1

Space Tourism

1.1 Introduction

Dennis Tito launched into Space on a Soyuz rocket in 2001, alongside two Russian cosmonauts. The American investment manager spent eight happy days on the International Space Station (ISS) before returning to Earth. But while Tito had previously worked as an engineer at NASA's Jet Propulsion Laboratory, he had not participated in the same highly competitive selection process as the astronauts and cosmonauts on the ISS. Instead, he paid US$20 million to a private company called Space Adventures, which arranged his transport and made him the first ever Space tourist.[1]

Over the next decade, six other individuals followed Tito's path to the ISS, paying around US$20 million to 25 million each. Microsoft software architect Charles Simonyi enjoyed his first trip so much in 2007 that he went back in 2009. All these trips were taken on Russian government-owned rockets and spacecraft. But now, private companies are taking Space tourism in a new direction by developing their own capabilities to send paying customers to Space, in a variety of ways.

Two types of Space tourism are presently under way: suborbital and orbital. A third, lunar tourism, will likely follow in the next decade or two. While several ventures have failed, three companies began launching tourists in 2021: Virgin Galactic, Blue Origin and SpaceX. The emergence of Space tourism raises a host of difficult issues. One example is the environmental impact of launches on the atmosphere and the corresponding implications for climate change. Another is the contribution of Space tourism to the Space debris crisis in low Earth orbit (LEO).

Space tourism also raises difficult questions of international law. Some of these, such as legal responsibility for Space debris, are addressed in

[1] 'World's first space tourist 10 years on: Dennis Tito', *BBC News* (30 April 2011), online: www.bbc.com/news/science-environment-13208329.

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other chapters of this book. In this chapter, we focus on issues of specific relevance to Space tourism, including whether states have a duty to rescue tourists in distress.

1.2 Suborbital Tourism

Sir Richard Branson rode a white rocket plane to the edge of Space on 11 July 2021. His mission: 'Evaluating the customer spaceflight experience' on Virgin Galactic's *SpaceShipTwo*.[2]

Branson has a long history of taking already cool enterprises, adding the Virgin brand, and making them even cooler. In 2004, a small US company called Scaled Composites won the US$10 million Ansari X-Prize by twice flying an experimental rocket plane, *SpaceShipOne*, to an altitude higher than 100 kilometres. Impressed by the global attention attained by the feat, Sir Richard hired Scaled Composites to build him a spacecraft based on *SpaceShipOne*'s design.[3]

That rocket plane, *SpaceShipTwo*, launches at an altitude of between 40,000 and 50,000 feet after being released from the underside of a twin-fuselage, four-jet-engine aircraft.[4] It can carry two pilots and six paying passengers to an altitude of 80 kilometres – the lowest and easiest-to-reach definition of Space, and thus the most profitable. Eighty kilometres is approximately the transition point between two upper levels of the atmosphere: the mesosphere and the thermosphere. It is the altitude where, in the 1960s, US Air Force pilots flying the X-15 rocket plane earned their astronaut wings.

However, the use of the 'mesopause' to define the boundary of Space is done for convenience and not because it is physically relevant. The location of the mesopause is not exactly 80 kilometres and varies depending on seasonal and other factors. The US Air Force chose 80 kilometres (actually, it chose 50 statute miles, or 80.47 kilometres) because it was a round number, and probably because the X-15 could reach there!

[2] Paul Brinkmann, 'British billionaire Richard Branson plans to soar into space Sunday', *UPI* (9 July 2021), online: www.upi.com/Science_News/2021/07/09/richard-branson-virgin-galactic-flight-space/1121625768487.

[3] Nicholas Schmidle, *Virgin Galactic and the Making of a Modern Astronaut* (New York: Henry Holt & Co, 2021).

[4] It is common practice to use feet for aircraft altitudes, and kilometres in Space.

Eighty kilometres has never been widely accepted as the boundary of Space. Following the lead of the non-governmental Fédération aéronautique internationale, most states use a 100-kilometre threshold – the so-called 'Kármán Line' – to define the start of Space.[5] Yet this too is an arbitrary choice, based on the ostensible upper limit of aerodynamic flight, i.e. above the highest altitude achievable using only aerodynamic lift.[6] Complicating matters further, some satellites on stable but highly elliptical orbits have perigees below 100 kilometres.

Arguments over the location of the boundary between Earth and Space will certainly continue, with Jonathan McDowell having recently mounted a science-based defence of 80 kilometres.[7] But does it really matter? No one argues whether the International Space Station is in Space. Likewise, satellites placed in orbit, even those in very low Earth orbit (VLEO), are deemed to be spacecraft without question. Rather, the location of the boundary seems to be most pertinent to counting the number of Space flights conducted by states – and to determining who gets to be called an astronaut. Missile defence and other security-related activities taking place within the transitional zone between the atmosphere and Space raise difficult questions, including those discussed in Chapter 7 of this book. Yet none of these questions would be solved by having a widely agreed boundary.

It is the advent of suborbital Space tourism that has brought this long-lasting and previously irrelevant debate among international lawyers into the public consciousness. The question of who gets to call themselves an astronaut suddenly matters, not least to Branson, who has invested about half of his fortune in the expectation that most people will consider 80 kilometres good enough.[8] After all, who would pay US$450,000 to call themselves an 'almost astronaut'? Blue Origin, which took its first

[5] See generally Michael Byers and Andrew Simon-Butler, 'Outer Space' in Anne Peters, ed, *Max Planck Encyclopedia of Public International Law* (Oxford: Oxford University Press, article last modified Oct 2020), online: opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1202; Bin Cheng, 'The legal regime of airspace and outer space: The boundary problem. Functionalism versus spatialism: The major premises' (1980) 5 *Annals of Air & Space Law* 323.

[6] For reference, the United States' high-altitude Lockheed U-2 spy planes can only reportedly reach about 24 kilometres.

[7] Jonathan C McDowell, 'The edge of space: Revisiting the Karman Line' (2018) 151 *Acta Astronautica* 668.

[8] Benjamin Stupples, 'Richard Branson richer than ever from Reddit traders and space plans', *Bloomberg* (2 February 2021), online: www.bloomberg.com/news/articles/2021-02-02/branson-richer-than-ever-from-reddit-traders-and-space-plans.

tourists above 100 kilometres on 20 July 2021, is already marketing flights on its *New Shepard* rocket as offering something that Virgin Galactic and *SpaceShipTwo* cannot – reaching an altitude that everyone accepts is in Space.[9]

To complicate things yet further, we need to ask ourselves whether altitude alone is even a sensible way to define an astronaut. Flying on a commercial airliner does not make you an aviator. Riding in a ferry does not make you a mariner. Perhaps we should distinguish between the flight crew and the passengers when deciding whether someone has earned the title of 'astronaut', as we might normally think of pilots earning their wings. The United States' Federal Aviation Administration (FAA) weighed in on this just as Branson and his rival Jeff Bezos were making claims to being astronauts, writing that individuals will only be considered 'commercial astronauts' if they meet the altitude requirements (50 miles in this case) and 'demonstrated activities during flight that were essential to public safety, or contributed to human space flight safety'.[10] We agree: anyone who guides a rocket plane to 80 kilometres on dozens, perhaps hundreds, of occasions will be demonstrating an awesome level of skill and courage. Those who sit at the controls of *SpaceShipTwo* deserve their astronaut wings. As for the passengers, or those who evaluate the customer spaceflight experience, stepping into a rocket is a necessary but insufficient condition for those wings.

Whether astronauts or 'astro-nots', getting launched to 80 kilometres takes courage – or perhaps a certain lack of awareness. Spaceflight is always perilous; even among national Space agencies, missions are never treated as routine. Based on its design and early performance, the Space Shuttle was estimated to have an overall failure rate of about 1 per cent.[11] In the end, two spacecraft were lost out of 135 missions. Virgin Galactic faces unique safety challenges since *SpaceShipTwo* is manoeuvered by pilots while becoming supersonic and climbing to an altitude that is eight

[9] See Blue Origin, 'From the beginning, New Shepard was designed to fly above the Kármán line so none of our astronauts have an asterisk next to their name. For 96% of the world's population, space begins 100 kilometres up at the internationally recognized Kármán line' (9 June 2021 at 11:33), online: *Twitter* twitter.com/blueorigin/status/1413521627116032001.

[10] FAA Commercial Space Astronaut Wings Program, FAA Order 8800.2 (20 July 2021), online: www.faa.gov/documentLibrary/media/Order/FAA_Order_8800.2.pdf.

[11] RP Feynman, 'Volume 2: Appendix F – Personal observations on reliability of shuttle', *Report of the Presidential Commission on the Space Shuttle Challenger Accident* (1986), online: history.nasa.gov/rogersrep/v2appf.htm.

times that used by commercial airliners. In 2014, a pilot error led to a fatal accident during a test flight.[12]

Another risk derives from the fact that Virgin Galactic does not provide pressurised spacesuits to its crew or passengers. This choice seems strange when considering that pressurised suits have always been viewed as a necessity by Space agencies for both launch and re-entry. In 1961, when 'Ham the Chimp' was launched on a Mercury-Redstone rocket by the United States, a pressurised suit saved his life after the capsule sprung a leak.

