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Reflections on 100 Years of Aerospace

By Burt Rutan

My activity as an aerospace designer spans exactly half the period in question. Fifty years ago, as a nine year old, I began picking up pieces of wrecked model airplanes and scrap materials, forming them into new shapes with the intent of satisfying my curiosity about their airworthiness. That age is the most formative time in our lives, when we make those inner decisions about what is important, what is fun. This is the age when we acquire the burning desire to learn the skills that will shape our future capabilities and careers. In 1953 exciting things were happening. Military and research aircraft were rapidly moving from propellers to supersonic speeds and rocket development was brisk. Viewing this no doubt inspired me.

Reflecting on aerospace history, I am drawn to the people rather than the hardware. I think about the key pioneers that inspired me: those with vision, courage, initiative, and an uncanny ability to have 'confidence in nonsense' well before the 'nonsense' became defined as a 'breakthrough'. The nine pioneers that influenced my career were all just small boys during the short period that I consider to be the most exciting era in aviation history. Sure, they might have been inspired by the Wright's 1903 flight, but their formative years occurred during that 3-year revolution between 1909 and 1912. In 1908 only ten people had flown airplanes. Then, after Wilbur Wright flew his airplane in Europe, people the world over decided: "I can do that". By 1912 many thousands of pilots were flying hundreds of airplane types in 39 countries. One organization alone (the Aero Club of France) had certified 2,000 pilots and recorded 10,000 passengers. By 1912 the European airplane industry had grown to 45 million dollars (nearly a billion$ today) and three shops each had delivered more than 500 aircraft. At least 40 cash prizes, some for 'impossible' feats, boosted the growth. Air shows attracted crowds topping 100,000 paying visitors.

Aviation flourished, even though the safety record was poor: 35 of the world's first 1000 pilots died in accidents and 139 fatalities were recorded in 31 countries during 1911. Soon after 1912, as designs matured, safety dramatically improved as companies addressed transportation and military applications. Witnessing that exciting revolution, the nine boys were to become the pioneers who provided my inspiration:

> Wernher von Braun. I met von Braun in 1965 when we both were receiving AIAA awards. His presence was forever etched in my mind at the pre-award party. He was a giant of a man, not just one of us. More than anyone in aerospace, he was able to take his boyhood dreams and forge them into existence. His charisma motivated both his technical staff and the public. He steered critical political decisions unlike anyone before or since. Clearly we would not have met our early space goals without him. Nine months after

the Apollo 11 flight, Wernher moved to NASA headquarters in Washington, on the promise that he would be the master architect to plan exciting future space projects. However, his 27 months there led to his isolation and even depression. Ignored, excluded from policy meetings and directed to speak only the party line to Congress, his effectiveness was limited to the Skylab and some early Shuttle planning. In the subsequent 31 years, manned space programs have been justified mainly by politics or science, not by exploration or to open the frontier for the rest of us. Since then we have been stuck in low earth orbit, flying only a vehicle we cannot afford.

Kelly Johnson. When I met Kelly Johnson in 1976 he was still "having fun." He had conducted his work with an unrelenting ethic to do what was right, regardless of what was the big-company norm. His book "More Than My Share of It All" tells it well. This country owes him a great deal for his accomplishments, not just his breakthrough aircraft but what he taught us about building an environment for efficient research.

Charles Lindbergh. His courage, foresight and activities after his 1927 flight no doubt accelerated the introduction of worldwide air transportation. I was privileged to meet Charles Lindbergh in 1969.

Jack Northrop. Like Kelly, Jack stubbornly ran his organization based on his own beliefs of what was right. He also was a very good airplane designer. I had the privilege to talk airplanes with him in 1976.

Ed Heineman. He was responsible for the design of just about every Douglas combat aircraft from the Dauntless to the Skyhawk. One of my greatest thrills was to show him my design for the Ares light attack prototype in 1988.

