
Kongsberg University, Japan

2027
Andreas Johansson
Hudding University, Sweden

2028
Peter Krua
Hudding University, Sweden

2029
Brian Surgeon, Nick Vaughan and Matthew Tulley
Queen’s University of Canada and University of Bath

2030
Mike Wettig
UBC, Canada

2031
19 – 20th September
“Structural Meso-Materials”
No award

2032
13 – 14th September
“Computers in Fluid Power”
No award

2033
21 – 23rd September
“Power Electronics and Systems”
No award

2034
8th September
“Working on Pumping”
No award

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The institution of mechanical engineers’ Joseph Bramah medal

The Bramah Medal was established in 1968 at the instigation of Mr Frank Toswell, a Fellow of the Institution (1932-1977), who arranged for its support by industry to commemorate Joseph Bramah, the inventor of the hydraulic press and other machines concerned with pumps, water supply, the manufacture of pipes and tubes, and locks. The award is for outstanding achievement tending to advance the science of mechanical engineering, particularly in the field of hydraulic engineering. The medal has no formal link with Bath, but due to its relevance to hydraulic sciences several of the Centre’s academics have been involved in the IMechE Board responsible for nominating candidates over the last 3 decades. The Medal has frequently been presented at the Bath symposium.

Past Winners

2017 Prof. Huaying Yang for his contributions to fluid power, particularly in the field of hydraulic machines and mechatronics.

2016 Prof. Andrew Hitchens, for contributions to fluid power and control research, particularly in advanced pump theory.

2015 Sir John Stennis, for the National Fluid Power Centre at Northumbria University, which has been an outstanding contributor to fluid power education and training.

2014 Prof. Willy Bengtsson, Anglian-Boreham-Power and University of Greenwich, for his development of an axial displacement hydraulic pump and valves.

2013 Prof. Richard T. Burton, University of Bath, for an outstanding contribution to fluid power research and education.

2012 Prof. Satoshi Yokota, Tokyo Institute of Technology, for outstanding contributions to fluid power research, particularly in the field of hydraulic systems.

2011 Prof. Nigel H. Brown, Loughborough University, for outstanding achievements in the field of fluid power.

2010 Prof. Stefan Kahl, University of Stuttgart, for his work in the field of fluid power.

2009 Prof. David J. Burt, University of Bath, for outstanding contributions to the development of fluid power systems.

2008 Prof. David J. Burt, University of Bath, for outstanding contributions to the development of fluid power systems.

2007 Dr. Peter Ashwell, for his work in the field of fluid power.

2006 Prof. John W. Cook, for outstanding contributions to the development of fluid power systems.

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The ASME Robert E. Koski medal

The Robert E. Koski Medal, established in 2007, recognizes individuals who have advanced the art and practice of fluid power motion and control through education and/or innovation. The Medal was established by ASME’s Fluid Power Systems and Technology Division to honour Robert E. Koski’s contributions to the field of dynamics, control and design engineering. It is presented annually at the Bath/ASME symposium, at which the recipient is invited to give the keynote Koski Lecture.

**Medal Recipients**

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<thead>
<tr>
<th>Year</th>
<th>Recipient</th>
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<tbody>
<tr>
<td>2018</td>
<td>Luca Zentti</td>
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<tr>
<td>2017</td>
<td>Werner Deier</td>
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<tr>
<td>2016</td>
<td>Kim A. Skaugen</td>
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<tr>
<td>2015</td>
<td>Monika Ivanovskaya</td>
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<tr>
<td>2014</td>
<td>Hubertus Mennehoff</td>
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<tr>
<td>2013</td>
<td>Wayne J. Dock</td>
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<tr>
<td>2012</td>
<td>Siegfried Helbauer</td>
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<tr>
<td>2011</td>
<td>Richard T. Burton</td>
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<tr>
<td>2010</td>
<td>Yingming Lu</td>
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<tr>
<td>2009</td>
<td>Jan-Ove Palmberg</td>
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<tr>
<td>2008</td>
<td>Clifford B. Dunwoody</td>
</tr>
<tr>
<td>2007</td>
<td>Wolfgang Backé</td>
</tr>
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2013 recipient Professor Milan Ivanovskaya with sexism and Chris Koski, and previous recipients of the Koski Medal, at PTMC 2013 in Chicago.