The lack of pressurised suits cannot be a question of style. Beginning with Yuri Gagarin and Alan Shepard, such suits are part of the idealistic image of an astronaut. The pressurised Space suits used by SpaceX on Crew Dragon are both functional and fashionable. Virgin Galactic's decision not to provide such suits might be part of an effort to make Space travel seem routine – just as Stanley Kubrick did, more than half a century ago, in the 'Blue Danube' scene in *2001: A Space Odyssey*. If so, it is dangerously misleading. The start and finish of a *SpaceShipTwo* voyage would seem familiar to anyone who has travelled on a private jet, or even a commercial airliner. However, it is the elements in between – the rocket-propelled climb to 80 kilometres, the upward rotation ('feathering') of the twin tail rudders to increase drag and stability for re-entry, the transition from free fall back to flight – that are unusual and therefore perilous.

Branson's selection of 11 July 2021 for his first flight was part of an aggressive marketing strategy since it enabled him to beat his rival to the limelight. Bezos, the founder of Amazon, the so-called online 'Everything Store', had announced the previous month that he would be launching on 20 July 2021, the anniversary of the Apollo Moon landing.

Bezos achieved that success: strapping himself in alongside three other passengers, launching to over 100 kilometres, and landing safely. But then, after alighting, one of the world's richest men proceeded to humiliate both himself and Space tourism generally by thanking Amazon's customers and low-salaried employees because they 'paid for all of this'.[13]

[12] Tariq Malik, 'Deadly SpaceShipTwo crash caused by co-pilot error: NTSB', *Space.com* (28 July 2015), online: www.space.com/30073-virgin-galactic-spaceshiptwo-crash-pilot-error.html.

[13] Gino Spocchia, 'Jeff Bezos criticised by Amazon workers and customers after thanking them for funding space launch', *The Independent* (28 July 2021), online: www.independent.co.uk/news/world/americas/amazon-workers-slam-jeff-bezos-b1887944.html.

This callous statement, and the unmistakably phallic shape of Bezos's spacecraft, combined to make him a ripe target for ridicule on the Internet and late-night television.

The spacecraft was developed by Bezos's privately owned company Blue Origin. Named *New Shepard* after the first American in Space, its stubby rocket propels a small but still bulbous capsule onto a ballistic trajectory before returning to the launch site and landing on legs. The capsule, designed for six passengers, delivers several minutes of weightlessness before returning to Earth using parachutes.

Unlike Virgin Galactic, both the rocket and the capsule are automated; no crew is required. As with Virgin Galactic, pressurised spacesuits are not provided. With no path for emergency decision making within the capsule, and no physical protection if the capsule leaks or is punctured by a micrometeoroid or Space debris, *New Shepard* passengers are essentially thrill-seekers on a potentially dangerous carnival ride.

Another important difference between Blue Origin's and Virgin Galactic's approach is that *New Shepard* reaches the 100-kilometre threshold. This ensures that its passengers can be widely accepted as genuine astronauts, if altitude is a sufficient criterion. Achieving this threshold was particularly important for 82-year-old Wally Funk, who flew with Bezos on 20 July 2021. Funk was one of the 'Mercury 13' – highly skilled pilots who, in the 1960s, were never selected for the astronaut program only because they were women.

1.3 Orbital Tourism

'Can't get it up (to orbit) lol' – That is what Elon Musk tweeted in April 2021, after Blue Origin complained to NASA about SpaceX winning a US$2.9 billion contract to construct a lunar lander. The CEO of SpaceX and Tesla could himself have travelled to Space, had he wished to do so, since SpaceX had begun transporting NASA astronauts to the ISS in November 2020.

Orbital tourism is more complicated and expensive than suborbital tourism because the spacecraft must reach orbital speeds of approximately 7.7 kilometres per second (about 28,000 kilometres per hour), depending on the altitude. Orbital tourists also spend more time in Space and travel farther from Earth – in the case of the ISS, between 370 and 460 kilometres. SpaceX's recently developed human-rated spacecraft, Crew Dragon, not only provides transport to the ISS for astronauts from NASA and other Space agencies; it also offers a passenger service to orbit for those able and willing to pay the hefty ticket price.

SpaceX is the first company to launch tourists into orbit on its own equipment. Some of the flights are arranged by Space Adventures, the same company that set up Dennis Tito's flight on Soyuz, while others are arranged by a company called Axiom. Axiom is charging US$55 million for an eight-day visit to the ISS. The first of such trips to the ISS took place in April 2022. Known as Axiom-1, it involved former NASA astronaut and Axiom vice president Michael López-Alegría, along with three wealthy investors. Three more trips are already planned.[14] Access to the ISS has been negotiated with NASA and not with all the ISS partner states, following the precedent established by Space Adventures and the Russian Space Agency (Roscosmos) beginning with Tito's 2001 flight.

Axiom is sensitive to criticisms directed at Space tourism, with López-Alegría emphasising, 'We are not space tourists. I think there is an important role for space tourism, but it is not what Axiom is about.'[15] The company and its customers all point to the eight weeks of intensive training involved. Passenger Larry Connor noted that those flying on Axiom-1 'spent anywhere from 750 to 1000 hours of training' in comparison to the '10 to 15 hours training, 5 to 10 minutes in space' done by those who take suborbital flights.[16] However, the company's president, Michael Suffredini, has admitted that 'while we do endeavor to train to the same level as our NASA colleagues, I'm not sure that we do all the way up to that'.[17]

It is nonetheless fair to distinguish between passengers on suborbital flights and those on orbital flights. Figure 1.1 depicts the difference in scale for these two forms of spaceflight. Moreover, as Suffrendini said, 'the crew has been trained on the systems they will need to interact with, including the research systems. So, they're fully trained on that. They're also trained on what not to interact with'.[18] There is thus some

[14] Mike Wall, 'SpaceX to fly 3 more private astronaut missions to space station for Axiom Space', *Space.com* (2 June 2021), online: www.space.com/spacex-axiom-deal-more-private-astronaut-missions.

[15] Jamie Groh, 'Axiom delays launch of all-private mission to the ISS until no earlier than April 8', *Florida Today* (3 April 2022), online: www.floridatoday.com/story/tech/science/space/2022/04/03/nasa-axiom-spacex-ready-first-private-mission-space-station/7192788001.

[16] Kenneth Chang, 'Private astronauts launching to space station don't want to be "tourists"', *New York Times* (8 April 2022), online: www.nytimes.com/2022/04/08/science/axiom-launch-nasa-spacex.html.

[17] Groh, op. cit.

[18] Ibid.

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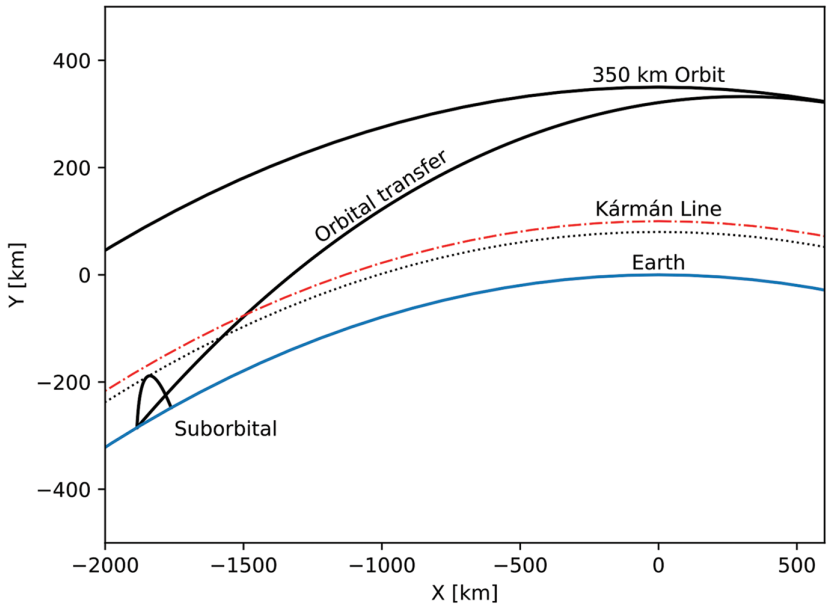

Figure 1.1 A comparison between suborbital and orbital flight trajectories. The blue curve represents the surface of the Earth, the grey dotted curve is the 80-kilometre altitude mark, and the red dot-dashed curve is the Kármán line. The Earth's surface passes through $X,Y = 0,0$ on this plot. (Note that the axes have different scales.) The suborbital flight (small, inverted U on the left) is an example of a trajectory that just reaches the 80-kilometre threshold. The much larger curve, including its initial 'transfer' orbit, is illustrative of an orbital launch, which imagines a 'delta-V' at an altitude of 350 kilometres that places the rocket into a circular orbit.

potential blending between the categories of passenger and crew member if passengers are indeed trained to use critical Crew Dragon systems and not just to resist urges to push buttons. Axiom further tries to use the 'experiments' and research that the passengers conduct, including naked-eye Earth observing or monitoring their personal health, to avoid the 'tourist' label. Still, with all this in mind, it is telling to consider SpaceX's own send-off to the self-styled Axiom-1 astronauts: 'Thanks for flying Falcon 9. You guys enjoy your trip to that wonderful space station in the sky.'[19]

[19] Chang, op. cit.

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The real difference might be that Axiom is now moving forward with plans to provide its own module to house tourists on the station from 2024.[20] Thus the Axiom spaceflight passengers are contributing to experience building for Axiom, NASA and SpaceX – experience in taking the wealthy to Space.

When the ISS is decommissioned, around 2028–2030, Axiom plans to detach its module and use it as part of a commercial Space station. Presumably, this orbital hotel will be advertised to potential guests as both luxurious and entertaining, just like the spaceliners in the 1997 Bruce Willis film *The Fifth Element* and the 2007 *Doctor Who* 'Christmas Special', starring Kylie Minogue and entitled 'Voyage of the Damned'. It will, no doubt, also facilitate some 'science'.

