

In Aviation, Pants Are Optional

The long and colorful history of aviation is comprised of many chapters and giants. The chapter we're reviewing in this installment of Addendum is the invention and development of the retractable landing gear. We'll also touch wings with a couple of those "giants"—i.e., Jack Northrup and Leroy Grumman—both of whom played key early roles in determining a most critical design element for the critical landing gear: Pants or no pants?

That is the question. But first some much needed context.

It was the Roaring Twenties and by then the flyboys were pretty sure the aviation thing was a winner, so of course the American thing to do was to make it even better. One immediate goal was—of course—*more speed with less fuel*. Serious testing began. Indeed, the National Advisory Committee for Aeronautics (NACA) in 1927 debuted its Propeller Research Tunnel (PRT) at Langley Memorial Aeronautical Laboratory in Virginia. The wind tunnel—unique for its time—could accommodate an entire airplane for testing. NACA engineers suspected that aircraft landing gear contributed to much of the drag of an airplane, and the PRT was the first wind tunnel that would allow them to confirm their suspicions.

Tests in the outsize tunnel immediately confirmed that landing gear contributed nearly 40% of fuselage drag. This shocked the researchers—and handed them a "eureka moment."

They now realized that reducing drag produced by landing gear would significantly improve the overall performance of the airplane in flight. And, they were aware of several ways to reduce the drag of the landing gear. The two most obvious methods were to either retract the landing gear inside the aircraft, or to redesign a fixed landing gear so that it produced less drag while still protruding below an aircraft. At the end of the day, the bottom line for designers is—as mentioned—overall performance. Which, in turn, led designers of that period to a consensus that landing gear should be brought up into the fuselage, thus removing all resistance and accompanying drag.

(In fact, it was determining this delicate balance between the extra weight of the gear and the reduced drag that was most important for the overall acceptance of retractable landing gear.)

But consensus is not unanimity. There remained many who felt fixed landing gear were the best approach, an approach that could be improved aerodynamically with the addition to the landing struts of something never seen on landing gear before: "*pants*."

It's true. That is what the designers came to call the metal shrouds that enwrapped the fixed landing gear. These streamlined coverings that extended down from the fuselage with the wheels sticking out at the bottom, were also known—somewhat more elegantly—as "trouser gear." Jack Northrup, a leading proponent and one of the last holdouts for gear pants (but he called them "cowls")—clung to his design—until the late 1930s.

For it was in 1937 that the humble yet now irreplaceable O-ring (as we remember the Space Shuttle Challenger) was born, making simple hydraulic systems suddenly possible for moving retractable gearing into place. (Early iterations were

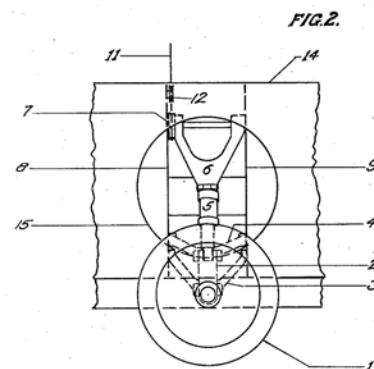
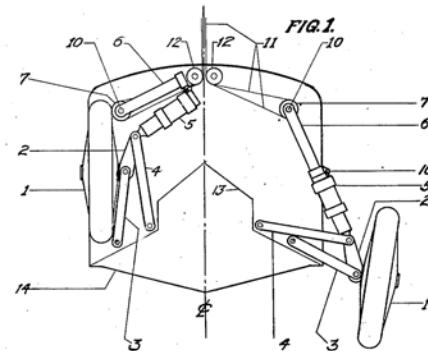
May 24, 1932.

L. R. GRUMMAN

1,859,624

RETRACTABLE LANDING GEAR FOR AIRPLANES

Filed Feb. 25, 1930



WITNESS
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either hand-cranked or driven by inefficient electric motors.) When the O-ring came online, the improved hydraulic systems became practical for retracting wheels.

And since the outbreak of WWII, the rule has been fixed wheels for light planes flying less than 200 mph; retractable gear for fast commercial and combat planes.

To get to the end of the story, we need to retrace a bit.

The first U.S. patent for retractable landing gear was awarded in 1925 to American Paul G. Zimmerman and Russian Boris V. Korvin-Kroukovsky, both of Monmouth, New Jersey. And the Boeing Monomail (1930), along with the Lockheed Model 9 Orion (1931), are generally considered pioneers in the development of retractable landing gear, proving that it was practical.

In 1932, aware of the U.S. Navy's desire for retractable landing gear, Leroy Grumman was awarded U.S. Patent 1,859,624, *Retractable Landing Gear for Airplanes*, based on an earlier design of his. The innovative, manually operated landing gear helped win a number of Navy defense contracts for his company.

But it was after the outbreak of World War II in Europe that Grumman's still scuffling company realized almost overnight success as the war prompted France and Britain to order a skyful of F4F Wildcats—Grumman's first monoplane fighter design and still bearing his original signature design element—the retractable undercarriage that had been created in 1932—with pants. (Sources: www.century-of-flight.net; Googlepatents.com; www.uh.edu/engineers.)