

2

You mean we have a space program?



Figure 2.0: Credit: ESA

Message to President Reagan (after the successful first flight of the Space Shuttle)

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18 You mean we have a space program?

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I was thrilled to hear that the flight of the Columbia has been successfully completed.


The development of the space shuttle, which opens a new era in the space age, has been a great achievement and I share with you the pride you must now be feeling. Please convey to everyone involved — from the astronauts themselves to all the teams supporting them on the ground — my warmest congratulations on behalf of the British people. Margaret Thatcher, Prime Minister.

That little soundbite was sent by Prime Minister Margaret Thatcher on April 14, 1981, shortly after the successful landing of the Shuttle's inaugural mission. While that missive may have been supportive, Thatcher's interest in manned space flight was virtually non-existent. In fact, it was the Thatcher government that pulled the plug on the possibility of Britain joining the U.S., Canada, France, Germany, and ... well, the rest of the world, by flying its own astronaut. Instead, thanks to Thatcher's myopic view of manned spaceflight, Britain was forced to watch non-government astronauts fly missions to *Mir* and on the Space Shuttle. Despite the political viscosity that defined the Thatcher era and beyond, British-born astronauts Michael Foale, Piers Sellers, Nick Patrick, Richard Garriott and Helen Sharman would subsequently add their names to the list of those who had flown in space, albeit on other countries' programs. Meanwhile, Britain continued its meager contribution to the European Space Agency (ESA). While Thatcher's enterprise-friendly macroeconomic policies allowed the British satellite market to thrive, her government refused to support a UK manned space program. So how did Major Tim Peake get selected as an ESA astronaut? To answer this, we need to go back to the Reagan Years.

THE REAGAN YEARS

In the 1980s, President Reagan invited ESA to join the effort to construct what would become the International Space Station (ISS). A decision was also made to invite the Russians so they could put their missiles to alternative use. But although Britain was a member of ESA, the government opted out of participation in ISS, complaining about lack of funds. This decision resulted in the widespread but unfounded British belief, at least among the decision makers, that manned spaceflight is an unaffordable luxury, whereas it is in fact a key part of any modern nation. To illustrate the point, by the time Helen Sharman flew her mission to ISS, no less than 21 other countries had already flown at least one astronaut (see Table 2.1). Abdicating from ISS was a shameful decision because Britain had been one of the first countries in space (as mentioned earlier, the country's first satellite was launched in 1962). In 2017, the nation still retains the unwelcome legacy of being

Table 2.1 Astronauts and Cosmonauts Timeline by Nationality

No.	Country	Name	Flight	Date
1	 Soviet Union	Yuri Gagarin	 Vostok 1	1961 Apr 12
2	 United States	Alan Shepard	 MR-3	1961 May 5
3	 Czechoslovakia	Vladimír Remek	 Soyuz 28	1978 Mar 2
4	 Poland	Mirosław Hermaszewski	 Soyuz 30	1978 Jun 27
5	 East Germany	Sigmund Jähn	 Soyuz 31	1978 Aug 26
6	 Bulgaria	Georgi Ivanov	 Soyuz 33	1979 Apr 10
7	 Hungary	Bertalan Farkas	 Soyuz 36	1980 May 26
8	 Vietnam	Phạm Tuân	 Soyuz 37	1980 Jul 23
9	 Cuba	Arnaldo Tamayo Méndez	 Soyuz 38	1980 Sep 18
10	 Mongolia	Jügderdemidiin Gürragchaa	 Soyuz 39	1981 Mar 22
11	 Romania	Dumitru Prunariu	 Soyuz 40	1981 May 14
12	 France	Jean-Loup Chrétien	 Soyuz T-6	1982 Jun 24
13	 West Germany	Ulf Merbold	 STS-9	1983 Nov 28
14	 India	Rakesh Sharma	 Soyuz T-11	1984 Apr 3
15	 Canada	Marc Garneau	 STS-41-G	1984 Oct 5
16	 Saudi Arabia	Sultan al-Saud	 STS-51-G	1985 Jun 17
17	 Netherlands	Wubbo Ockels	 STS-61-A	1985 Oct 30
18	 Mexico	Rodolfo Neri Vela	 STS-61-B	1985 Nov 26
19	 Syria	Muhammed Faris	 Soyuz TM-3	1987 Jul 22
20	 Afghanistan	Abdul Ahad Mohmand	 Soyuz TM-6	1988 Aug 29
21	 Japan	Toyohiro Akiyama	 Soyuz TM-11	1990 Dec 2
22	 United Kingdom	Helen Sharman	 Soyuz TM-12	1991 May 18
23	 Austria	Franz Viehböck	 Soyuz TM-13	1991 Oct 2
24	 Russia	Aleksandr Kaleri Aleksandr Viktorenko	 Soyuz TM-14	1992 Mar 17
25	 Belgium	Dirk Frimout	 STS-45	1992 Mar 24
26	 Italy	Franco Malerba	 STS-46	1992 Jul 31
27	 Switzerland	Claude Nicollier	 STS-46	1992 Jul 31
28	 Ukraine	Leonid Kadenyuk	 STS-87	1997 Nov 19
29	 Spain	Pedro Duque	 STS-95	1998 Oct 29
30	 Slovakia	Ivan Bella	 Soyuz TM-29	1999 Feb 20
31	 South Africa	Mark Shuttleworth	 Soyuz TM-34	2002 Apr 25
32	 Israel	Ilan Ramon	 STS-107	2003 Jan 16
33	 China	Yang Liwei	 Shenzhou 5	2003 Oct 15
34	 Brazil	Marcos Pontes	 Soyuz TMA-8	2006 Mar 30
35	 Iran	Anousheh Ansari	 Soyuz TMA-9	2006 Sep 18
36	 Sweden	Christer Fuglesang	 STS-116	2006 Dec 10