Independently of all this, American software billionaire Jared Isaacman booked a Crew Dragon for a four-person, three-day free-flying orbital flight in September 2021.[21] The mission, named Inspiration4, did not visit the ISS and therefore did not require the involvement of NASA.[22] Nor was a SpaceX astronaut present on the fully automated spacecraft. Although the four tourists remained in contact with SpaceX mission control, they were otherwise on their own. The spacecraft travelled on an elliptical orbit with an apogee of 585 kilometres, giving the tourists an enhanced view of Earth against the backdrop of Space.

Isaacman enjoyed the experience so much that he promptly booked three more missions with SpaceX.[23] The first, named Polaris Dawn, will

[20] National Aeronautics and Space Administration (NASA), news release, 20-007, 'NASA selects first commercial destination module for International Space Station' (27 January 2020), online: www.nasa.gov/press-release/nasa-selects-first-commercial-destination-module-for-international-space-station. Adding a module always involves safety risks, as demonstrated in August 2021 when the thrusters on the new Russian module Nauka began firing after docking, putting the entire ISS at peril. See Joey Roulette, 'Uncontrolled firing from Russian module causes brief "tug of war" on International Space Station', *The Verge* (29 July 2021), online: www.theverge.com/2021/7/29/22600306/uncontrolled-firing-from-russian-module-causes-brief-tug-of-war-on-international-space-station. Those risks will likely be higher with a first-time commercial operator.

[21] Tom Huddleston Jr, 'Meet the billionaire commanding SpaceX's all-civilian mission – he dropped out of high school to start his business', *CNBC* (7 February 2021), online: www.cnbc.com/2021/02/07/billionaire-high-school-dropout-is-leading-spacex-mission.html.

[22] For an overview of the mission, see Vicky Stein and Scott Dutfield, 'Inspiration4: The first all-civilian spaceflight on SpaceX Dragon', *Space.com* (5 January 2022), online: www.space.com/inspiration4-spacex.html.

[23] Stephen Clark, 'Billionaire plans three more flights with SpaceX, culminating in Starship mission', *Spaceflight Now* (14 February 2022), online: spaceflightnow.com/2022/02/14/billionaire-plans-three-more-flights-with-spacex-culminating-in-starship-mission.

attempt to break the 1,372-kilometre altitude record for astronaut flight in Earth orbit, held by Pete Conrad and Dick Gordon from Gemini 11 in 1966. It will also involve 'extravehicular activity' (EVA), making Isaacman the first tourist to 'walk' in Space. Neither SpaceX nor Isaacman has revealed the cost of these missions, but individually they are likely to be much less expensive than a visit to the ISS would be.

Roscosmos is also returning to Space tourism. Thanks to NASA's Commercial Crew Program, which enables astronauts from the United States and NASA partner states to fly on SpaceX Falcon 9 rockets and Crew Dragon spacecraft from US soil, Soyuz seats formerly occupied by Western astronauts can now be used for tourists. In October 2021, actor Yulia Peresild and filmmaker Klim Shipenko visited the ISS to shoot scenes for a Russian Space-and-medical drama entitled *Challenge*.[24] The trip had its own promotional aspect, with the Russian state-owned television Channel One providing live coverage and then Roscosmos director general Dmitry Rogozin being listed as co-director of the film. There might even be an element of geopolitical competition involved, with news of the Russian plan being released after then NASA Administrator Jim Bridenstine announced on Twitter that Tom Cruise and producer Doug Liman would travel to the ISS with SpaceX to film scenes for a new movie.[25] The date of Cruise and Liman's trip, initially reported as October 2021, remains uncertain.

Then, in December 2021, Japanese fashion billionaire Yusaku Maezawa visited the ISS in a Soyuz spacecraft, accompanied by filmmaker Yozo Hirano, who documented his flight. Eric Anderson, the CEO of Space Adventures, the company that arranged the excursion, explained that boredom was a motivating factor for Maezawa: 'there's only so much fine dining and other things that he could do'.[26] Separately, the Japanese tycoon has an agreement with SpaceX that should see him, along with

[24] Joey Roulette, 'Russian film crew wraps space station shoot and returns to Earth', *New York Times* (17 October 2021), online: www.nytimes.com/2021/10/17/science/russia-film-space-station.html.

[25] See Jim Bridenstine, 'NASA is excited to work with @TomCruise on a film aboard the @Space_Station! We need popular media to inspire a new generation of engineers and scientists to make @NASA's ambitious plans a reality' (5 May 2020 at 15:21), *Twitter* (on file with authors).

[26] Joey Roulette, 'Japanese billionaire arrives at space station for 12-day tourist trip', *New York Times* (8 December 2021), online: www.nytimes.com/2021/12/08/science/yusaku-maezawa-space-station.html.

eight others he selects, fly around the Moon in the company's new interplanetary spacecraft, Starship, in 2023.[27]

As this new wave of Space tourism demonstrates, off-Earth travel is often romanticised, with the dangers either minimised or, more often, completely ignored. Yet accidents and other emergencies are inevitable. Emergencies involving Space tourists will raise difficult issues, such as whether the international duty to rescue astronauts extends to them.

1.4 The Duty to Rescue

In the 2015 film *The Martian*, NASA's efforts to rescue astronaut Mark Watney (played by Matt Damon) suffer a seemingly catastrophic failure when a rocket loaded with emergency supplies explodes shortly after launch. The camera cuts to Beijing, where scientists at the China National Space Administration are deliberating whether to offer a newly developed, still secret rocket to NASA for use in a rescue mission. The Chinese rocket plays an essential role in enabling the American astronaut to be saved, in the best possible depiction of a key principle of international Space law in action: the duty to rescue astronauts in distress.

The duty to rescue astronauts was first set out in the 1967 Outer Space Treaty (OST).[28] The opening sentence of Article V reads, 'States Parties to the Treaty shall regard astronauts as envoys of [hu]mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas.'[29] Article V goes on to specify that astronauts 'shall be safely and promptly returned to the State of registry of their space vehicle', that astronauts carrying out activities in Space and on celestial bodies 'shall render all possible assistance to the astronauts of other States Parties', and that parties have an additional duty to 'immediately inform' the other parties or the UN secretary general of 'any phenomena they discover in outer space, including the moon and other celestial bodies, which could constitute a danger to the life or health of astronauts'.[30]

[27] Yusaku Maezawa's Moon mission website advertises '8 crew members wanted! For the mission to the Moon in 2023' (2021), online: dearmoon.earth.

[28] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) (Outer Space Treaty).

[29] Ibid. Art. V.

[30] Ibid. As we explain in Chapter 2, the Chinese Mission to the United Nations office in Vienna referred to the latter duty when, in December 2021, it reported to the UN

The importance attached to the rescue of astronauts during the early years of human spaceflight was demonstrated by the fact that a second treaty, devoted to this specific topic, was concluded almost immediately. This second treaty – the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement)[31] – was 'negotiated backstage' in confidential talks between American and Soviet diplomats, with the other delegations to the United Nations being given less than one week to consider the final text.[32] This accelerated process unfortunately resulted in several ambiguities or errors that have bedevilled international Space lawyers ever since.

Fortunately, however, and as we explain in the next section, these ambiguities or errors can be resolved through a systematic exercise in treaty interpretation, with the result being a duty to rescue that is comprehensive in both geographic scope and the range of persons to which it applies. This outcome is consistent with the humanitarian objectives behind the rescue provision in the OST, as well as the Rescue Agreement. It is also well suited to current developments in human spaceflight.

1.5 The 1968 Rescue Agreement

Article 3 of the Rescue Agreement provides that, if

> the personnel of a spacecraft have alighted on the high seas or in any other place not under the jurisdiction of any State, those Contracting Parties which are in a position to do so shall, if necessary, extend assistance in search and rescue operations for such personnel to assure their speedy rescue.[33]

secretary general that the Chinese Space Station had manoeuvered on two occasions to avoid potential collisions with Starlink satellites.

[31] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 22 April 1968, 672 UNTS 119 (entered into force 3 December 1968) (Rescue Agreement).

[32] Bin Cheng, 'The 1968 astronauts agreement or how not to make a treaty' (1969) 23 *Year Book of World Affairs* 185, reproduced in Bin Cheng, *Studies in International Space Law* (Oxford: Oxford University Press, 1999) 265 at 273. As Cheng explains, the 1963 UN Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space and the 1967 Outer Space Treaty were also the result of backstage US–USSR negotiations followed by greatly curtailed public proceedings.

[33] Rescue Agreement, op. cit., Art. 3.

Article 5 of the Rescue Agreement introduces a new requirement, namely that a state, when requested, return 'space objects or component parts' discovered 'in territory under its jurisdiction or on the high seas or in any other place not under the jurisdiction of any State'.[34] Space objects or component parts are not granted the same priority as the personnel of spacecraft, as the state is only required to 'take such steps as it finds practicable' to recover them. Moreover, the 'launching authority' is required to reimburse any expenses incurred in fulfilling this obligation.

The Rescue Agreement also expands the geographic scope of the duty to rescue. Article V of the OST, by specifying that the duty applies on the 'territory of another State Party or on the high seas', would seem to implicitly exclude both Antarctica and Space – except in those circumstances where a state already has astronauts in Space or on a celestial body, in which case those astronauts 'shall render all possible assistance to the astronauts of other States Parties'.[35] Article 3 of the Rescue Agreement fills these possible gaps with the words 'any other place not under the jurisdiction of any State'.[36] It also specifies that, with regard to persons in distress in such a place, a state that is 'in a position to do so shall, if necessary, extend assistance in search and rescue operations for such personnel to assure their speedy rescue'.

