

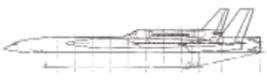
	Airliners	Spaceplanes (When fully developed)
		
Flights per vehicle	20,000+	20,000+
Cost per flight \$million	0.2	0.5
Number of seats	400	50
Cost per seat \$ (typical)	500	10,000

Figure 2. Spaceplanes compared with Airliners



Figure 3: Saunders Roe SR.53 Rocket Fighter, 1957. Image courtesy of Charles Brown, Collection, Royal Air Force Museum

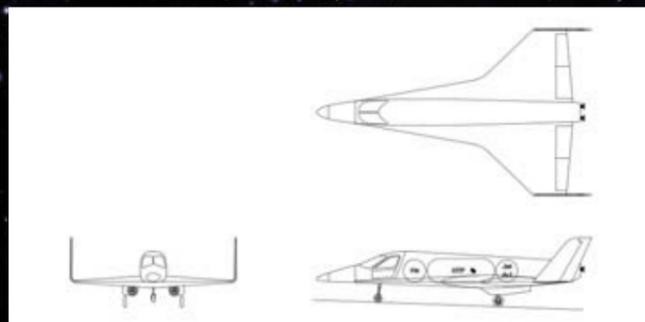


Figure 4: The Bristol Spaceplanes Ascender Entry-Level Spaceplane

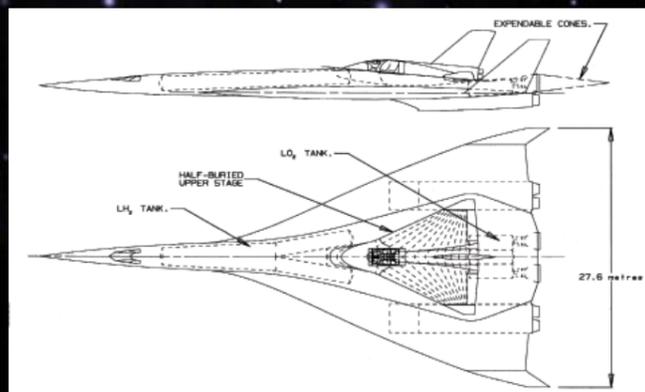


Figure 5: Spacecab

It must be emphasised that costs that low depend on fully mature spaceplane designs. Early prototypes will cost far more. These could be built in five to seven years, and it would then take about eight years to mature the designs, especially to develop a long-life rocket engine. Thus, a 1000 times cost reduction appears to be possible within 15 years.

**How the UK can lead**

The main obstacle to achieving the new space age soon is mind-set. Even now, NASA is planning to build large new throwaway launchers for a new programme of lunar exploration, even though it can readily be shown that costs could be reduced about ten times by adopting an aviation approach.

As stated earlier, I believe that this country is well placed to break the mould

of conventional thinking, as it has no major commitments to expendable rocket projects. However, its world-class aerospace industry has access to all the technologies required to produce an entry-level spaceplane. Of all aeroplanes that have actually flown, the best technology demonstrator for an entry-level sub-orbital spaceplane is arguably the Saunders Roe SR.53 rocket fighter (Figure 3), which first flew in 1957!

When it was cancelled in 1958, Saunders Roe proposed a space research variant. The Ministry showed some interest, but not enough to make it happen. What might have been! My own company's entry-level spaceplane project, Ascender (Figure 4), is in effect a simplified and updated SR.53.

Ascender would be useful for carrying science experiments, high-level photography, meteorological research, astronaut training, and carrying passengers on brief space experience flights. Perhaps, more importantly, it would pave the way for the first orbital spaceplane. Our Spacecab (Figure 5) has been designed specifically to be the most competitive candidate for the first orbital spaceplane. It is in effect an updated version of the 1960s European Aerospace Transporter project designed to minimise development cost by using existing technology. The difficult part of Spacecab design was avoiding anything difficult!

Spacecab has a payload in the one tonne class. This could be a satellite or supplies or crew for a space station. As soon as the first orbital spaceplane enters service, it will be able to undercut any expendable launcher of comparable payload. This will encourage higher traffic levels, which will in turn release investment to mature the design. This will lead to even lower costs and higher traffic levels, and so on down a virtuous cost spiral until the lower limit of spaceplanes using mature developments of existing technology is reached. As we have seen, this is about 1000 times lower than the cost today and could be approached in about 15 years. So, we are talking revolution rather than evolution, with the UK well placed to play a leading part.

**Conclusions**

A new space age is in sight, with greatly reduced cost and improved safety. The main obstacle is the scandalous failure over the past few decades of government space agencies to take this prospect seriously. However, courtesy of private sector initiatives, progress at last appears to be possible.

