

## Sociotechnical Synthesis

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Aircraft were first fitted with armaments during the first World War. Since then, warfighting operations have relied heavily on the support of airplanes and helicopters. Combat has evolved over the past century, and planes have adapted to the ever-changing landscape to best support troops and carry out military operations. In the early 20<sup>th</sup> century aeronautical engineering was in its infancy, meaning all of the planes that were used in the war effort were powered by propellers, had low top speeds, and could only manage limited payloads. While the primary purpose of these aircraft was reconnaissance at the start of the war, they were adapted to be combative machines. They were outfitted with machine guns and explosives, giving them the ability to root out enemies in their trenches and provide close air support to the troops on the ground. These planes were slow enough that pilots were able to spot targets and maneuverable enough to attack them at close range, providing precise firepower on the enemies.

Today, most of the world's militaries are supported by state-of-the-art, jet engine powered, heavily armed, supersonic aircraft. These planes, like the F-35, F-16, A-10 Thunderbolt, and the British Harrier can drop big explosives from high altitudes and then disappear in a flash. While extremely powerful weapons, these aircraft come at a hefty price to their militaries and aren't quite suited for precise air support at close range, unlike their predecessors in the 1910's.

Another family of military planes, called light attack aircraft, are also used globally. Some light attack aircraft are powered by turbofan or turboprop engines, resembling (at least a little) the planes of the Great War. They are smaller, lighter, less expensive, and more

maneuverable at low speeds than their heavy counterparts. Their payload-capabilities are often in the 2,000-4,000 kg range, compared to the F-35's whopping 8,160 kg payload capacity. What the light attack aircraft lack in firepower, they make up for in precision, and out-perform heavier aircraft in austere environments.

Combat has evolved from the traditional scene where the position of enemy targets is known, and can be taken out with large explosives. Enemy bases, supply depots and encampments can still be leveled by lightning fast aircraft, but many combat situations require precise air support at close range. Today, military operatives engage in small ground skirmishes in remote environments. Unlike traditional combat, the enemy forces can be very close to allied forces, and their location can be hard to pinpoint for large aircraft to accurately engage. Light attack aircraft have the ability to throttle down and fly at low speeds, enabling their pilots to identify targets and engage with precise firepower. Because of their slim weights, generating enough lift to keep these planes in the air require less speed, and enables them to hover around a military engagement for long periods of time. In addition, light attack aircraft are better suited for landing and taking off from unfinished runways in austere environments that are common in modern warfighting locales. Whether it's in a jungle, in the mountains, or on the streets, light attack aircraft provide critical air support by utilizing visual targeting and maneuverability.

In modern theaters of war, large missiles delivered by heavy planes are outperformed by light attack aircraft. The very meaning of air superiority no longer necessitates the fastest, heaviest, and most powerful airplanes. Instead, lighter and more rugged planes are required to best support military operations. The technical project's goal is to design a light attack aircraft that can carry a substantial payload while still being able to take off and land on unfinished runways in austere environments.

Similar to combat, the meaning of space and space technologies has evolved greatly since the first artificial satellite Sputnik I orbited the earth in 1957. During the Cold War, dominance in space technologies was not only a matter of national defense for the United States and Soviet Union, but also a source for national pride. NASA controlled the development of rockets, such as the Mercury-Redstone that pushed the Liberty Bell 7 into space. With a substantial budget and the support of the American people, the United States successfully landed on the moon with an American flag in a dramatic show of national pride.

Today's space program has changed since the days of Cold War, with private companies taking the lead on developing new space technologies and controlling the launch capabilities of the United States. SpaceX, Boeing, and Lockheed Martin are just a few examples of private firms that partner with NASA to send satellites into space. This has changed the role of politics in space exploration. The USA and USSR were in a head to head matchup in outer space, but today the politics revolve around the private industry's contributions to space exploration. Moreover, the meaning of space has evolved as well. People all over the world rely on space technology for GPS, communication, as well as scientific imaging from orbiting cameras.

Just as aircraft technologies have adapted to the ever-changing needs of military operations, space technologies have evolved to serve new purposes. Both the modern combat scene and outer space have evolved in terms of the need for unique technologies to serve humans, and the way in which we perceive them.