It is important to note that the phrase 'in a position to do so' provides considerable discretion to the state, which is the only entity capable of deciding whether it truly has the equipment and personnel ready and able to provide 'necessary' assistance.[37] It is also clear that efforts to assist should not be made against the wishes of the state of registration of the spacecraft in distress. With all those qualifiers noted, such assistance might, in some circumstances, extend to launching a spacecraft on a rescue mission.

[34] Ibid., Art. 5.
[35] Outer Space Treaty, op. cit., Art. V.
[36] Rescue Agreement, op. cit., Art. 3.
[37] Steven Wood, 'The scope of international obligations to extend rescue assistance to "astronauts" and "personnel" under the Outer Space Treaty and the Return and Rescue Agreement', in Jan Wouters, Philip De Man and Rik Hansen, eds., *Commercial Uses of Space and Space Tourism: Legal and Policy Aspects* (Cheltenham: Edward Elgar, 2017) 44 at 62, citing Paul G Dembling and Daniel M Arons, 'The treaty on rescue and return of astronauts and space objects' (1968) 9:3 *William and Mary Law Review* 649 at 649–650; R Cargill Hall, 'Rescue and return of astronauts on Earth and in outer space' (1962) 63:2 *American Journal of International Law* 197 at 205; Francis Lyall and Paul B Larsen, *Space Law: A Treatise* (Farnham: Ashgate Publishing, 2009) at 140.

At the same time, the drafters of the Rescue Agreement created some confusion by including the word 'alighted' in Article 3, i.e. 'the personnel of a spacecraft have alighted on the high seas or in any other place not under the jurisdiction of any State'.[38] Several experts have argued that, as a consequence, the duty to rescue only applies when personnel have descended and landed on Earth or a celestial body, and not when they are in distress in orbit or deep Space.[39]

This concern over 'alighted' seems misplaced, however, once the international rules on treaty interpretation are applied in a systematic manner to the issue. These rules, set out in Articles 31 and 32 of the 1969 Vienna Convention on the Law of Treaties, are widely accepted as codifying pre-existing customary international law and can therefore be applied to an earlier treaty[40] – in this case, a treaty concluded just one year prior.[41] Article 31 of the Vienna Convention reads, 'A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.'[42] There are thus three elements to any treaty interpretation, which are normally assessed in turn: the ordinary meaning of the terms; their context within the treaty, including its preamble; and the object and purpose of the treaty. Regarding ordinary meaning, we need to look for the meaning at the time the treaty was concluded, and not the meaning today.[43]

[38] Mark J Sundahl, 'The duty to rescue space tourists and return private spacecraft' (2009) 35:1 *Journal of Space Law* 169.

[39] Wood, op. cit. at 57–58, citing CQ Christol, *The Modern International Law of Outer Space* (New York: Pergamon Press, 1982) at 171–72; Dembling and Arons, op. cit. at 649; Hall, op. cit. at 206; Sundahl, ibid. at 169.

[40] Customary international law is one of the three primary sources of international law. It is unwritten and results from a combination of 'state practice' and '*opinio juris*' (i.e. a sense of legal obligation or legal relevance), as explained in greater detail in Chapters 5 and 8.

[41] Vienna Convention on the Law of Treaties, 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980) (Vienna Convention). The International Court of Justice has often stated that the Vienna Convention codifies customary international law. See e.g. *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory*, Advisory Opinion, [2004] ICJ Reports 136 at 174, para. 94; *Armed Activities on the Territory of the Congo* (*Democratic Republic of the Congo* v. *Rwanda*), [2006] ICJ Reports 6 at 51–52, para. 125; *Case Concerning Kasikili/Sedudu Island* (*Botswana* v. *Namibia*), [1999] ICJ Reports 1045 at 1059, para. 18. For the pre-existing rules of customary international law, see Lord McNair, *The Law of Treaties* (Oxford: Oxford University Press, 1961) (republished 1986).

[42] Vienna Convention, op. cit., Art. 31.

[43] Anthony D'Amato, 'International law, intertemporal problems', in R Bernhardt, ed, *Encyclopedia of Public International Law* (Oxford: Oxford University Press, 1992) 1234.

Article 32 of the Vienna Convention then allows for recourse to 'supplementary means of interpretation', including the preparatory work of the treaty (i.e. the official negotiating records, referred to as the *travaux préparatoires*) and the circumstances of its conclusion. But such recourse may only be made 'to confirm the meaning resulting from the application of article 31', or 'to determine the meaning when the interpretation according to article 31: (a) leaves the meaning ambiguous or obscure; or (b) leads to a result which is manifestly absurd or unreasonable'.[44]

And so, we begin our treaty interpretation of Article 3 of the Rescue Agreement with a consideration of the ordinary meaning of the term 'alight' in the phrase 'the personnel of a spacecraft have alighted on the high seas or in any other place not under the jurisdiction of any State'.[45]

The verb 'alight' is defined in the *Merriam-Webster Dictionary* as:

1. To come down from something (such as a vehicle): such as
   a. Dismount
   b. Deplane
2. To descend from or as if from the air and come to rest: land, settle.
3. *Archaic*: to come by chance.[46]

Although a present-day dictionary refers to this last meaning as 'archaic', we should remember that the Rescue Agreement was drafted more than half a century ago, by diplomats who themselves would have been about half a century old.

Steven Wood cites the 1913 version of *Webster's Revised Unabridged Dictionary* ('to come or chance (upon)') and the 1891 *Century Dictionary and Cyclopedia* ('to fall (upon); come (upon) accidentally, or without design; light: as, to alight on a particular passage in a book, or on a particular fact; to alight on a rare plant').[47] It seems plausible, if not likely, that there were three alternative meanings of 'alight' in ordinary usage in 1968.

There is an exception for 'relative terms' – expressions such as 'suitable, appropriate, convenient' that are 'not stereotyped as at the date of the treaty but must be understood in the light of the progress of events'. McNair, op. cit. at 467.

[44] Vienna Convention, op. cit., Art. 31.

[45] Rescue Agreement, op. cit., Art. 3.

[46] Merriam-Webster, 'alight' (last modified 25 March 2022), online: *Merriam-Webster.com Dictionary*, at www.merriam-webster.com/dictionary/alight.

[47] Wood, op. cit. at 61.

And again, ordinary meaning is only the first part of a Vienna Convention Article 31 interpretation. We turn now to the 'context' of Article 3, namely the rest of the treaty, including its preamble, all of which supports a broader interpretation.

The preamble of the Rescue Agreement is short and all of it is relevant to the interpretation:

> The Contracting Parties,
>
> Noting the great importance of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which calls for the rendering of all possible assistance to astronauts in the event of accident, distress or emergency landing, the prompt and safe return of astronauts, and the return of objects launched into outer space,
>
> Desiring to develop and give further concrete expression to these duties,
>
> Wishing to promote international co-operation in the peaceful exploration and use of outer space,
>
> Prompted by sentiments of humanity,
>
> Have agreed on the following: . . .[48]

Note the emphasis on the obligation in the OST to render 'all possible assistance to astronauts in the event of accident, distress or emergency landing', and the fact that this obligation (being referred to here with approval in the preamble to the Rescue Agreement) is not limited to emergency landings. Also note the phrase 'sentiments of humanity', which supports an expansive application that does not distinguish between the different possible locations of the personnel in distress.

Then there is the first part of Article 1 of the Rescue Agreement, which reads,

> Each Contracting Party which receives information or discovers that the personnel of a spacecraft have suffered accident or are experiencing conditions of distress or have made an emergency or unintended landing in territory under its jurisdiction or on the high seas or in any other place not under the jurisdiction of any State . . .

Note, again, that the scope of this provision extends well beyond landings to include any personnel who 'have suffered accident or are experiencing conditions of distress'.

[48] Rescue Agreement, op. cit., preamble.

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The final stage of our Article 31 interpretation concerns the 'object and purpose' of the treaty, which in this case is clearly humanitarian. Indeed, the very short preamble to the Rescue Agreement states that it is 'Prompted by sentiments of humanity'. The rapid conclusion of the Rescue Agreement was motivated, in significant part, by two fatal spacecraft accidents (one American, one Soviet) in 1967.[49]

Moreover, as Wood explains, the Rescue Agreement 'evidences its humanitarian nature through the decision not to condition the obligations to rescue or return "personnel of a spacecraft" upon their State(s) of national origin', and thus 'the universal nature of these obligations and the intention to ensure the safety and safe return of all spacecraft personnel'.[50]

This humanitarian object and purpose call for a broad reading that does not distinguish between people in peril. Indeed, a more restrictive reading would have disturbing consequences. It is difficult to imagine that the humanitarian goals of the Rescue Agreement would exclude the personnel of a spacecraft that became distressed in orbit and was unable to descend safely to Earth. Would the drafters of the treaty have wanted the personnel of the spacecraft to attempt a dangerous crash landing before Article 3 applied?[51]

Since the systematic Article 31 interpretation conducted here does not result 'in any ambiguity or obscurity, or a result which is manifestly absurd or unreasonable', the matter is settled. Article 3 of the Rescue Agreement applies everywhere. There is no option to resort to the 'supplementary means of interpretation' referred to in Article 32 of the Vienna Convention to find support for another conclusion.

