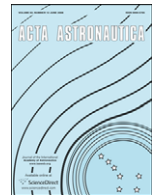




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What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace

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ABSTRACT

The authors argue that the creation of a popular new industry of passenger space travel could be economically and socially very beneficial in creating new employment in aerospace and related fields in order to supply these services. In doing so, the application of nearly a half-century of technological development that has yet to be used commercially could create many new aerospace engineering business opportunities. In addition, by growing to large scale, space tourism has unique potential to reduce the cost of space travel sharply, thereby making many other activities in space feasible and profitable. The paper discusses the scope for new employment, stimulating economic growth, reducing environmental damage, sustaining education particularly in the sciences, stimulating cultural growth, and preserving peace by eliminating any need for “resource wars”.

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1. Introduction: potential growth of space travel industry

Images of rockets launching satellites and crew into orbit, like the idea of space travel, are widely treated as “futuristic” in the media. However, it is noteworthy that such rockets are not only not futuristic, they are very old technology, developed in Germany during WW2. The first successful spaceflight was achieved on October 3, 1942, after which the project leader Walter Dornberger held a party for the team, who toasted the future of space flight with him:

We have proved rocket propulsion practicable for space travel. This 3rd day of October, 1942, is the first of a new era in transportation, that of space travel.

Walter Dornberger, after the first successful space flight [1].

If German rocket development had continued as Dornberger envisaged, the V2 (of which a winged version reached Mach 4) and the Messerschmidt 163 piloted rocket-plane projects could well have led to the start of sub-orbital passenger space flights, using fully reusable, piloted spaceplanes, by 1950. In this case, passenger travel services to and from low Earth orbit (LEO) would presumably have started during the 1960s. Instead of this possible scenario, rocket development was dominated by the cold war competition between the USA and USSR, which led to the production of tens of thousands of long-range missiles. As a result, launch vehicles were derived from missiles, rather than being designed *ab initio* as passenger vehicles as aircraft had been, decades before. Government space agencies have continued to develop expendable rockets, of which the safety and cost/passenger are inevitably much closer to those of missiles than to passenger vehicles. (The space shuttle, as well as being

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partly expendable, was designed primarily to launch the “Big Bird” satellite and land within the continental USA after one orbit—not to achieve low-cost space travel.) As of mid-2009, sub-orbital passenger space flight services are expected to start in 2011: there has thus been more than a half-century delay in developing passenger space travel. In view of this history, the rockets used to launch satellites today, rather than being considered “futuristic” can reasonably be described as “obsolescent”. That is, they could have been replaced by reusable launch vehicles several decades ago if policy-makers had so chosen, and they would have been if space technology investment was intended to earn commercial profits. This is because market research strongly suggests that there is much greater potential demand for reusable launch vehicles carrying fare-paying passengers than for expendable rockets. This is well exemplified by the study performed by Futron Inc. as part of NASA’s “ASCENT” study (Analysis of Space Concepts Enabled by New Transportation) to identify and quantify possible uses of reusable launch vehicles [2]. Having considered numerous possibilities, it concluded that sub-orbital travel services in the USA alone might grow several times larger than world-wide commercial satellite launch services [3]. It is not possible to accurately predict future orbital travel growth rates even before sub-orbital passenger services begin, but the potential scale to which orbital passenger space travel might grow, based on market research, is discussed in [4,5]. For modeling sales of new services, the family of s-shaped “Gompertz curves” uses estimates of what percentage of households will eventually buy a new product or service, and how long it will take for a certain percentage of households to adopt it, in order to generate consistent scenarios of annual sales. An interesting precedent of rapid growth of a new service was the explosive growth of the mobile phone industry in Japan from 1994 through 1996. Starting from almost zero, new customers

reached 40 million within 3 years, and the largest service supplier grew into a 50 billion dollar company. Some \$30 billion were invested by the service providers during those 3 years, at a time during Japan’s deepest post-war recession. All of the participating companies greatly underestimated how fast sales would grow. Another interesting precedent was the rapid growth of airline passenger traffic, sometimes called the “Lindberg Boom”, which took place during the 1930s world depression. This was aided by a number of effective government policies designed to encourage passenger air travel. In 2008, the Tauri Group studied the personal spaceflight industry, and estimated total revenues of some \$200 million in 2006 and \$300 million in 2007 [6]. Although promising, this amount is barely 1% of what governments give to space agencies. Consequently additional investment of even several times this amount would be a trivial cost to governments—and utterly negligible compared to the trillions that they have given to banks during 2008–9. Consequently, if governments are sincere in their claims that they are trying to aid innovation and growth of new industries, then it is not only easy, but it would cost very little to accelerate the growth of passenger space travel services. Cost estimates by the Japanese Rocket Society [7], Bristol Spaceplanes [8], Bekey [9] and others, corroborated by the very low cost of “SpaceShipOne”, indicate that once space travel grows to 1 million passengers/year, prices could fall to 5000 Euros for sub-orbital flights, and 20,000 Euros for orbital flights [7–9]. The latter is equivalent to some 200 Euros/kg or about 1% of launch costs today. We can estimate that if sub-orbital passenger travel had started in 1950, orbital travel could have grown to perhaps several million passengers/year by 2000, as shown in Fig. 1.

Costs for the development of low-cost orbital passenger transportation systems are of the order of 10 billion Euros [7–9]. Even 10 times this amount would be less than

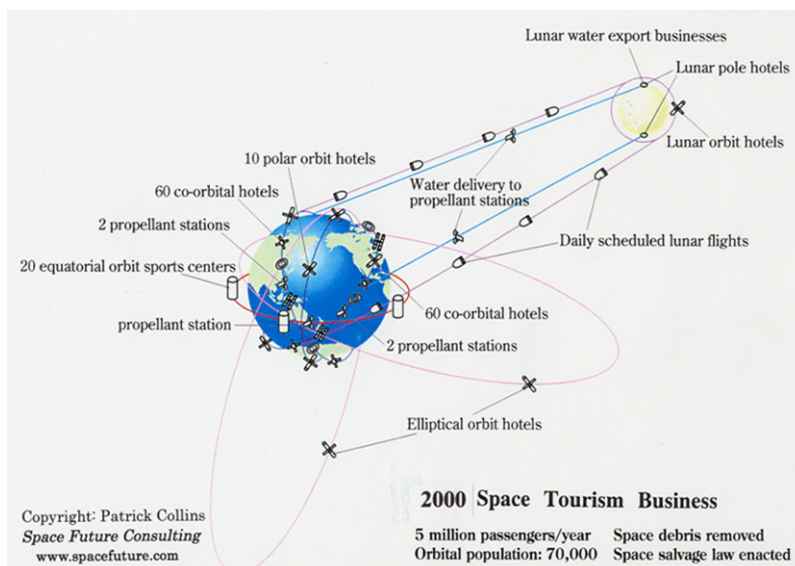


Fig. 1. Year 2000 space tourism industry if sub-orbital tourism had started in 1950 (adapted from [10]).

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