

Amphibious Aircrafts

It has been a 108 years since the first aircraft took off for a 12 second flight from the field of Kitty-Hawk, Northern Carolina, USA on 17th December, 1903. It was The Wright Flyer I built by the Wright Brothers, Wilbur and Orville Wright. That was the beginning of an era of airplanes and gave a whole new dimension to the then field of aeronautics (previously aeronautical tests and experiments were mainly done on hot air balloons). As years passed by aircrafts began to growing in their size, operational range and carrying capacity. New dimensions of design were born which enabled aircrafts to cross the speed of sound, i.e. (768 mph / 1235 km/h). Operational capabilities of aircrafts were enhanced and aircrafts are now operating in all weather conditions (except in highly adverse conditions) and in all regions of the world. Aircrafts are also now operational not only from land but also from water (seaplanes) and amphibious aircrafts (comes from the word amphibian), are able to operate from both conventional runways on land and from water bodies.

The development of amphibious aircrafts can be traced back to the invention of seaplanes. The first powered hydroplane that took off from the water on 28th March, 1910 in Martigues, France was flown by French aviator Henri Fabre. According to US records the first citizen to fly a seaplane in the US was Glenn Hammond Curtiss on 26th January, 1911, the founding father of The Curtiss Aeroplane and Motor Company. His airplane had floats or pontoons attached to its undercarriage which helped it to land and takeoff from water. Although these were among the first powered seaplanes, drawings and designs of amphibious flying machines and vehicles could be traced back to the early years of the 19th century. Seaplanes, mainly flying boats saw extensive action in the Second World War. Notable aircrafts like Short Sunderland (serving the Royal Air Force), Kawanishi 8HK (Serving the Imperial Japanese Navy, termed as the fastest flying boat of World War II) and the amphibious bomber aircraft Consolidated PBY Catalina (primarily serving The United States Navy) mainly conducted anti-submarine warfare and torpedo bombing caused great losses to the enemy especially their navy and submarines. The main factor which leads to their success

was their versatility to operate and land on water, while other land based anti-submarine aircraft had to take off from their bases far away from the coast thus consuming more fuel and precious time.

Since then, with the increasing advancements in the field of aeronautics, amphibious aircrafts designs also changed. Amphibious aircrafts built by The Cessna Aircraft Corporation and Bombardier Aerospace Corporation are becoming popular. The harsh terrains of Alaska and Canada are primarily dependent on sea-planes and amphibious aircrafts for transporting passengers and cargo to the remotest parts of their territory where construction of runways and airports are virtually impossible.

According to the design and construction of amphibious aircrafts, they can be broadly divided into two factions: -

- The flying boat type.
- The floatplane type.

The flying boat type - These are the most common types of heavy amphibious aircraft seen today. They have a specially designed and strengthened fuselage which acts like the hull of a ship and thus helps the aircraft to takeoff and land on water. They generally have a high wing configuration with respect to its fuselage with engines mounted on them to prevent them from being sprayed by water during takeoff or landing. The retractable landing gear is commonly housed within the fuselage which is retracted when landing on a runway.

Very often, the flying boat type being larger and longer in size has retractable under wing floats which provide additional stability to the aircraft while taxiing, taking-off or landing on water. These under wing floats often are used to store additional fuel for the aircraft (just like the external drop tanks of conventional military aircraft). An excellent example of this type is the Consolidated PBY Catalina. Another example of an amphibious aircraft of the flying boat type currently in service is the Bombardier 415.

The floatplane type – Very few heavy amphibious aircraft are of the floatplane type. They are generally cheaper and lighter than the flying boat type. Mainly used for private transport and for transportation of a limited number of people and cargo, they are preferred in mountainous terrains due to their small size. Their landing gears are incorporated into their floats while the rest of the aircraft features are similar to that of a conventional land based aircraft. The design of floatplanes are however more aerodynamic compared to the flying boat type aircraft. The only problem faced by floatplanes is their large floats, which add extra drag to the aircraft thus rendering them less maneuverable. The stability of floatplanes on water is also comparatively much less than that of the flying boat type. The floatplanes are slower than their all-land versions having a lower rate of climb and increased empty weight due to the introduction of the floats.