Wood is more generous to those who advocate for a more restrictive interpretation, accepting that the disagreements over Article 3 open the door to an examination of the 'supplementary means of interpretation' by generating a result that is 'ambiguous or obscure' or even 'manifestly absurd or unreasonable'. He writes,

> Recognizing these various arguments and examples supporting the opposing interpretations of 'have alighted' as alternatively referring to either the spacecraft or personnel, ambiguity and confusion exist

[49] Dembling and Arons, op. cit. at 638; Remy Melina, 'The fallen heroes of human spaceflight', *Space.com* (11 April 2011), online: www.space.com/11353-human-spaceflight-deaths-50-years-space-missions.html.
[50] Wood, op. cit. at 49.
[51] Ibid. at 59.

> regarding the ordinary meaning of this term. Under the VCLT [Vienna Convention], confusion caused by ambiguous meaning calls for reconsideration of the intended ordinary meaning through consultation of the *travaux préparatoires* and other supplementary sources of interpretation. Further, preconditioning the duty to render assistance on spacecraft landing or personnel disembarking contravenes the humanitarian purposes of the ARRA [Rescue Agreement] and results in absurd consequences, especially where a State Party is well positioned to extend assistance to those in need.[52]

To paraphrase Wood in more succinct terms, the customary international law of treaty interpretation requires that 'an alternative meaning for "have alighted" consistent with the purposes and objectives of the ARRA must be investigated' to avoid an inconsistent and therefore absurd result,[53] i.e. a restrictive interpretation.

As Wood then explains,

> [T]he *travaux préparatoires* include a statement made to the UNGA by French delegate Mr Berard. In his statement, a recapitulation of previous statements before COPUOS and the Legal Subcommittee, Mr Berard indicated that the ARRA is meant to apply 'to search and rescue undertaken not only on the Earth and in its atmosphere, but also in outer space and on celestial bodies'.[54]

Further to this, under Article 32 of the Vienna Convention one could also consider the circumstances of the conclusion of the Rescue Agreement. These circumstances include the two fatal accidents in 1967, as mentioned above. They also include the broader history of the duty to rescue in other areas of international law, including at sea and following aviation accidents.

As we explain in Chapter 6 on planetary defence, the duty to rescue is included in numerous treaties, including the 1914 International Convention for the Safety of Life at Sea (SOLAS Convention),[55] the 1944 Convention on International Civil Aviation (Chicago Convention),[56]

[52] Ibid.
[53] Ibid.
[54] Ibid. at 60, citing UNGAOR, 22nd Sess, 1640th Plen Mtg, UN Doc A/PV1640 (1967) [provisional] at paras. 77, 80, online: https://digitallibrary.un.org/record/742766?ln=en
[55] International Convention for the Safety of Life at Sea, 1 November 1974, 1184 UNTS 278 ch V, reg 15 (entered into force 25 May 1980) (SOLAS Convention).
[56] Convention on International Civil Aviation, 7 December 1944, 15 UNTS 295 Annex 12 (7th ed, 2001), Art. 2.1.2 (entered into force 4 April 1947) (Chicago Convention).

the 1979 International Convention on Maritime Search and Rescue (SAR Convention),[57] and the 1982 United Nations Convention on the Law of the Sea (UNCLOS),[58] as well as numerous regional and bilateral treaties. The drafters of the Rescue Agreement were operating within a legal and political context where the duty to rescue was well recognised as extending to all areas beyond national jurisdiction and all persons in distress.

Together, the OST and the Rescue Agreement provided rules on rescue and return that were appropriate for the early decades of human Space travel, when any accidents or emergencies would have involved astronauts from national Space agencies. Today, however, the advent of Space tourism has introduced some new legal uncertainties.

1.6 The Duty to Rescue and Commercial Spacecraft

Government astronauts on a commercial spacecraft – for instance, NASA astronauts on a SpaceX Crew Dragon – are clearly covered by the Rescue Agreement. But does the duty to rescue extend to rescuing someone who is not employed by a government, and who is on a commercial spacecraft that is not under contract with a government?

The OST is not limited in scope to state actors. For example, the first two sentences of Article VI read,

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.[59]

Within the international legal system, Space law is unusual in making states responsible for all the actions of non-governmental entities. The responsibility extends to liability, as Article VII of the OST makes clear:

[57] International Convention on Maritime Search and Rescue, 27 April 1979, 1405 UNTS 119 Annex, ch 2, Art. 2.1.1 (entered into force 22 June 1985, including amendments adopted in 1998 and 2004) (SAR Convention).

[58] United Nations Convention on the Law of the Sea, 10 December 1982, 1833 UNTS 397 Art. 98 (1) (entered into force 16 November 1994) (UNCLOS).

[59] Outer Space Treaty, op. cit., Art. VI.

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the moon and other celestial bodies.[60]

Similarly, nothing in the OST or the Rescue Agreement indicates that the duty to rescue is limited to government spacecraft and government employees.

The term 'spacecraft' is used throughout the Rescue Agreement. When the approach to interpretation required by customary international law and the 1969 Vienna Convention on the Law of Treaties is applied to 'spacecraft', it becomes clear that the term includes commercial vehicles. First, the ordinary meaning of 'spacecraft', as defined by the *Merriam-Webster Dictionary*, is broad in scope, namely, 'a vehicle that is used for travel in outer space'.[61] Second, the context – i.e. the rest of the Rescue Agreement – includes the preamble, with its reference to the OST calling for 'the rendering of all possible assistance to astronauts in the event of accident, distress or emergency landing' and its statement that the Rescue Agreement was 'prompted by sentiments of humanity'.[62] Further to this, Article 1 and other provisions of the Rescue Agreement do not refer to the state that owns a spacecraft but rather to the 'launching authority'. This choice of words corresponds with the assignment, to states, of responsibility and liability for all the actions of non-governmental entities – in Articles VI and VII of the OST, as reproduced above.

Then there is the change in terminology, as between the OST and the Rescue Agreement, from 'astronauts' to 'personnel of a spacecraft'. As Mark Sundahl explains, the broader language used in the Rescue Agreement is controlling, because the Rescue Agreement was concluded after the OST:

> [T]he Rescue Agreement supersedes the Outer Space Treaty with respect to the duty to rescue under the *lex posteriori* rule. The Rescue Agreement employs the phrase 'personnel of a spacecraft' to describe the beneficiaries of the duty to rescue rather than 'astronaut' – and this inconsistency is

[60] Ibid. Art. VII.
[61] Merriam-Webster, 'spacecraft' (last modified 20 April 2022), online: *Merriam-Webster.com Dictionary* www.merriam-webster.com/dictionary/spacecraft.
[62] Rescue Agreement, op. cit., preamble.

> resolved in favor of the later treaty. As a result, space tourism companies only need to concern themselves with the question of whether 'personnel' includes their passengers.[63]

As part of our Vienna Convention Article 31 interpretation, we must also consider the object and purpose of the Rescue Agreement, which (as we saw above) is humanitarian. This too supports an interpretation that encompasses commercial spacecraft.

Finally, under Article 32 of the Vienna Convention we can confirm this interpretive outcome by considering the circumstances of the Rescue Agreement's conclusion. As they were above, the 1914 SOLAS and 1944 Chicago Conventions are highly relevant here, since the duty to rescue in those early and widely ratified treaties extends to commercial vessels and aircraft. There is, as a result, no doubt that the obligations in the Rescue Agreement extend beyond rescuing government employees, to include at a minimum the rescue of non-governmental crew members.

1.7 The Duty to Rescue and Non-governmental Passengers on Commercial Spacecraft

Does the term 'personnel of a spacecraft' in the Rescue Agreement extend to non-government passengers on commercial spacecraft? The first step in answering this question concerns the 'ordinary meaning' of the term 'personnel', as part of a Vienna Convention Article 31 interpretation.

'Personnel' is defined in the *Merriam-Webster Dictionary* as:

1. a body of persons usually employed (as in a factory or organization).
2. a division of an organization concerned with personnel.[64]

It seems reasonable to conclude that the ordinary meaning of 'personnel' includes some degree of function or service.

Turning to the 'context' provided by the rest of the Rescue Agreement, we noted above that the preamble supports a broad interpretation of the duty to rescue. At the same time, however, the treaty's full title might suggest a narrower interpretation of 'personnel', one that excludes people who are not playing a functional role. Again, that title is: Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space. The term 'personnel of a spacecraft'

[63] Sundahl, op. cit. at 185.

[64] Merriam-Webster, 'personnel' (last modified 27 April 2022), online: *Merriam-Webster.com Dictionary* www.merriam-webster.com/dictionary/personnel.

appears later, in the text of this treaty. All that being said, from the point of view of pop culture and general public perception, the term 'astronaut' was and is widely understood to include everyone who has travelled to Space, with few in the media questioning whether Jeff Bezos and Wally Funk achieved 'astronaut' status.

As for the 'object and purpose' of the Rescue Agreement, the preamble explains that the agreement was 'prompted by sentiments of humanity', which supports the argument that it 'should be interpreted as applying to all persons involved in a space tourism flight'.[65] One can also discern object and purpose in the variety of terms used in the four Space treaties concluded between 1967 and 1974:[66] 'astronauts', 'personnel of a space object', 'personnel of a spacecraft', and 'persons on board a space object', which together indicate a principle of ensuring that 'the protection provided by the Space treaties covers all persons participating in Space flights'.[67]

As a result of this Article 31 interpretation, we conclude that 'personnel of a spacecraft' includes everyone on board. But we should confirm this interpretation, as we are permitted to do under Article 32 of the Vienna Convention, through an examination of 'supplementary means of interpretation' in the form of the *travaux préparatoires*.