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# It's all about YOU

Joseph Giacomini of the Human Centred Design Institute (HCDI) at Brunel University discusses the challenges that lie ahead for designers and presents some of the Institute's work.

Ask any selected person on the street what is meant by good design and the response will very likely involve tables or chairs. With luck, the respondent may prove more engaging and may articulate a point of view which is based on concepts such as 'form', 'function' or 'emotion'. And yet, even such an articulate passer-by would still be missing the point, because such a response is more typical of the 20th century than of the 21st.

So what's up? Where is design headed in the 21st century? A first clue on the trail to an answer lies in two recent paradigms which appear set to dominate the stage in the coming years. These obtain nightly coverage of one form or other in the news media in discussions of architecture, product design, or the services offered by the business community or by government. These new ways forward which are transforming the very machinery of our creative economy are Sustainable Design and Human Centred Design.

The first paradigm is the unavoidable result of our recent industrial and political success. The deployment of industrial methods on a vast scale to the benefit of large sections of society has led to great pressures on the natural world. Through the eyes of the citizens of the industrialised nations it is difficult not to notice the drawbacks associated with the use of vast amounts of energy in the service of people, and it is hard to avoid concluding that more attention needs to be paid to how we use materials and energy. Put bluntly, this first paradigm is about saving our planet, an unavoidable requirement until such time as we have somewhere else to go.

**More than just a trend**

In many ways the second paradigm is even more focused than the first, and, basically, is about us. Human Centred Design is about looking at the

world through the eyes of people. Sometimes referred to as People Centred Design or User Centred Design, it is a multidisciplinary field which is at the point of contact between the business, design, manufacturing and scientific communities.

In fact, HCD is more than just a trend or a point of view, it is the systematic gathering and deployment of knowledge about humans from the Arts, Humanities and Sciences.

HCD combines knowledge and technologies from many fields to achieve products and services which are physically, perceptually, cognitively and emotionally intuitive to their users, with intuitive being the key to success. Yes, we can read the manual and learn to use the device and, yes, we can attend the training session and learn to follow that rule, but are the devices and rules intuitive? Are the things around us a pleasure or a nightmare? HCD is as simple as asking these questions and looking in the right places for answers, and when it is deployed with skill it achieves products and services which improve our quality-of-life at work and in the home. Simple, right?

Not so fast. So what information and skills does a human centred designer actually have? A simple answer to this question might be that such a designer makes regular use of information coming



from fields, including anthropometrics, arts, branding, emotional design, engineering, entrepreneurship, ergonomics, inclusive design, information architecture, perception, philosophy and psychology. An even more worrying answer might be that HCD includes all elements of knowledge which are required to design products or services which are physically, perceptually, cognitively and emotionally intuitive to their users. Oh dear.

**All-encompassing**

Defining Human Centred Design would seem to lead to the inevitable conclusion that 21st century design will be a more complex and all-encompassing activity than its 20th century predecessor. For those who do not already feel this pressure, it should be sufficient to stop and consider how the general public has upped the ante on us designers. From banks to broadcast media, and from iPhones to eyecare, a quick look around confirms the vast improvements in design which have been achieved in recent years.

Brand and brand identity now permeate our environment, both functionally and emotionally, manifesting themselves in a bewildering range of sophisticated products and services which meet people's needs. We are today surrounded by the semiotics of humanity. Well known brands, such as Apple, Alessi, BMW, Google, Ferrari, Nokia and Virgin have led the way. The key to their success has been their human centred focus, whether it be their internal organisation as companies or the look and feel of their products and services. Choosing and rescaling technologies to fit people's needs has been the trick in many cases, such as Apple, while focusing on emotional engagement has made companies like Alessi a household name. The feel of a button, the simplicity of a menu, the elegance of a solution to a problem are all issues which can be understood and often even quantified by means of Human Centred Design methods.

Being familiar with such a vast range of human thoughts and abilities is a very demanding challenge indeed, and only the best designers will become proficient at more than the basic methods, but as the many recent success stories confirm, HCD is a deeply rewarding activity and possibly the only way forward for the development of new products and services in the coming century.

Designers be warned. Much, much, more is now expected of you, and we are definitely at the start of a very busy century.

**Human Centred Design Institute (HCDI)**

The Human Centred Design Institute (HCDI) was established in 2006 to bring together a group of internationally recognised academics and researchers in areas of augmented cognition, branding, design management, ergonomics, human factors, human centred design process, inclusive design, information architecture, perception, philosophy, usability and trust.

The objectives of the HCDI are to carry out both fundamental and applied research into Human Centred Design, to identify the key challenges of Human Centred Design in the 21st century, to deliver postgraduate programmes in Human Centred Design and to promote Human Centred Design to industry and to the general public.