the only one to have ever renounced its space capability. For decades, Britain not only gave up on manned spaceflight but also abandoned its launcher capability, opting out of helping ESA develop its Ariane launcher (Figure 2.1) and leaving the promising Reaction Engines *Skylon* program on life support. That left only satellites, although the British became very good at building these. But because the country had given up its launcher capability, Britain was reduced to hitching a ride on someone else's launcher, which in turn meant that companies building these satellites were driven to build small ones.



Figure 2.1: Ariane 5 flight V198. Ariane 5 is ESA's heavy lift launch vehicle that is part of the Ariane expendable launch system, capable of delivering payloads into geostationary transfer orbit or low Earth orbit. Operated and marketed by Arianespace, the rockets are launched from the Guiana Space Center in French Guiana. Originally designed to launch ESA's Hermes spaceplane, Ariane 5 was repurposed to launch satellites after the spaceplane idea was dropped in 1992. Credit ESA

Table 2.2. Major Tim Peake's Career Timeline

1990	Completed Combined Cadet Force as a Cadet Warrant Officer
1991	Member of a six-month Operation <i>Raleigh</i> expedition to Alaska
1992	Graduated as an Army Air Corps Officer. Served on attachments with the Royal Green Jackets as Platoon Commander
1994	Awarded flying wings. Served as a reconnaissance pilot and flight commander in Germany. Qualified as a combat survival instructor
1998	Qualified as a helicopter flying instructor
1999	Selected for an exchange posting with the U.S. Army
2002	Qualified as an Apache helicopter instructor
2005	Selected for test pilot training
2006	Served with the Rotary Wing Test Squadron at Boscombe Down
2009	After logging more than 3000 hours flying time on more than 30 types of helicopters and fixed wing aircraft, he retires from the army and is selected as an astronaut

Of course, none of this 1980s space politicking was on the radar for Timothy Nigel Peake. A student at Chichester High School in West Sussex, where he was described as the “calm, sensible type” (a phrase that one primary school report used to describe him at age 10), Peake was more interested in doing what kids at that age do. In Peake's case, much of his spare time was spent outdoors, engaging in camping, canoeing and cycling. Space wasn't even on his agenda, although family visits to the Science Museum piqued his interest. By the age of 15, Peake's interests revolved mainly around helicopters, and flying them. This was despite having a fear of heights, which he conquered by taking up rock climbing. While at school, he signed up with the cadet flying club and spent weekends flying gliders and tandem-seat Chipmunks. With his mind set on a career that involved flying, Peake studied hard to ensure he gained the qualifications necessary to apply to the military. As with most things Peake puts his mind to, the military venture was a success, and he graduated from the Royal Military Academy in Sandhurst in August 1992, as an officer in the British Army Air Corps. His first assignment was as platoon commander with the Royal Green Jackets, after which he was promoted to lieutenant. Three years later, he was promoted to captain and qualified as a helicopter instructor after graduating from the Defence Helicopter Flying School at RAF Shawbury in 1998. He then completed tours in Northern Ireland (flying Gazelle helicopters), Afghanistan, Bosnia and Kazakhstan (home to the Baikonur Cosmodrome). Another promotion followed in 2004 when Peake achieved the rank of Major and that same year he also graduated from the Empire Test Pilots School, having been awarded the Westland Trophy for best rotary wing pilot. In 2006, Peake was awarded the Commander-in-Chief's Certificate for Meritorious Service, for exemplary service to the British Army. That year, he also completed his educational achievements by attaining his bachelor of science degree (Hons) in Flight Dynamics and Evaluation from the University of Portsmouth.

