Airships

For many of us, airships occupy a sort of odd speculative space left open where materials science, aviation, engineering, computerization, and air traffic control have all improved massively while airships themselves have seen comparatively little use. That leaves a lot of room for argument and a handful of startups that promise that everything is fixed now and they can slot neatly into this low carbon, slower than planes, faster than ships, with fewer transfers, cargo or passenger niche.

The interesting thing is that airships didn't actually vanish with the Hindenburg, though there are certainly fewer examples in operation, and many of those that remained were military. Still, these airships give us some solid evidence backing up the kind of improvements we expect from massively more powerful motors, better materials, etc.

Misconceptions

Airships are unsafe

Airships are slow and unmanuverable

Airships are more vulnerable to strong winds than other aircraft

An airship’s ability to land and take off in strong winds is directly proportional to its speed. Back in the ‘50s and ‘60s, U.S. Navy radar blimps were taking off and landing in blizzards and thunderstorms with over 40-knot winds. In practice, all-weather Navy airships were able to operate in worse weather conditions (besides just wind) than Navy helicopters because airships had a number of other characteristics that made it safer for them to do so, such as having more stability, being able to divert far greater distances to alternate landing zones, and having vastly greater endurance before running out of fuel, allowing them to wait for better visibility, precipitation, or wind conditions.

Hence, Navy blimps were able to operate in blizzards and thunderstorms that grounded all fixed-wing and rotary-wing aircraft. There wasn’t anything particularly special about the Navy blimps either — they had de-icing gear, variable-pitch propellers, sturdy tricycle landing gear, and reasonably powerful engines that gave them a top speed of 82 knots. As a rule of thumb, an airship can land and take off in wind speeds that are about half its top speed.

An airship designed to have a 200-knot top speed could thus theoretically land and take off even in a 100+ knots hurricane, though obviously no one would ever be crazy enough to do such a thing, nor would it be desirable — just because its engines could make enough headway in a hurricane to be able to land or get in the air doesn’t mean that it would appreciate being blasted with a bunch of flying debris near the ground. In practice, it would do what all airships and helicopters have done when confronted with a hurricane—simply go around or wait it out.

Even historical airships, which were incredibly crude aircraft with structural insufficiencies we can now readily identify, managed some impressive feats in high winds: The *Graf Zeppelin* once intentionally steered into a typhoon over the Pacific Ocean to try and pick up a tail wind to help speed it on its way during it's round-the-world flight in late summer of 1929.

The remaining hurdles are in terms of the lack of available experts and sufficient funding to undergo a years-long research and development program for a large airship, but it has long been established in World War II and the Cold War that airships can be engineered to serve as safe, practical, low-cost alternatives to conventional aircraft where speed isn't a priority.

Much in the same way we know that it is possible to build reliable, profitable high-speed rail, even if the concept of such a thing seems wildly out of reach to people in places where it doesn't exist.

Types of Modern Airship Design

This section gathers broad categories of design and intended use

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The Airship Niche

With ships, they can compete sometimes (fresh food, high-value manufactured goods, etc), with freight trains, definitely not, but trucks? The largest airships can compete with trucks in terms of cargo cost per ton/mile, and are considerably faster, in addition to their capability to carry things too bulky and/or too heavy for a truck. That won't detract from trucks' ability to transport things last-mile, of course, but there's certainly some useful applications.

Relevant Technological Advancements

What can you expect from a modern airship?

Airships actually benefit far more from electrification than other aircraft, for a number of reasons—which are many and varied, but basically boil down to the advantages of electric propulsion not being particularly helpful to airplanes and helicopters, while the disadvantages exacerbate their greatest weaknesses.

For airships, it's the reverse—they're greatly aided by the benefits of electrification, and the disadvantages of electrification aren't particularly harmful to airships, or are even beneficial instead.

For example, airplanes and helicopters are greatly disadvantaged by the fact that batteries and fuel cells either don't lighten at all or lighten far less than a kerosene fuel tank, which can be reduced by tens of tons over the course of a flight, making it much more efficient. By contrast, airships greatly appreciate a constant, unchanging weight since that allows them to operate more efficiently without having to compensate for changes in buoyancy.

Movement Speed

Lift Gas Types, Sources, and Storage Requirements

The astronomical improvements in aviation safety would more than make up for the difference in safety between hydrogen and helium, such that a properly designed modern hydrogen airship would

be incomparably safer than a historical helium one, but that doesn't change the fact that hydrogen is always going to be more dangerous.

Docking Facilities

Traditionally Airships had to dock at a mooring mast (of which there were several types) or shelter inside a hangar. This is because an unpowered airship is basically a huge sail, and is likely to drift. Landing them on the ground was a huge and dangerous undertaking which involved landing parties of hundreds of men physically pulling the airship down to the ground by ropes. Attaching them to a mooring mast involved the tower crew and the airship crew both lowering lines which would be linked together by a ground crew so the tower could winch the airship in.

With improvements to maneuverability and control over buoyancy modern airships are far more controllable and can dock or land on their own.

Option 1: Just land on the ground

Not all airships are designed to land, but those that do have such a light footprint they often land on completely unimproved grassy fields. A modern airship like the Lockheed-Martin P-791 can use its landing gear to stay fixed in place on the ground without any external support equipment with up to 40 knots of wind down the nose or 25 knots of wind from any other direction. A Cessna needs to be tied down at 25 knots to keep from being flipped over. They have also landed on lakes, beaches, swamps, ice floes, and aircraft carriers. Some of the new designs, such as those of Lockheed-Martin, have no ground infrastructure or crew requirements whatsoever.

Option 2: Mooring Masts

Not all Airships are designed to land. Some, like flying crane designs such as the LCA60T, will dock at a mooring mast instead. The idea here is that the airship attaches nose-first to the tower and is allowed to freely rotate around it like a weathervane in the wind. This ensures that it always has the lowest possible exposure to the wind.

Modern mooring masts are almost disappointingly simple and are often deployed as part of a large truck.

When hooked up to a mast truck, airships can stay put in 70-90 knots of wind — and anything past that, they'd have to evacuate the area, because higher wind speeds than that would be a hurricane or tornado.

Option 3: Both?

A new option that allows the best of both worlds is a large rotating platform design called a Boyant Aircraft Rotating Terminal or Depot (BART or BARD). This design allows for the convenience of landing (perhaps for loading and unloading cargo) while still allowing the airship (and the platform it's anchored to) to turn so it's facing into the wind.

Option 4: Hangars

Hangars are to airships as drydocks are to ocean vessels — they can be located on cheap land, since they don't need to be visited very often except during initial construction or intensive tear-down maintenance overhauls/refits, which only happen rarely. Modern Airships are designed to spend almost their entire lives outside.

Further Reading:

The best layman-accessible compendium on the various airship projects over the years, past and current, is Peter Lobner's excellent "Modern Airships" series of articles, which are given a handy index and general airship industry overview/airship science summary here.

The best source for understanding airship science, economics, and design from a far more technical perspective is the Feasibility Study of Modern Airships, a vast, multi-phase, multi-part study for NASA and the Department of Commerce conducted in many separate parts by Boeing and Goodyear Aerospace. These can be found on NASA's archives for free.

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