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Government, Business, and Technology: U.S. Airliner Development, 1927–2012

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In today's often divisive political debate, the role of the federal government is hotly argued. Much anger is directed at Washington and the nation's representatives over a variety of issues, all eventually concerning taxpayer's dollars and how that money is spent. Some see a smaller role for government, some see no role. Few see an expanded one. These lively, open debates are a critical part of the success of a representative democracy, but sometimes the level of vitriol clouds judgment and obscures the reality of the debate. Despite the complaints of some extreme points of view, the federal government has demonstrated a willingness to invest in new technologies when private capital would not and to share with industry new technologies that would better serve the public. One of the most obvious but little known examples is that of the airline industry and its aircraft.

From the very beginning of the airline industry in the United States, the federal government has worked closely with industry in developing the aircraft, equipment, and infrastructure necessary to create and foster a rational, coherent system of passenger air travel. It is important to remember that in aviation, as with most other national transportation industries, the federal government has taken an active role in improving communications across the nation.

The government's role in developing the air transportation network is well known. From 1918 until 1927, the U.S. Post Office pioneered the nation's air routes, proving to a skeptical aviation industry that routine long -distance air commerce was not only possible but also practical. By 1924, air mail was consistently crossing the country in fewer than 24 hours over routes developed in cooperation with the Department of Commerce, which developed a sophisticated system of lighting and other navigational aids. By 1926, the Post Office willingly turned over the delivery of the mail to contractors—the airlines. By this time, Wall Street was convinced that civil aviation could prosper as long as it operated in the public interest with government help.

The government, through the Air Mail Act of 1925 and subsequent amendments, ensured that the new airlines could profit, and through the Air Commerce Act of 1926, ensured that the operation would be as safe as possible through the licensing of pilots and mechanics, the certification of air frames and engines, and the implementation of increasingly sophisticated radio and navigation aids as well as significant investment in the physical infrastructure of airports and airways.

What is less known is the important role government played in the actual development of many of the aircraft that have made air transportation the most popular means of long-distance travel. With the explicit cooperation of the National Advisory Committee on Aeronautics, and later the National Aeronautics and Space Administration (NASA), the government took a direct role in the discovery and implementation of new aviation technologies that would revolutionize air transportation. Particularly, the stringent requirements of the military have produced rapid improvements in the performance and efficiency of commercial airliners.

During the early 1920s, when the Post Office struggled to open air routes across the country, numerous airlines emerged and quickly

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- Aeronautics
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- Boeing
- Business
- Government
- Jet
- NASA
- Technology
- Whitcomb

Abbreviations and Acronyms
ALCOA: Aluminum Corporation of America
NACA: National Advisory Committee on Aeronautics
NASA: National Aeronautics and Space Administration

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Figure 1. Charles Lindbergh fitted his Ryan NYP, *Spirit of St. Louis*, with a reliable air-cooled Wright J-5C engine, a type designed originally for the U.S. Navy. (Reprinted with permission from the National Air and Space Museum.)

died because the existing aircraft were so inefficient. Based on World War I vintage technology, these wooden-framed, fabric-covered biplanes were unreliable, slow, and uncomfortable. Engines were usually heavy water-cooled Liberty V-12s, which were equipped with bulky radiators and untrustworthy water pumps and hoses. Engine failures were an ever-present problem.

In the early 1920s, the U.S. Navy was teaching itself how to fly from ships. Operating from its first aircraft carrier, the U.S.S. Langley, the Navy was keenly aware of the inherent limitations of water-cooled engines. Whereas engine failures over land were usually just a nuisance, engine failures over the ocean were catastrophic to the aircraft and often the crew.

During this time, the U.S. Navy became increasingly interested in the air-cooled radial engines produced by the tiny Lawrance Aero-Engine Corporation of New York City. The Lawrance J series of engines seemed ideal for the task because they had no troublesome and heavy radiators, water pumps, or vulnerable cooling lines.

Wishing to find a large company with enough resources to produce and develop this engine, the Navy threatened and cajoled Fred Rentschler, then president of the Wright Aeronautical Company, into purchasing the Lawrance Company in 1923. By 1924, the Wright J-3 and J-4 engines, better known as the Whirlwind engines, were in service. Incorporating Englishman Samuel D. Heron's revolutionary sodium-cooled valves, which virtually eliminated the chronic problem of burned exhaust valves, the improved J-5 series was the first to offer power and great dependability. This power plant, the world's first truly reliable aero-engine, made possible Charles Lindbergh's nonstop flight from New York to Paris in 33.5 hours with no problems and was soon the engine of choice for most long-distance flights (**Figure 1**). More important in the context of this discussion, the Whirlwind quickly became the preferred engine on a new generation of airliners, specifically, the Fokker F.VII/3m series and its derivatives, and the classic Ford 4-AT Tri-Motor (**Figure 2**). It was the Ford Tri-Motor that helped convince the traveling public that safe, reliable—albeit loud—air travel was now a possibility.

As good as the Whirlwind was, its 220 hp was insufficient if larger, more capable aircraft were to be developed. In 1924, Rentschler left Wright and formed the Pratt & Whitney Company in 1925, assuming the name of an idle tool factory in Hartford, Connecticut and began the development of a new, higher-horsepower engine. Incorporating numerous changes, the new Wasp engine could generate 400 hp. The Navy was so enthusiastic over the test results that 200 engines were quickly ordered for its new series of combat aircraft.

From Seattle, Phil Johnson of the Boeing Airplane Company was interested in bidding on the last air route, the highly profitable CAM-18 from Chicago to San Francisco. To win the contract he felt he needed an aircraft superior to any then in existence. Key to this was the Wasp engine. Pratt & Whitney was building its Wasps for installation in a series of Boeing fighters for the Navy, which piqued Boeing's interest in the engine for a civilian application. The result was the Model 40A. This aircraft allowed the new Boeing Air Transport to underbid Western Air Express by 50% yet to fly profitably once Boeing Air Transport opened its service in the summer of 1927. Clearly by this time the air-cooled radial engine, which had been developed specifically for the needs of the U.S. Navy, was now the engine of choice for the nation's airlines.

By 1927, the technology necessary for the creation of a new generation of aircraft began to coalesce. Although the advantages of all-metal, cantilevered, stressed-skin construction had been known for some time, the problems of airframe weight and of aluminum corrosion had remained a limiting factor. The advent lightweight, high-powered radial engines solved the weight problems, and the development of anodized aluminum in Great Britain and Alclad by the Aluminum Corporation of America (ALCOA) solved the corrosion problems of duralumin, the high-strength aluminum alloy best suited for aircraft structures.

Figure 2. Ford Tri Motor equipped with 3 Pratt & Whitney Wasp engines with 420 horsepower each. Weight was 13,500 pounds, capacity was 13 to 15 passengers. This was the first real passenger plane in the U. S. (Reprinted with permission from the National Aeronautics and Space Administration.)