The official records of the negotiations of the Rescue Agreement, which began as early as 1962, reveal an intent, on the part of the drafters, to be as inclusive as possible in terms of the beneficiaries of the duty to rescue. In 1964, for example, Working Group I of the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) reviewed draft treaty proposals from both the United States and the Soviet Union, as well as a joint proposal from Canada and Australia. The records of the working group reveal that, initially, the term 'astronaut' had been suggested to take the place of 'crew' or 'personnel' as 'it means all those persons who have been in outer

[65] Steven Freeland, 'Up, up and . . . back: The emergence of space tourism and its impact on the international law of outer space' (2005) 6:1 *Chicago Journal of International Law* 10.

[66] Outer Space Treaty, op. cit.; Rescue Agreement, op. cit.; Convention on International Liability for Damage Caused by Space Objects, 29 March 1972, 961 UNTS 187 (entered into force 1 September 1972) (Liability Convention); Convention on Registration of Objects Launched into Outer Space, 12 November 1974, 1023 UNTS 15 (entered into force 15 September 1976) (Registration Convention).

[67] Vladlen S Vereschetin, 'Astronauts', in Anne Peters, ed, *Max Planck Encyclopedia of Public International Law* (Oxford: Oxford University Press, article last modified Jan 2006), online: opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1141.

space and have performed there certain duties'.[68] In response, the term 'crew' was suggested because it 'is relevant for the purpose of the Agreement since only in the distant future will space objects be used for pleasure trips'.[69] At one point an alternative phrase, 'persons on board a spacecraft', was advanced but then rejected out of concern that it would leave out personnel who had 'abandon[ed] the craft before landing'.[70] Most notably, however, is that the term 'personnel' was suggested because it 'is wider than the term "crew" and thus more preferable for the purpose of the Agreement'.[71]

Further to this, Wood points out that the OST

> constitutes an excellent supplemental source to inform the interpretation of 'personnel' because it forms the basis on which the ARRA [Rescue Agreement] was built and because it was adopted in the same year as the ARRA. OST Article VIII stipulates that States of registration 'shall retain jurisdiction and control over [their space] object, and over any personnel thereof'. This provides exceptional support to the position that the ordinary meaning of the term 'personnel' included private passengers at the time the ARRA was concluded.[72]

Last but perhaps not least, we can also consider the circumstances of the conclusion of the Rescue Agreement. Once again, these circumstances include the SOLAS and Chicago Conventions, where the duty to rescue includes the passengers on ships and aircraft. Indeed, the negotiation of the SOLAS Convention was prompted by the large number of passengers who died during the sinking of the RMS *Titanic* two years earlier.[73] On

[68] Committee on the Peaceful Uses of Outer Space, *Report of the Legal Subcommittee on the Work of the Second Part of Its Third Session (5–23 October 1964) to the Committee on the Peaceful Uses of Outer Space – Part I: Assistance to and Return of Astronauts and Space Objects. Summary of Points Raised in Discussions of Working Group I (Continued)*, UNGAOR, UN Doc A/AC.105/21/add.2 (23 October 1964) at 6, online: www.unoosa.org/pdf/reports/ac105/AC105_021E-ra.pdf.

[69] Ibid.

[70] Ibid.

[71] Ibid.

[72] Wood, op. cit. at 54; although the Rescue Agreement was opened for signature on 22 April 1968, the final stages of its negotiation were in 1967 (the year the OST was signed and entered into force), with the Rescue Agreement unanimously adopted by resolution of the General Assembly on 19 December 1967; *Agreement on the Rescue and Return of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, GA Res 2345 (XXII), UNGAOR, 22nd sess, 1640th Plen Mtg, UN Doc A/RES/22/2345 (19 December 1967).

[73] Catherine Phillips and Jaideep Sirkar, 'The International Conference on Safety of Life at Sea, 1914', (Summer 2012) 69:2 *Coast Guard Proceedings: Journal of Safety & Security at*

this basis, as well as for the reasons above, we conclude that the term 'personnel of a spacecraft', and therefore the duty to rescue, extend to rescuing non-government passengers on commercial spacecraft.

1.8 The Duty to Rescue and Suborbital Flights

As we explained above, there is no agreement on where airspace ends and Space begins. This lack of agreement creates uncertainties as to the legal regime applicable to suborbital flights. Virgin Galactic flights reach altitudes just above 80 kilometres, which some consider to be Space, and others do not. Blue Origin flights reach altitudes just above 100 kilometres, which is unarguably Space, but they will not achieve orbit and are therefore akin to intercontinental ballistic missiles (ICBMs) which cross through Space but are not generally regarded as subject to international Space law.[74]

In the context of the duty to rescue, the uncertainty whether air law or Space law applies is unlikely to create practical problems. Unlike ICBMs, the vehicles used by Virgin Galactic and Blue Origin land very close to their launch sites, and therefore within the territory of the same state. Even if an accidental landing were somehow to occur on the territory of another state, or on the high seas, a duty to rescue would always exist – whether under the Rescue Agreement; the Chicago Convention on Civil Aviation; or the combined provisions of the SOLAS Convention (Regulation V-33), SAR Convention and UNCLOS (Art. 98). Finally, no crew or passengers from a suborbital flight will ever require a rescue in Space, since their vehicle would not remain there for more than a few minutes, even after an accident.

At the same time, determining which legal regime applies to a suborbital flight will have consequences for the liability regime that applies, as well as for the registration of the vehicle. The liability regime in airspace is fundamentally different from the liability regime in Space. In airspace, liability is based on fault (of the air carrier), and states are not responsible for the actions of private airlines and other non-governmental entities.

Sea 27, online: www.dco.uscg.mil/Portals/9/DCO%20Documents/Proceedings%20Magazine/Archive/2012/Vol69_No2_Sum2012.pdf.

[74] Indeed, the issue of ICBMs was avoided in the drafting of the OST, which only prohibits the stationing of nuclear weapons in orbit or anywhere else in Space. See Rex J Zedalis and Catherine L Wade, 'Anti-satellite weapons and the Outer Space Treaty of 1967' (1978) 8:3 *California Western International Law Journal* 454 at 465.

Under the 1972 Convention on the International Liability for Damage Caused by Space Objects (Liability Convention),[75] there is absolute liability of a 'launching state' for damage caused by its Space object 'on the surface of the earth or to aircraft in flight' (Art. II) and fault-based liability for damage caused elsewhere, i.e. in Space (Art. III). Moreover, under the OST, states are responsible for any damage (Art. VII), including damage caused by 'national activities' undertaken by 'non-governmental entities' (Art. VI), such as suborbital tourism companies incorporated within, or launching from, their territory.

Stephan Hobe argues that we can determine which legal regime applies to suborbital flights by examining, among other things, (1) the way the vehicle leaves the Earth's surface and (2) the vehicle's intended purpose.[76] From this, a differentiation between aircraft and spacecraft can be made, allowing the respective legal regimes to be applied appropriately.[77]

Some suborbital vehicles, such as Virgin Galactic's *SpaceShipTwo*, are ferried to a high altitude by an aircraft before being released, at which point they continue upwards under their own rocket power. As Hobe explains, while the vehicle is attached to the aircraft, the combined units should be dealt with under air law because they exhibit the 'technical functions such as flight pattern and maneuverability' of an aircraft.[78] Indeed, the definition of an aircraft under the Chicago Convention is: 'Any machine that can derive support in the atmosphere from the reactions of the air'.[79]

Once the vehicle detaches from the aircraft and engages its rocket engines, Hobe argues that it should be considered a 'space object'.[80] This argument has merit, given the language of Article VII of the OST, which reads,

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the moon and other celestial bodies.[81]

[75] Liability Convention, op. cit.
[76] Stephan Hobe, 'Legal aspects of space tourism' (2007) 86:2 *Nebraska Law Review* 442.
[77] Ibid.
[78] Ibid at 443.
[79] Chicago Convention, op. cit., Annex 7, ch 1.
[80] Hobe, op. cit. at 443.
[81] Outer Space Treaty, op. cit., Art. VII.

The key words here are 'into outer space', which, again, begins no more than 100 kilometres above the Earth. The Liability Convention follows the approach of the OST, adding only that '[t]he term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof'.[82] And it makes sense for the Liability Convention to apply to suborbital flights when they are in Space, since a suborbital vehicle could cause damage even during its brief time there. However, this conclusion might not apply to *SpaceShipTwo*, depending on whether one considers the boundary of Space to be 80 or 100 kilometres.

Determining the applicable legal regime will also be important with regard to any damage caused by the vehicle during its return to Earth. Article II of the Liability Convention reads, 'A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight.'[83] Again, under international air law, it is the airline that is liable and not a state. Moreover, the liability is fault-based under air law rather than absolute as in Space law.

The Liability Convention applying to suborbital flights (at least those which reach above 100 kilometres) does not mean that the Registration Convention is likewise applicable. For the first sentence of Article II of the Registration Convention reads, 'When a space object is launched *into earth orbit or beyond*, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain'.[84]

Some experts have argued that suborbital flights could, for the purposes of the Registration Convention, be treated as failed attempts to launch into Space. The argument seeks to draw on the fact that a spacecraft which is intended to be launched into orbit, but which fails to achieve orbit, remains governed by the Space law regime. However, a suborbital vehicle does not fail to reach orbit by accident; it fails to reach orbit by design. Achieving orbit is never a possibility because the vehicle cannot achieve orbital speeds.

The limited state practice on this matter does not help to clarify things. The FAA has been licensing Blue Origin and Virgin Galactic's flights as 'commercial space transportation' under Chapter III, Title 14, of the Code of Federal Regulations. However, Title 14 includes both aeronautics and Space and the FAA is of course the Federal *Aviation* Administration.

[82] Liability Convention, op. cit., Art. I(d).
[83] Ibid. Art. II.
[84] Registration Convention, op. cit., Art. II, added emphasis.