Howard Hughes. An eccentric for sure, but when he was focused on airplanes he was a delightful, capable designer and leader. He understood the importance of performance optimization and setting records. He put his life on the line flight-testing his breakthrough aircraft.

Sergei Korolev. He was the brilliant leader of the early Russian space programs. His work provided the necessary competition so Apollo could move ahead with full support.

Alexander Lippisch. I met him in 1972, when I was about to fly my first aircraft design, the VariViggen. He had devoted 60 years of his

life as a creative designer and builder of a large variety of aircraft. Known for his work with flying wings, his designs were elegant, functional and pioneering.

Bill Lear. Lear was an outrageous maverick. He got things done by forcing the establishment to use his own rules. He almost single-handedly dragged an industry forward with him, challenged its concepts and forced it to see his vision. He did not do the conceptual work, but sought it out and then brought it to market. I met him in 1975 when he was seeking ideas for his composite LearFan.

Okay, now a bit of hardware. I have selected two products that, to me, were the most significant. The first is the Lockheed A-12/SR-71 Blackbird. This Mach-3+ aircraft was designed only 15 years after we moved away from slow piston-propeller aircraft, and was into flight test within 3 years. Now, 40 years later, there is nothing in the USAF lineup that comes close to its performance capabilities. The second is the Grumman Lunar Module, the system that was used for descent-from-orbit, landing, take-off and ascent-to-orbit during our manned lunar missions. The LM was designed less than 4 years after the world's first manned space flight, and was into flight test within 3 years. Now, 35 years later, we have nothing that comes close to its capabilities. Both these products performed well beyond what might have been expected at the time. Both were developed during times of urgent need and in environments that allowed enormous risk-taking. Our very best stuff is now in museums, not on the flight line.

When I began my flight test career in the mid-60s, our fighters (F-4, F-104, F-105, F-111) all had very impressive performance. Forty years earlier, fighters were only just emerging from the wire-braced biplane era. Now, forty years later, we will soon field two new fighters, the F-22 & F-35. Avionics and stealth aside, these two have basic performance capabilities that are very similar to the 60s aircraft. What happened? Our stalemate was caused by the rules and the risk-aversion of the customer. We got Mach-3 reconnaissance and moon landings because we had the courage to try something that most said was impossible. However, when we are risk-averse, we must accept marginal or no progress.

It might seem that space travel has matured, because it has been 42 years since the first manned space flights. It hasn't. There have only been 241 manned flights above 100 km altitude, an average of only one every two months. Only 431 people have flown in space. Many fly multiple times, but the total number of seats flown is only about 950. The early spacecraft were much safer than the early aircraft. The 41 flights made by Vostok (6), Mercury (6), X-15 (the 2 above 100km), Voskhod (2), Gemini (10) and Apollo/Skylab (15) resulted in no fatalities. Fatal accidents have occurred only with the craft that are currently in operation: the Soyuz (2 of 87 flights) and the Shuttle (2 of 113 flights). Our only, and most "mature" vehicle, the Shuttle, is the most dangerous, suffering the only operational space fatalities in the last three decades. Eighteen people have died flying in spacecraft, a risk rate equal to the very early aircraft of 1911.

My conclusion: space travel, rather than being mature, is in fact primitive, much like the airplanes of 1911.

Maturity may not happen within another 42 years, if left to government research labs. True progress will require an environment similar to that needed to develop the early aircraft: the realization by those outside of NASA that “I can do that”. Robust solutions can be found by testing many diverse concepts. Some that appear to be ‘nonsense’ will later be considered ‘breakthroughs’. Once started by the entrepreneurs, rapid progress, similar to the early aircraft revolution, may follow. Benefits might even be similar to those achieved by aircraft. It is hard now for most to see the benefits, just like those without vision were unable to see the benefits of aircraft in 1910. However, I clearly see one benefit: the excitement would spark the imagination of our current youngsters, to reach for the stars and strive to be the genius pioneer heroes of the next 100 years. If our current generation remains bored by aerospace we will not generate the needed future leaders.