And then there was that astronaut job.

“Tim has done so many things in his life that when he told us he had been chosen, it didn't come as a surprise. Tim has always shown huge determination to succeed. I can remember school reports from Chichester High which said: “Tim never gives up.”

Nigel Peake, Tim's father

22 You mean we have a space program?

“He persevered with swimming, although it didn’t come naturally. He wasn’t that good at it. Even if he was the last to finish, he’d keep plugging away.”

Mrs. Angela Peake, Tim’s mother

If there is one quality every astronaut has in abundance, it is that ability to keep on ‘plugging away’. This is probably not that surprising, when you consider just how difficult it is to be selected as an astronaut in the first place. But that’s just the beginning. Training is on another level entirely. First, there is the small matter of 18 months of basic training and then, once selected for a flight, astronauts spend another 18 months training just for that mission. Given the broad spectrum of tasks that astronauts must be proficient in, it is also probably not surprising that, every once in a while, an astronaut has to cope with a task they find a little more challenging than anticipated. In Peake’s case, the hurdle that required him to apply his ‘plugging away’ skills was mastering the Russian language.

THE CATALYST – DAVID WILLETTS

From the Thatcher era onwards, Britain missed out on an awful lot of space activity, but in 2012 there was an opportunity to end the stagnation when ESA’s ministerial meeting took place to establish budgets. The French and the Germans were at loggerheads and there was the risk that ESA might fall short of its ISS commitments. Fortunately, the British minister responsible for space at the time – the Rt. Hon. David Willetts (the Minister of Universities and Science, [Figure 2.2](#)) – finally reversed decades of British government policy and offered a contribution that allowed Britain to become part of ESA’s program for the ISS. There was one condition, however: that this contribution secured a flight for Tim Peake. And so, the deal was done. Thanks to the foresight of David Willetts (helped in part by the work done by Lord Drayson of the previous Labour government), Britain was finally in a position to become one of the world’s leading space-faring nations.

Even now, however, despite all the positive spin generated by Tim Peake’s flight, there are still those who argue that Britain should stay out of manned spaceflight (see sidebar). But there are arguably more reasons for the country to continue to support further flights than there are to return to the old days of just building satellites. For one thing, humans can do a lot that robots can’t. Take the Apollo missions, for example. The astronauts travelled 17 miles on the lunar surface using the lunar rover. The Mars rover on the other hand, neat as it is, travelled just three miles in three years. Three years! And then there are the positive side-effects of having a British astronaut in space. After Peake’s flight, there was a big increase in the number of students who wanted to study science and engineering, and that can be no bad thing with Britain’s manufacturing sector constantly crying out for a technically competent workforce.

So, 25 years after Helen Sharman’s flight, Peake finally put Britain back on the manned spaceflight map, and for many it was a flight that was long overdue. After all, this was a country that had produced international space celebrities such as Arthur C. Clarke, Colin Pillinger of Beagle 2 fame, and Stephen Hawking. Just no astronauts!