Moreover, *SpaceShipTwo* has also been registered by the FAA as an aircraft and more specifically a 'glider'.[85] This makes sense because, during most of its flight, i.e. during the ferry ride to 50,000 feet, and then during its return to Earth, *SpaceShipTwo* fits the definition of an aircraft under the Chicago Convention, i.e. 'Any machine that can derive support in the atmosphere from the reactions of the air'.[86] *New Shepard*, which does not have wings, does not fit the definition and could not be so registered.

At the international level, applying the Registration Convention to suborbital vehicles would serve little purpose, since the point of registration is to publicise the presence of human-made objects in Space, and suborbital vehicles only spend a couple of minutes at the lowest fringes of Space. In other words, it makes sense for the Liability Convention to apply to suborbital flights, and for the Registration Convention not to do so. There is no reason why the geographic reaches of the treaties should be the same, since they deal with different issues.

Again, in terms of the duty to rescue, all this concerns a distinction without a difference. The duty to rescue applies everywhere on Earth, under either the Rescue Agreement, the Chicago Convention, the SOLAS Convention, the SAR Convention and/or UNCLOS. It also exists, as we explain in Chapter 6, as a universally applicable rule of customary international law.

The duty to rescue is a central principle of international Space law; so central, in fact, that the 1968 Rescue Agreement was concluded almost immediately after the 1967 OST to elaborate, via a dedicated treaty, on the duty to rescue as already set out in the OST. Although the drafters of the two treaties might not have foreseen that Space tourists would fly on commercial spacecraft in the 2020s, they worded the duty to rescue in broad terms, and with the clear intent of having it apply to all human beings engaged in Space travel.

Rescues in orbit, on the Moon and other celestial bodies and in deep Space will be difficult and expensive. But they will occur. At sea, states take the duty to rescue seriously, sometimes deploying aircraft and ships thousands of kilometres to save the crews of foreign ships and boats, whether publicly or privately owned. Although this practice is not always consistent – as sadly sometimes those same states look away when the

[85] To find the registration for *SpaceShipTwo*, search N202VG at 'Aircraft Inquiry' (2022), online: *FAA* registry.faa.gov/aircraftinquiry/Search/NNumberInquiry.
[86] Chicago Convention, op. cit., Annex 7, ch 1.

human beings in distress are economic migrants or even refugees – international rules can exist without uniform practice or coercive enforcement.

The duty to rescue is not coupled with a right to be reimbursed for costs. Article 5(5) of the Rescue Agreement sets out an obligation, on the part of the launching authority, to bear the '[e]xpenses incurred in fulfilling obligations to recover and return a space object or its component parts'. But the absence of a similar provision concerning the duty to rescue confirms that the rescuer bears the costs. This raises the question whether there is a need for new international rules, or perhaps a compensation fund, to reduce the costs to states or companies when they engage in rescue missions. For instance, Space companies could be required to carry insurance for the costs incurred by any rescuer. Alternatively, or additionally, Space companies could be required to maintain a rescue capability whenever they have human beings in Space. Consider the best practice demonstrated by NASA, which held a Saturn V/Apollo and then a Space Shuttle on standby whenever it had astronauts in Space. Today, SpaceX provides the same readily available backup with Falcon 9/Crew Dragon. Again, it is important to note that this issue will not arise with suborbital flights, which will always return to Earth even if something goes wrong.

1.9 Climate Impacts

There is nothing inherently wrong about finding new and cheaper ways to access Space. The development of commercial spacecraft could lead to innovations of general value. The problem, rather, is one of volume, with humanity already struggling to limit its collective impacts on the atmosphere. Richard Branson and Jeff Bezos are clearly planning for a very large number of tourist flights. In 2018, Branson said, 'There are, we believe, millions of people who would love to go to space, and we want to tap into those people. If you can create the best – the best hotel chain, the best clubs, the best spaceship company – it'll become very valuable.'[87] Coming from someone who once spent a lot of time and energy cultivating an image as a climate change activist, this embrace of Space tourism represents a stunning turnaround.[88]

[87] Nicholas Schmidle, *Virgin Galactic and the Making of a Modern Astronaut* (New York: Henry Holt & Co, 2021) 213.

[88] For a sharp assessment of Branson's record on climate change, see Naomi Klein, 'The hypocrisy behind the big business climate change battle', *The Guardian* (13 September 2014), online: www.theguardian.com/environment/2014/sep/13/greenwashing-sticky-business-naomi-klein.

In 2010, the development of *SpaceShipTwo* prompted a peer-reviewed study which predicted that 'emissions from a fleet of 1000 launches per year of suborbital rockets would create a persistent layer of black carbon particles in the northern stratosphere that could cause potentially significant changes in the global atmospheric circulation and distributions of ozone and temperature'.[89] Although the study was not specific to the form of synthetic rubber used as fuel in *SpaceShipTwo*'s 'hybrid' rocket motor, it emphasised that the black carbon produced in the upper atmosphere by such rockets could have a 'radiative forcing effect' that exceeds, by several orders of magnitude, the climate impact of their carbon dioxide emissions. Specifically, the study estimates that

> after one decade of suborbital hybrid rocket launches at the assumed rate, [radiative forcing] from the accumulated [black carbon] for these 10,000 launches will exceed [radiative forcing] from the associated CO_2 emissions by a factor of about 10^5. As long as the launch rate is maintained, the CO_2 climate forcing for this fleet would be minuscule compared to the [black carbon] forcing. Accordingly, assessments of climate forcing for passenger and cargo rockets that consider only CO_2 emissions [citation removed] underestimate rockets' contribution to climate change by many orders of magnitude.[90]

This point is critical. A significant amount of the public discussion concerning climate impacts of human activities is focused on CO_2 emissions, and for good reason. But this cannot be at the expense of dismissing contributions from other substances that are much more relevant to rocket launches. Even water vapour placed into the upper atmosphere has the potential to form mesospheric clouds, for which the climate impacts are not fully understood.

The FAA overlooked the issue of black carbon when it conducted an environmental impact assessment of *SpaceShipTwo* in 2012.[91] The FAA did consider small particulate matter, including soot, in the exhaust of *WhiteKnightTwo* – the aircraft that ferries *SpaceShipTwo* to over 40,000 feet. However, it did not investigate the soot production by *SpaceShipTwo* in any capacity, citing the lack of data on particulate matter for the rocket

[89] Martin Ross, Michael Mills and Darin Toohey, 'Potential climate impact of black carbon emitted by rockets' (2010) 37:24 *Geophysical Research Letters* L24810.

[90] Ibid.

[91] FAA, 'Final environmental assessment for the launch and reentry of SpaceShipTwo reusable suborbital rockets at the Mojave air and space port', Federal Aviation Administration (May 2012), online: www.faa.gov/about/office_org/headquarters_offices/ast/media/20120502_Mojave_SS2_Final_EAandFONSI.pdf.

plane. This is a clear failure. For by limiting itself to 'data-driven' decisions (i.e. those that can be based on existing data), the FAA is treating as irrelevant scientifically well-informed models that show that soot in the upper atmosphere can have a substantial climate impact. It also implicitly supports the notion that companies can avoid rigorous environmental impact assessments by declining to make data available or simply not acquiring the necessary data in the first place.

But this does not mean that the rest of us should give Branson and Virgin Galactic a pass on their cumulative, potentially massive, climate impacts. Indeed, the 2010 peer-reviewed study concluded that the buildup of black carbon from all these joyrides to the edge of Space might, over a decade, cause as much damage to the atmosphere as all subsonic aviation – in other words, all the goods and millions of people transported by air around the world each day.[92] What if all the efforts the rest of us are making to mitigate climate change – whether paying carbon taxes, retrofitting buildings, buying electric cars, or avoiding long-haul vacations – are about to be nullified by the wealthiest 0.1 per cent engaging in Space tourism? Virgin Galactic should be required to address its potential climate impacts, including from black carbon, with publicly accessible data – or limit flights until it adopts a less-polluting fuel.

New Shepard is powered by liquid hydrogen and liquid oxygen, which is at face value a clean-burning fuel – as Blue Origin gleefully points out.[93] But all liquid fuels will affect mesospheric cloud formation,[94] for which the full climate effects, as well as other implications for the atmosphere, are poorly understood. Moreover, all fuels have impacts, and it is essential that the full spectrum of impacts is evaluated for understanding how rocket launches will alter Earth's environment. Focusing on just, for example, comparing today's rocket CO_2 emissions with those from aviation and shipping will miss numerous other factors and provide a distorted view of the consequences of human Space use.

[92] Ross, Mills and Toohey, op. cit.

[93] See Blue Origin (9 June 2021 at 11:33), online: *Twitter* twitter.com/blueorigin/status/1413521627116032001. The tweet, which includes a side-by-side comparison of *SpaceShipTwo* and *New Shepard*, actually cites Martin Ross and James Vedda, 'The policy and science of rocket emissions', Center for Space Policy and Strategy, the Aerospace Corporation (2018), online: https://aerospace.org/sites/default/files/2018-05/RocketEmissions_0.pdf.

[94] JA Dallas, S. Raval, JP Alvarez Gaitan, S Saydam and AG Dempster, 'The environmental impact of emissions from space launches: A comprehensive review' (2020) 255 *Journal of Cleaner Production* 120209.

Orbital launches are generally worse for the atmosphere than suborbital launches since it takes more energy – more combustion – to achieve orbital speeds. SpaceX's Falcon 9 rockets are powered by kerosene and liquid oxygen, with the consumption of the kerosene injecting black carbon into the upper atmosphere. Such launches also often leave spent rocket stages and other objects behind in low Earth orbit and geosynchronous transfer orbits, increasing the operational hazards for thousands of satellites as well as the ISS and China's new Tiangong Space station.

