

essay

# Beyond Aeronautics

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A few months ago, at the end of a long day in my office at the Centre National d'Etudes Spatiales (CNES), I was impatient to get to my flat in the St.-Germain-des-Prés district of Paris. It's in an old house on a small street. The building itself is about a hundred years old, and the basement dates back to some time in the 13th century. A dozen years ago, the owner managed to squeeze a lift into the center of the stairwell. It's probably the smallest and slowest elevator in Paris. Out of curiosity I counted the seconds to the fourth floor: 28,29, 30...

As I was pushing open the door of the elevator and looking for my keys, it occurred to me that 30 seconds is about 1/30th of the time needed to go to orbit. If I had a flat in a low orbit around Earth, I could be home in 15 minutes. Of course I'd need another elevator.

I then wondered why we who work in the realm of space activities never think of space elevators but always of spacecraft the semantic offshoot of "aircraft"? The reason is that we have developed the habit of thinking about space as aerospace. Because of the origins of the space era, we subconsciously yoke the separate disciplines of aeronautics and space travel. But the hidden hyphen in the word "aerospace" is a dangerous mind trap, and to gain the freedom to challenge space on its own terms, we ought to take a pair of scissors and perform some overdue surgery.

At this point in its development, we can view the field of space exploration as the promising child of aeronautics, which was about to mature and live on its own when it ran headlong into a difficult adolescence. The Russians have successfully run the Salyut and Mir space stations, but they could not take the logical next steps, constructing a permanent outpost on the moon. The Europeans have mastered the Ariane launcher, but they have made no progress toward the dream of a European moon program. In the United States the space station has stalled, and only the space shuttle remains of Wernher von Braun's ambitious

program to move humankind outward. Those of us who have worked in the field look around and, like baffled parents, ask ourselves *Where did we go wrong?*

Paradoxically, we have leaned too heavily on the aeronautical brilliance that got us started. Following the dazzling successes of airplane manufacturers, we have limited our ideas to transportation. The project that has done more than any other to keep the dream alive is the U.S. space shuttle, a winged spacecraft and an engineering marvel. But the shuttle has so deeply anchored space developments in their aeronautical origins that it has kept the dream alive at the expense of reality. The reality is that there are no plans for large space operations with benefits to offset the cost of transportation. Instead of working toward those objectives, the Europeans were seduced by the achievement of the shuttle and the fallacy of winged craft into undertaking the ill-fated Hermes project, a rocket-launched spaceplane. And the Russians, forgetting that they already had the world's best space transportation system, built the Buran shuttle. Until recently the U.S. aerospace industry pushed the National Aerospace Plane as the ultimate achievement in space transportation. Even with the financial crises of the past decade, these countries had money enough to build a moon base, develop efficient electric propulsion in space, and build large stations as staging locations from which to move outward. But much of that money was misdirected to the projects just named because of the attachment to wings and joysticks. Should the shuttle stop its operations? Of course not. But neither should new programs follow its developmental path.

When the question changes from *Where did we go wrong?* to *What do we do now?* the answer must be *Sever the umbilical cord between aero and space*. For the aero-minded, space is somewhere beyond the blue of the atmosphere, a place you fly out to. For the space-minded, Earth is the bottom of a gravity well, and you try in some way to lift

# If space enterprise is to mature, it must take off on its own.

yourself out of it. With this point of view comes the realization that you need no wings to escape the surface of the planet and no wings to return. An Apollo or Soyuz capsule is not a prefiguration of a spaceplane cockpit but rather a simple elevator cabin. After a 20-minute ride you leave it for weeks or months, and when you return, you just need atmospheric braking down to the ground. With small thruster corrections, a capsule can land within a few hundred meters of its target. Those who argue that a shuttle is reusable whereas the earlier capsules were not lose sight of the fact that the most sensitive parts of the winged spacecraft—the engines—still need to be regularly replaced, not to mention the tanks and solid boosters.

It is not easy for airmen to think about giant space power systems, interplanetary space tugs, or moon manufacturing. But to those who have already converted to the space mindset, such thoughts are familiar. The challenge now is to make such thinking the norm instead of the exception.

The most effective tool for freeing space of its dependency on aeronautics is formal education. But in today's aerospace engineering schools in Europe and the United States, the curriculum is driven by the aeronautical environment. Only by electing upper-level and graduate courses can students specialize in space technology. How can these students learn enough about space medicine, communications, or astronomy? If their primary training were in general astronautics, with later specialization in Earth observation, radio communications, and even aeronautics, they would be better prepared to conceptualize genuinely integrated space systems.

For this reason the establishment of the International Space University in Strasbourg, France, seems to be the most important step so far taken toward an independent discipline of space science and technology. The ISU curriculum begins with the assumption that its disciplines will be practiced *in space*, not getting *to space*. The ISU, however, should not remain the only choice for students.

The conversion should also take place in industry. In France Arianespace has been the first company to position itself—as a simple carrier, letting its client corporations find their own niches in space commerce. Its founders realized that the essential part of space technology — what some refer to as merely "applications" — is the hardware that works in space. So far, only the communications industry has accepted the challenge to design its own space systems. The major utilities should be the next to enter the space arena.

A clear example of the failure of aerospace companies to solve space problems occurred in the late 1970s, when engineering visionary Peter Glaser proposed orbiting satellites to provide solar energy for Earth. Millions of dollars were spent paying hundreds of aerospace specialists to assess the practicality of the idea. The specialists determined that too many shuttle flights would be necessary to ferry from Earth to geostationary orbit the thousands of tons of materials required. After the final report, the Space Studies Institute of Princeton asked why a possibly more economical option had not been considered — that of constructing mining operations on and launching materials from the moon. Only after SSI challenged their results did the aerospace engineers acknowledge that the lunar option had never occurred to them.

One generation after the dawn of the space era, keeping "aero" attached to "space" restrains us from taking bold new steps in Earth orbit and beyond. Space will not fulfill its commercial or scientific promise until the next generation's space professionals can envision not only the excitement of leaving Earth but also the challenge of managing its global environment with the resources of the solar system.

*The opinions expressed in this essay do not necessarily represent the official views of CNES.*

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