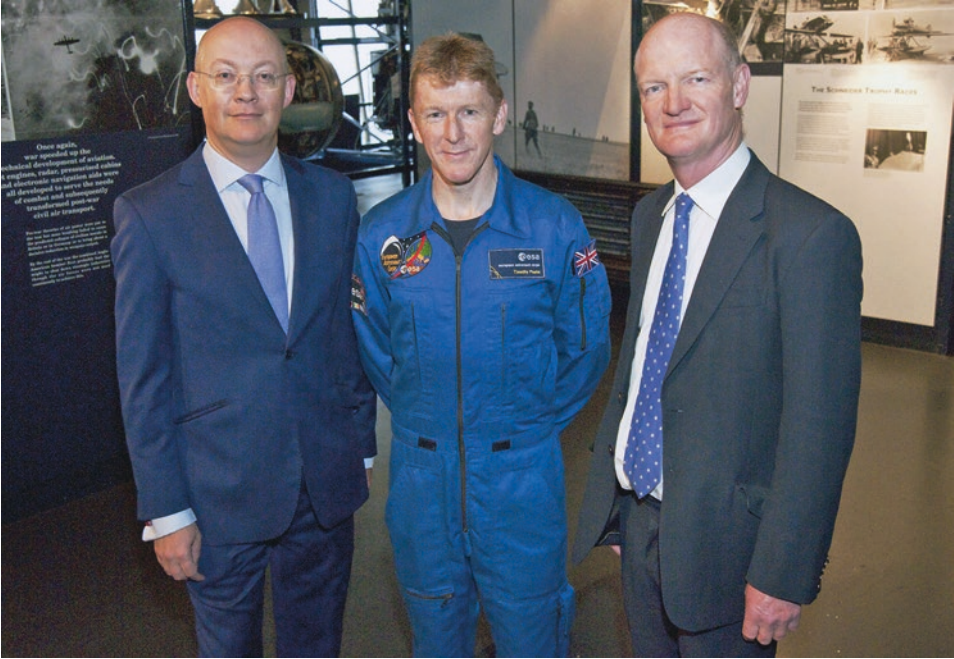


Figure 2.2: Science Minister David Willetts (right) with Tim Peake and museum director Ian Blatchford at the announcement of Peake's ISS mission. Credit: The Science Museum

Manned or Unmanned?

In 2007, a working group addressed the issue of Britain missing out by not having a manned space program. The group, which was set in motion by Ian Pearson (Minister of State for Science), recommended that a manned spaceflight program should be established by undertaking precursor missions to the ISS. That way, the group argued, Britain could gradually create a corps of four astronauts who could build experience and also inspire students at schools and colleges. The recommendations made by the group seemed sensible enough, but there were some hurdles that stood in their way. One of these was the fact that the Treasury exerted a vice-like grip on any public project, and was reluctant to hand over money for those projects that didn't have an immediate, or at least a near-term, spinoff for industry. And while space was deemed profitable, manned spaceflight was still judged to be a luxury, with the working group's case hardly helped by the \$100 billion cost of the ISS. A second hurdle was the British robotic science lobby, which traditionally had used most of the meager pittance of Britain's space budget. That budget would be stretched beyond breaking point if some of the money had to be siphoned off to send British astronauts on a low Earth orbit joyride. It didn't matter that manned spaceflight proponents like the British Interplanetary Society (BIS) had pointed out that

most of the developed world seemed able to fly satellites *and* astronauts. Take Sweden, for example. At the time of the working group's recommendations, Sweden had already sent its astronaut, Christer Fuglesang, on his first space mission – STS-116 in 2006. Sweden was also operating a rocket range in Kiruna *and* it built satellites, and all on a shoestring budget of \$100 million a year – less than half of Britain's budget at the time.

THE ISS AGA

The announcement of Tim Peake's launch was a huge deal for British involvement in space and the ISS program, with which the UK had always had a hot-and-cold relationship. The beginning of that relationship came on January 29, 1998, when the UK was one of 15 nations to sign the ISS Intergovernmental Agreement (IGA – see sidebar), which was the instrument that formally – and finally – brought the ISS (Figure 2.3) off the drawing board and into reality.

The ISS Intergovernmental Agreement (IGA)

The ISS is a program of collaboration between the U.S., Russia, Canada, Japan and 10 member states of Europe. The legal framework governing the development, utilization and operation of the orbiting outpost is outlined in the IGA in Article 1 as follows:

Article 1: Object and Scope

1. The object of this Agreement is to establish a long-term international cooperative framework among the Partners, on the basis of genuine partnership, for the detailed design, development, operation, and utilization of a permanently inhabited civil international Space Station for peaceful purposes, in accordance with international law. This civil international Space Station will enhance the scientific, technological, and commercial use of outer space. This Agreement specifically defines the civil international Space Station program and the nature of this partnership, including the respective rights and obligations of the Partners in this cooperation. This Agreement further provides for mechanisms and arrangements designed to ensure that its object is fulfilled.

2. The Partners will join their efforts, under the lead role of the United States for overall management and coordination, to create an integrated international Space Station. The United States and Russia, drawing on their extensive experience in human space flight, will produce elements which serve as the foundation for the international Space Station. The European Partner and Japan will produce elements that will significantly enhance the Space Station's capabilities. Canada's contribution will be an essential part of the Space Station. This Agreement lists in the Annex the elements to be provided by the Partners to form the international Space Station.



Figure 2.3: The International Space Station. Credit: NASA

26 You mean we have a space program?

3. The permanently inhabited civil international Space Station (hereinafter “the Space Station”) will be a multi-use facility in low-Earth orbit, with flight elements and Space Station-unique ground elements provided by all the Partners. By providing Space Station flight elements, each Partner acquires certain rights to use the Space Station and participates in its management in accordance with this Agreement, the MOUs, and implementing arrangements.
4. The Space Station is conceived as having an evolutionary character. The Partner States’ rights and obligations regarding evolution shall be subject to specific provisions in accordance with Article 14.