SpaceX's new Starship will be fully reuseable and powered by methane and liquid oxygen, a somewhat more environmental combination that will, nevertheless, affect mesospheric cloud formation and still produce soot. Moreover, Elon Musk is planning to use Starship to shuttle fuel for deep Space missions departing from low Earth orbit, and for point-to-point travel on Earth itself. In numerous presentations and other public comments, Musk has made clear that he anticipates launching Starship spacecraft hundreds if not thousands of times each year. Indeed, in an e-mail to SpaceX employees in November 2021, obtained by CNBC, he warned that the company faced a 'genuine risk of bankruptcy if we cannot achieve a Starship flight rate of at least once every two weeks next year.'[95] Musk was most certainly exaggerating the threat of bankruptcy, since SpaceX is a privately held company that could raise vast amounts of money by going public on the New York Stock Exchange. But more importantly, the sustainability of all this activity must be questioned. Although some of the opportunities provided by these launches will undoubtedly benefit humanity, other aspects, such as Space tourism, will not. Again, it is all a question of volume – and with that, agreed limits on what states and private companies can do.

1.10 Who Will Rescue the Martians?

NASA has plans to establish a permanent human presence on the Moon, while Elon Musk claims that a self-sustaining community[96] on Mars is his principal motivation for building both SpaceX and Tesla (with

[95] Michael Sheetz, 'Elon Musk tells SpaceX employees that Starship engine crisis is creating a "risk of bankruptcy"', *CNBC* (30 November 2021), online: www.cnbc.com/2021/11/30/elon-musk-to-spacex-starships-raptor-engine-crisis-risks-bankruptcy.html.

[96] We prefer the term 'community' to the historically loaded terms 'settlement' and 'colony'.

revenue from car sales being necessary to fund the most expensive operation yet undertaken by humankind).

The potential for communities on the Moon and Mars raises all kinds of fascinating legal and policy issues, especially in the context of commercial missions where the spacecraft, habitations, and life-support systems belong to a private corporation. In democratic countries, there are some human and labour rights that cannot be surrendered through employment contracts, including the right to leave a job after due notice, but will these rights be available to people living in a SpaceX complex on Mars? There is also the issue of children born on Mars, and whether they might be compelled to work for SpaceX when they are adults. If not, what obligations, if any, does the company owe to them? There is also the issue of the right to self-determination, which should be available to a community in Space, not least because of its vast distance from the 'colonial power'.[97] Relatedly, there are issues involving sovereignty and territoriality. Will permanent habitations on Mars require some compromise on the prohibition on 'national appropriation of the Moon and other celestial bodies', as set out in Article II of the Outer Space Treaty? Might they require 'safety zones', as proposed by the Artemis Accords,[98] and could these be permanent – and legally opposable to other actors?

We will leave these issues for another book, except for the issue of the duty to rescue, which arises because of Article 3 of the Rescue Agreement. Again, that provision states that if

> the personnel of a spacecraft have alighted on the high seas or in any other place not under the jurisdiction of any State, those Contracting Parties which are in a position to do so shall, if necessary, extend assistance in search and rescue operations for such personnel to assure their speedy rescue.[99]

The question is, does Article 3 extend to people who have alighted on the Moon or Mars, not because of an emergency, but because they plan to stay there? In short, if people who are happily *living* on the Moon or Mars subsequently have an accident, or a medical emergency, or perhaps run out of supplies, can they benefit from this specific treaty provision? The answer, clearly, is 'no'.

[97] Michael Byers, 'Elon Musk, president of Mars?', *Washington Post* (22 January 2016), online: www.washingtonpost.com/opinions/elon-musk-president-of-mars/2016/01/22/732f1520-bfc7-11e5-bcda-62a36b394160_story.html.

[98] See discussion in Chapter 5 below.

[99] Rescue Agreement, op. cit., Art. 3.

But this is not the end of the enquiry. To answer the broader question, whether there is a duty to rescue, we have to go back to the second paragraph of Article V of the OST, which reads, 'In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties.'[100] This general obligation to 'render all possible assistance' to 'astronauts carrying on activities . . . on celestial bodies' is not limited to accidents occurring during the landing and 'alighting'. Nor is this general obligation superseded by the otherwise more specific provisions of the later-in-time Rescue Agreement, because they do not address this issue. So yes, the duty to rescue applies with regard to people living on the Moon or Mars, at least for now and the foreseeable future. We need not argue whether such individuals are considered to be tourists or part of the crew or something else. In fact, other terms may very well emerge to describe people who live for extended periods away from Earth or have never lived on Earth. As already discussed, 'astronaut' is intended to be broad in scope for the purposes of the Rescue Agreement.

Moreover, this duty to rescue people in distress on other celestial bodies likely also exists in customary international law, as a logical extension to our finding above that the duty to rescue applies everywhere on Earth. There is no apparent reason, either in treaty or in state practice, to think that a generally applicable rule of customary international law does not apply in Space. Indeed, Article III of the OST reads, 'States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations.'[101] The explicit mention of the UN Charter makes it clear that 'international law' in this context means international law in general, not just the specialised rules of international Space law.

But again, the duty to rescue is never absolute: a state has the discretion to decide that a rescue mission is impossible, unlikely to succeed, or simply too dangerous or expensive to attempt. Each situation will also depend on the facts specific to it. A refusal to mount a self-evidently feasible rescue mission to a nearby Moon base, with rovers and sufficient fuel and supplies available, might constitute a clear breach of the duty to rescue, but most other decisions will be less obvious. Even Hollywood

[100] Outer Space Treaty, op. cit., Art. V.
[101] Ibid. Art. III.

seems to recognise this: in *The Martian*, the Chinese provided a rocket, but did not put any of their own personnel at risk.

1.11 Conclusion

Richard Branson is the king of self-promotion, with an ability to draw in A-list celebrities to boost his own stature. Lady Gaga, Justin Bieber, Leonardo DiCaprio, Brad Pitt, Angelina Jolie, Katy Perry, Russell Brand, and Rihanna are all rumoured to have reservations on *SpaceShipTwo*.[102] All this celebrity comes with a large dose of cynicism. Prospective Space tourists have expressed a desire to engage in 'exploration' and to view our fragile 'blue marble' against the backdrop of the void. This last desire is often expressed alongside the goal of raising environmental awareness, including the need for those of us who have stayed on Earth to change our personal behaviours.

In 2009, Cirque du Soleil founder Guy Laliberté became Canada's first Space tourist, travelling to the ISS for 12 days on a Soyuz rocket. He claimed the journey as a business expense – a 'social and poetic mission' to raise awareness about the need for improved access to fresh water. Let that sink in. Some of the richest people in the world are paying to launch themselves into Space and then asking for the taxpayers to subsidise their joyride. Fortunately, the Tax Court of Canada disagreed, ruling that 'the motivating, essential and overwhelmingly primary purpose of the travel was personal'.[103] Appealed by Laliberté, this judgment was unanimously upheld by Canada's Federal Court of Appeal.[104]

Most of these wannabe astronauts prefer the terms 'private astronauts' and 'spaceflight participants' to 'Space tourists.' They sometimes also profess a desire to test themselves against new challenges, likening their trip to those taken by the first astronauts, or high-risk adventure sports such as summiting Mount Everest or sailing singlehandedly round the

[102] Not all celebrities have jumped on this bandwagon. When Billy Eilish was asked if she wanted to go to Space, she replied, 'I would literally rather do anything else.' Sophia June, 'Billie Eilish says she'd "literally rather do anything else" than go to space', *Nylon* (October 2021), online: www.nylon.com/life/billie-eilish-hates-space.

[103] *Laliberté* v. *The Queen*, 2018 TCC 186 at para. 11; see Sidhartha Banerjee, 'Tax court rules Cirque's Guy Laliberte's 2009 space trip was a taxable benefit', *Globe and Mail* (14 September 2018), online: www.theglobeandmail.com/canada/article-tax-court-rules-guy-lalibertes-2009-space-trip-was-a-taxable-benefit-2. The court did allow 10 per cent of the trip to be claimed as a business expense.

[104] *Laliberté* v. *Canada*, 2020 FCA 97.

world. But make no mistake: they use deep pockets to bypass rigorous selection processes; undergo minimal training, particularly for suborbital flights; and have little to no real inflight responsibility. It is perhaps sobering to point out that 'Ham the Chimp' was trained to perform a mission-critical job – pushing a lever to test reaction times in Space.

Projects like Axiom, while still a form of tourism, do have some potential for advancing human spaceflight through collaboration with NASA and other Space agencies. Indeed, the United States and its allies are counting on such companies to provide next-generation Space stations. But a healthy dose of skepticism is still needed, with Axiom's current focus being on building the most expensive and elite of travel lounges.

Some of those journeying into Space will push boundaries, and these individuals could have a positive impact on crewed Space exploration, even if it is by being thrill-seeking guinea pigs who pay their own way. But many Space tourists are simply engaged in a form of extinction tourism. They are like passengers on an Arctic cruise ship,[105] spewing greenhouse gases as they travel to the melting ice – to see it before it's gone. And yet states have a duty to rescue them if something goes wrong.

[105] Michael Byers, 'Arctic cruises: Fun for tourists, bad for the environment', *Globe and Mail* (18 April 2016), online: www.theglobeandmail.com/opinion/arctic-cruises-great-for-tourists-bad-for-the-environment/article29648307.