There are two types of floatplanes, one with a single main float generally attached to the fuselage centerline and two under wing floats. The fuselage centerline being one of the strongest parts of the aircraft gives it the ability to land on rough seas; however the double float-versions exhibit quite a lot of ease while mooring and boarding on calm water but they are not able to tackle the rough seas. The dual float also leaves it belly open for carrying of additional payload like torpedoes or bombs (in a military floatplane) or extra fuel in drop tanks.

With the advent of jet age, aircraft designs were made more aerodynamic and the range and carrying capacity of the aircraft increased considerably. Aerospace engineers came up with the idea of developing an all turbojet/turbofan powered amphibious aircraft. Currently the largest amphibious aircraft in service is the jet powered Beriev A-40 (NATO reporting name: Mermaid), built by The Beriev Aircraft Company of Russia. It has a length of 47 meters and a wingspan of 42.5 meters and a maximum takeoff capacity of 86000 kg. The aircraft is being primarily used by the Russian Naval Aviation. Another notable aircraft built by The Beriev Aircraft Corporation is the Beriev Be-200. These aircrafts are being used mainly for transportation and for fire fighting. However there are not many variants of jet amphibious aircraft due to problem of water spraying up to the engines while landing and takeoff.

Piloting a jet amphibious aircraft is also a tedious task. Since water is much more viscous than air, while landing, due to the high speed of the aircraft during touchdown, the aircraft fuselage experiences a large reaction force. Moreover, larger jet amphibious aircrafts have a much longer takeoff and landing distance and greater speeds which leads to the spraying of water up to the jet engines which can damage them. A skilful pilot is needed for handling a jet amphibious aircraft.

Present day amphibious aircraft are widely deployed all over the world because of its operational versatility. They are being mainly constructed for aerial firefighting, transportation of passengers and cargo, for conducting rescue missions at sea and are also being used by the military (navy) for patrolling the nation's coastline and for anti-submarine warfare.

It has been noticed that the amphibious versions of present day military fighter aircrafts are very unlikely to come into service. Present day fighter aircrafts use extremely modern technologies which are extremely sophisticated and delicate in nature. They are unable to withstand the impact of a water landing. Moreover with the advent of stealth technology, modern military aircraft is being made invisible to radar and instrumentation detection. Presence of water on the aircraft's structure causes them to be vulnerable to radar detection and damages the internal instrumentation and the onboard flight computers. A fighter aircraft lands with speeds above 200 miles an hour and with such a speed, the impact of the touchdown on water can cause considerable damage to the aircraft's airframe and to its onboard computer systems. A reinforced fuselage or floats induces extra drag on the aircraft and increases its overall weight, thus decreasing the speed and the rate of climb consuming more fuel and decreasing the operational range of the aircraft which are the most important factors looked for in today's combat aircrafts. Amphibious versions of military aircraft are also less maneuverable than their land based variants. Development is under process to come up with the design of an amphibious fighter aircraft which can operate from land and also retain the characteristics and performance of land based military aircrafts.

Despite being heavier and expensive than the land based aircrafts, the use of amphibious aircrafts in the commercial sectors and for patrolling, firefighting and anti submarine warfare is increasing. Aircrafts like the Beriev Be-200 and The Bombardier 415 are protecting the large forested areas by daily patrolling and surveillance. Their internal water/foam tanks store necessary fire retardants which are dropped onto the fire by the aircraft. Aircrafts like Beriev A-40 are being deployed for anti submarine warfare, patrolling the nation's coastline. Commercial amphibious aircrafts are being used for cargo and passenger transportation as they can reach remote areas and can land on water-bodies like lakes, carrying much heavier weight with a greater operational range, which was previously only accessible by helicopters. Amphibious aircrafts also brings down the cost of air-transport as it does not need airports and runways to be constructed.

Some time in future we also do hope that amphibious aircrafts would become increasingly popular due to the growing amount of air traffic in today's airports and due to their operational versatility; they can be widely employed in search and rescue missions, patrolling missions, for firefighting and transportation which are now limited by helicopters in many countries. In tropical and sub-tropical countries the presence of a large number of local water-bodies and rivers will facilitate the growth of the amphibious aircraft industry as amphibious aircrafts, being able to land on water will make air transportation more outreaching to the common people and will eventually make air travel faster and safer.