The HCDI has developed an in-house framework and methodology which puts the human at the heart of the design process. The aim is to develop usable, desirable, useful and sustainable solutions to meet the various human needs. The HCDI team believes that Human Centred Design can only be achieved by working closely with the ultimate users of the design, collaborating with all the stakeholders by means of a multidisciplinary approach. The HCDI works in close collaboration with a number of designers, manufacturers and service providers, with several professional organisations and with numerous educational, academic, governmental and charitable organisations.



**Branding – Busayawan Ariyaturn**

To many experts a brand is a promise. When people come into contact with a particular brand they know what to expect from it.

As battles over customers' hearts and wallets become more intensive, brands seek innovative ways to create and convey promises that go beyond commercial norms, such as reliability. Design, especially Human Centred Design, is highly regarded as a means to find out people's dreams and desires, as well as to deliver promises that inspire and capture people's imaginations.

Over the past seven years, research projects at Masters and Doctorate levels at Brunel University have covered almost every aspect of brand and branding. The studies range from Spiritual Branding to Sustainable & Ethical Fashion Branding. Despite the differences, all projects start and end with design. Design thinking is employed to identify and clarify problems, plan research methodology, create research tools, analyse results and propose practical solutions.

The same approach is applied in academic and industrial research projects, such as the user experience study conducted for a leading Taiwanese company, AverMedia. A combination of qualitative and quantitative research, including participatory research, was employed to identify the strengths and weaknesses of the current product portfolio at both the physical and emotional levels. The research identified strengths that the company did not realise, such as the fact that their visualisers promoted flexibility in terms of preparing teaching materials. It also revealed that inconsistent interface designs could backfire on their brand. As a result, a number of design and strategic planning tools were recommended as a means to enhance the user and brand experience.

**Trust – Stephane Lo Presti**

Nowadays, technology plays a central role in our life and the digital medium continues to change the world, but not without problems such as safety, security, usability, and legality. Each problem traditionally warrants a particular treatment depending on the product or service. The concept of trust brings about a new, holistic viewpoint on these issues, such that designers and customers can understand them better.

Trust is a complex notion that we studied in collaboration with QinetiQ in the context of e-Healthcare and in relation to using pervasive SPAE (SMIL Player and Authoring Environment) computing devices (eg, smart phones). For example, PDAs (Personal Digital Assistants) were used by pupils to write homework stories. The system was made more trustworthy by considering how it was built and studying how users performed tasks. The system complexity involved behind trust is complemented by how intuitive the concept is for people to grasp, as can be seen from the social networks and virtual worlds phenomenon.



**Perception – Marco Ajovalasit**

The perceptual experiences which occur at a product or service interface are fundamental towards cognitive and emotional engagement. Brand recognition, usability and inclusivity can all depend on the nature and intensity of the perceptual experience.

An example of design research performed to optimise the perceptual characteristics of a product was an activity performed for Shell Research Ltd, which developed a test method for quantifying driver response to engine idle vibration and sound. By understanding how a driver's feelings of engine roughness or power change with changes in the chemical properties of the fuel, it is possible to choose chemical compounds which meet and exceed customer expectation. In this case, knowledge of the human perceptual characteristics was deployed to design a fuel which considered the driver as much as it did the car.



**Cognition – Mark Young**

As technology becomes ever more prevalent in our lives, so our interactions with the world involve more mental activity than physical work. Instead of pulling levers or hauling loads, we now read interfaces and push buttons, or even just watch as an automated system does it for us. But where technology tries to make things easier, sometimes the job is actually harder, as we try to cope with information overload. And

sometimes it becomes too easy, with underload being just as bad as overload.

Understanding how humans think, interpret and respond to information, and then translating this into an interface design, is key to optimising system performance in the digital world. A good example is the Foot-LITE project where the HCDI is working with partners, such as MIRA, TRW and the Institute of Advanced Motorists, to design an in-car interface to encourage safe and eco-friendly driving, without overloading or distracting the driver. Such a fine balance can only be achieved through Human Centred Design.



**Information Architecture – Olinkha Gustafson-Pearce**

With the advent of more and more ‘information’ which is available to us, internet technology and ‘usability’ has advanced at an exponential rate. The web is possibly the most active repository of human knowledge and information. We are currently in the Web 3 manifestation of this medium and a large part of this is Web 3D.

The Web 3D engagement has meant that we must develop and employ new HCD methods of navigation, interaction and usability. Many corporations and education establishments now have an active presence in the Web 3D medium and are finding it highly beneficial for the delivery of training, conferences, promotion and public engagement.

