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Certification and safety aspects relating to the transport of passengers on high altitude balloons in Europe

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ABSTRACT

High-altitude balloons typically fly between 25 and 50 km in altitude, which, while below the Karman line of 100 km, is yet far above the altitudes typically flown by aircraft. For example, the highest-flying commercial aircraft – the Concorde – had a maximum cruising altitude of only 18 km. zero2infinity, a Spanish company, is currently developing a pressurized pod named "bloon" which will be capable of lifting six people, including two pilot crew members and four paying passengers, to an altitude of 36 km through the use of high-altitude balloons. The boundary between Airspace and Outer Space has never been legally defined, mostly because of the lack of activities taking place between the altitude where airplanes fly and the lowest orbiting spacecraft. High-altitude balloons do fly at these in-between altitudes and the prospect of commercializing access to these parts of the stratosphere poses some questions in a new light. Given the relatively low altitude at which they fly, it may well be that these types of balloons would be considered to operate exclusively within air space. However, given the technology involved in crewed high altitude balloon flights, which is more similar to spacecraft engineering than to traditional hot-air or gas ballooning, it is necessary to evaluate the various legal regimes, codes, and regulations that would apply to such flights, especially regarding licenses and liabilities. For high altitude balloon flights commencing in Europe, the European Aviation Safety Agency (EASA) would very likely be the competent certification or licensing agency for these flights, although there would likely be input from various national aviation authorities as well. However, because the European Commission (EC) has not yet issued regulations regarding commercial spaceflight, particularly the use of high altitude balloons, new rules and regulations governing such flights may still need to be drafted and promulgated. With the development of suborbital passenger vehicles such as bloon, Spaceplane as well as SpaceShipTwo (which is British-owned) this is clearly the appropriate time for the EC or other competent institutions to issue regulations regarding suborbital passenger flight. Rules and regulations regarding suborbital passenger transport such as liability and waivers to protect third parties, governments, and operators, need to be addressed by the European Union (EU) as a whole or at least by national or regional governments wishing to attract suborbital passenger flights to their territory. After all, it would be in Europe's financial and other interests to create and foster a favorable legal and commercial environment for the aerospace business within the borders of the EU.

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1. Introduction

Human high-altitude balloon flights are not reserved to daredevils like Felix Baumgartner who completed the highest Space dive from a high-altitude balloon capsule for the Red Bull Stratos Project on October 14th, 2012. He was indeed the first human to fly with a balloon to these altitudes in 40 years, but in the 1960s before the rocketry race begun, many manned high-altitude flights took place in Russia and the USA.

Balloonists were actually the first “astronauts” in the 1930s, if by astronauts we mean people that have seen the Earth from outside the boundary of our atmosphere. No need indeed to go up to 100km or more to be outside most of the mass of our atmosphere, or to see the view from Space as we imagine it: the black sky, the white sun, the blue line of the atmosphere and the curvature of the Earth clearly visible.

On November 12, 2012, zero2infinity, a Spanish company, launched an unmanned life-supporting capsule to 32 km from León, Spain, using a 43,000 m^3 balloon and its own launch vehicle and ground equipment, thereby officially entering the small club of heavy balloon launch providers (Fig. 1).

Spain also has a heritage in human high-altitude ballooning. In 1935, Emilio Herrera, a Granada-born scientist and aviator, designed the first ever spaceflight suit, which he intended to use to fly to an altitude of 30 km with a balloon. He tested his suit in an airless chamber, and conducted many other experiments, until he was ready for flight with the balloon and the basket constructed. The start of the civil war in Spain abruptly halted the project. He went into exile and could never fly. The Apollo mission space suits design was based on that of Emilio Herrera. It may be symbolic but zero2infinity's founder comes from the same city and graduated from the same University as this Spanish Space pioneer (Fig. 2).

But why fly with humans? For the view, but not only. Several significant scientific discoveries were made by man-made observations from high-altitude platforms back in the beginning of the previous century, including cosmic rays, the effect of solar flares on humans in Space, water ice on the Martian poles, water vapor on Venus, etc, especially during Projects Strato-Lab and FATSO (First Astronomical Telescopic and Spectrographic Observatory) with Audoin Dollfus in the 1950s–1960s [1].

Fig. 1. microbloon as seen at 32 km.

zero2infinity is not inventing anything fundamentally new but revisiting these historical capabilities in a 21st century fashion. Scientists and commercial passengers on our flights will not need to be test pilots, they will not need any particularly strenuous training, but they will get the benefits and the perspective from flying at these altitudes.

However, before these flights can take place commercially, safety and certification concerns need to be addressed. When thinking of safety and certification or licensing, several questions need to be answered: who is competent? Which regulations are in place? What are the safety systems and processes in place? How much experience exists in this field in general? How much experience does the company and its suppliers have?

2. Competence

The first concern is to identify the different competencies involved in the activity, in terms of applicable law, and competent organizations or authorities. This depends on several factors:

- Place where the activity takes place
- Nationality of the Operator
- International, European and national laws
- Other intergovernmental agreements, practices

2.1. Air or space?

High-altitude balloons typically fly between 25 and 50 km in altitude, which, while below the Karman line of 100 km, is yet far above the altitudes typically flown by aircraft. For example, the highest-flying plane – the Concorde – had a maximum cruising altitude of only 18 km. The boundary between Airspace and Outer Space has never been legally defined, mostly because of the lack of activities taking place between the altitude where airplanes fly and the lowest orbiting spacecraft. High-altitude balloons do fly at these in-between altitudes and the prospect of commercializing access to these parts of the stratosphere poses some questions in a new light. Given the relatively low altitude at which they fly, it may well be that these types of balloons would be considered to operate exclusively within air space. However, given the technology involved in crewed high altitude balloon flights, which is more similar to spacecraft engineering than to hot-air ballooning, it might also be considered that the environment is more Space-like than air-like.

Why does it matter? Aviation law and Space law are vastly different. The main difference is that airspace belongs to the State whose territory is located directly below, whereas Outer Space does not belong to any State [2]. However, in practical terms, the most important difference is the regime regarding licenses and liabilities. Space activities are considered more dangerous and the international liability regime in place is far more stringent. For any damage done by a Space object on the surface of the Earth or to an aircraft in flight, the liability of the