The IGA also allowed the ISS Partner States to extend their national jurisdiction to space, which means that the modules provided by those states are incorporated into the territories of the Partner States. This means that each Partner State retains control over the modules it registers and also control over its personnel, as stated in Article 5 (see sidebar).

IGA Article 5: Registration, Jurisdiction and Control

1. In accordance with Article II of the Registration Convention, each Partner shall register as space objects the flight elements listed in the Annex which it provides, the European Partner having delegated this responsibility to ESA, acting in its name and on its behalf.
2. Pursuant to Article VIII of the Outer Space Treaty and Article II of the Registration Convention, each Partner shall retain jurisdiction and control over the elements it registers in accordance with paragraph 1 above and over personnel in or on the Space Station who are its nationals. The exercise of such jurisdiction and control shall be subject to any relevant provisions of this Agreement, the MOUs, and implementing arrangements, including relevant procedural mechanisms established therein.

But while the UK was a signatory to the ISS IGA, it was the only country that did not contribute funding to the space station program. That decision was in keeping with the UK’s long-standing policy that prevented the country from putting up any funding for manned spaceflight. The decision also meant that Britain was left out when it came to sharing the benefits of the research that resulted from the science on the ISS. But, after decades in the wilderness – at least as far as manned spaceflight was concerned – Britain finally made a decision (fueled no doubt by the fact that the space industry contributed £9 billion a year to the British economy) to increase its involvement in the space arena. The first step was to establish the UK Space Agency (UKSA, Figure 2.4) in April 2010, an event that turned out to be a catalyst for a number of other benefits that would ultimately lead to Peake being offered his ISS flight opportunity. The creation of the UKSA (see sidebar), on the back of Peake’s selection as an astronaut, sparked a significant



Figure 2.4: UK Space Agency. Also known as the UK Space Agency, or just plain UKSA, the organization is an executive agency of the British government and is responsible for the country's civil space program. Established on April 1, 2010, the UKSA replaced the British National Space Centre (BNSC) and assumed responsibility for budgets and government policy. Before the creation of the UKSA, the space industry in the UK was valued at around £6 billion and supported 68,000 jobs. The aim of the UKSA is to boost those numbers over 20 years to £40 billion and 100,000 jobs. Credit: UKSA

increase in lobbying by space advocacy groups. Now, all of a sudden, UK manned spaceflight was on a roll. And it just kept on getting better.

Just two years later, Britain contributed £1.2 billion to ESA (which made the country the third largest contributor), of which an unprecedented £12.4 million was earmarked for ESA's European Life and Physical Sciences (ELIPS) program. This contribution meant that the UK would now be granted access to the microgravity environment of the station to perform research. Another important contribution made by the UK was the £16 million invested in ESA's efforts to design and build the Automated Transfer Vehicle (ATV, Figure 2.7) Service Module (SM) destined for NASA's Orion crew vehicle. That contribution kick-started a number of construction contracts for British companies, especially in the areas of propulsion and communication. The funding also meant that, with Britain now being a financial contributor to the Orion SM venture, the country was promoted to the status of ISS partner nation (the British flag had quietly been removed from the ISS in 2010) – at least for the 2015 to 2020 timeframe.

28 You mean we have a space program?

The catalyst for all these fortuitous events was Peake's selection as an ESA astronaut in 2009. At the time of his selection, Peake was identified as a 'European astronaut of British origin' and not as a 'British astronaut'. But that changed in 2013 – just six months after Britain's financial contributions – when Peake was assigned to his ISS mission. That event was marked by some controversy, however, since the original assignment was for a short duration mission of just 10 days. The British took umbrage at that decision, pointing out that Danish astronaut Andreas Mogensen had been assigned to a long duration mission, despite the fact that Denmark's contribution was less than Britain's. After some political arm-wrestling, ESA reversed its decision and handed off the short duration to the Danes and the long duration slot to the Brits. Everyone was happy. Well, perhaps not Mogensen.

UKSA Space Strategy

"The UK will be a recognised and valued participant in human spaceflight and space environments research – in low Earth orbit, on analogue platforms and in deep space exploration. Advancing scientific knowledge and technological capabilities as a pathway to growth will positively augment the UK economy and provide measurable societal benefits in sectors such as healthcare, communications and education."

*UK's first Space Environments and Human Spaceflight national strategy,
released by UKSA, July 2015*

TIM PEAKE and BRITAIN'S ROAD TO SPACE

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