A human centred approach is vital in this ‘social medium’ and at Brunel University we are currently exploring the many possibilities and potentials that it may offer us. We are actively building our presence in this new domain by focussing on public engagement with our student body and research groups, through a number of highly interactive exhibitions and through spaces such as ‘virtual Brunel’. We are also setting up student services ‘inworld’ to facilitate access for students who may not be able to access these services regularly on campus due to disability, professional commitments or other reasons.



**Innovation Management – John Boulton, Eilis McNulty, Jea Hoo Na**

Design, as a driver of user-centred innovation, is currently receiving considerable attention within the European Union. The role of User Centred Design, to further stimulate innovation capability, is being strongly advocated and has just been the subject of a wide ranging consultation and comprehensive working document. The expectation is that initiatives will be developed which use design as a catalyst for increased innovation performance, and that these initiatives will be given a high priority. The consequence is that Europe’s designers and consultancies will be at the forefront of dissemination and activity.

However, research undertaken within Brunel, studying the capabilities and strategies of Design Consultancies in the UK and Ireland and, to a lesser extent, other European countries, has identified an industry where complacency and lack of knowledge about user centred innovation are prevalent. This and the seemingly poor overall understanding of the strategic value of design places us potentially behind other countries, notably the US, the Asian and the South East Asian countries, where evidence suggests that there is a greater appetite to engage with the topic.



**Usability – Steve Love**

There is no doubt that mobile technology has changed and continues to change and shape our lives from both a social and economic perspective. Every day, as we travel through our streets, we see numerous examples of people using various types of mobile technology and applications.

As this area continues to develop there is a concomitant need for designers and researchers working in this area to fully understand what the future requirements of mobile technology applications and devices will be for users. Also, how to effectively evaluate these products, services and applications when they are developed or at the prototype stage of development.

An example of work on methodologies and measurement undertaken by the HCDCI is a project that was undertaken

with the mobile phone company H3G. This work involved the development of an evaluation methodology for a new customer service system. This methodology was based on a Human Centred Design approach which ensured that both the organisation’s and users’ requirements were taken into consideration.

This included observation to identify how customers and staff used the current version of the service and interviewing to gain an understanding of what they liked and disliked about the current service, and their ideas for improving the usability of the service. The result of the activity was the successful implementation and validation of a new improved customer service.

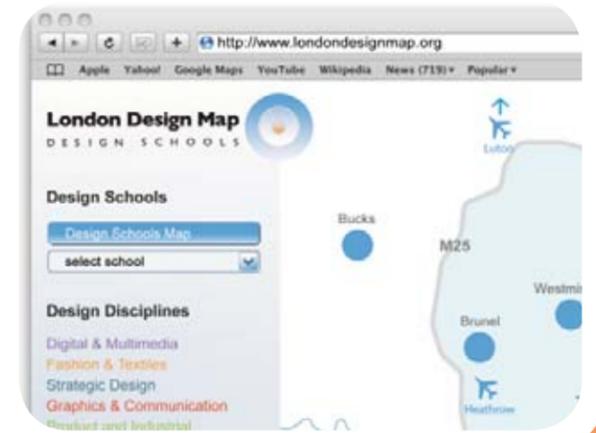
**Dissemination and Networking – Stephen Green**

It’s widely acknowledged within numerous Government backed reports that the UK is well placed to use innovation and the creative industries as an engine for economic development and to address significant global challenges such as the ageing population or climate change.

Within the London region, and related to this potential, there is a considerable asset represented by 26 Design Schools and over 18,500 design students within higher education. The London Development Agency has a remit to develop and promote the London economy and has been working with members of the HCDCI team on the London Design Map ([www.londondesignmap.org](http://www.londondesignmap.org)), taking a human centred approach to clarify and communicate what London Design Schools can offer.

Increasingly Design Schools are making more effective connections with industry and forming interdisciplinary networks to maximise the impact of their courses and research.

Considering the diverse audiences for the information, the London geography at the core of the map provides a universally understood basis for interaction. The London Design Map is a world first in collecting and clarifying information relating to design disciplines, research, courses, business collaborations and networks.



**Inclusivity – Hua Dong**

Design is experiencing paradigm changes, one being moving from deliberate exclusion to deliberate inclusion. This requires a comprehensive understanding of the user range; their capabilities, characteristics, needs and aspirations.

As the research partner of the design company PearsonLloyd and the manufacturing company Kirton Healthcare, the HCDCI team conducted design research into reducing healthcare-associated infections through engaging doctors, nurses, patients, cleaners, infection control specialists in the process, which led to the successful launch of two novel prototypes of hospital equipment: a patient chair and a commode.

The new designs, informed by human-centred design research, have been received favourably by patients and healthcare staff in its hospital trials, and have been selected for exhibition in the Design Museum in London.

