Ekranoplan, or wing-in-ground effect vehicles, are normally associated with work carried out in Russia on a family of giant military vehicles. Graham Taylor redresses the balance by describing the rather smaller wing-in-ground effect vehicles developed in the USA and Germany for the commercial market.

In the December 2002 issue of AIR International, Helmut F. Walther reported on the top-secret work carried out by the USSR’s Central Hydrofoil Design Bureau during the Cold War which developed a pioneering series of ‘ekranoplans’ ground effect vehicles (Russia’s Ekranoplans, page 372). During the same era, though in the USA and on the West German side of the Iron Curtain, similar research into ground effect was also taking place, albeit on a smaller scale. It is this work which could ultimately lead to the introduction of wing-in-ground (WIG) effect craft to commercial and paramilitary operation in just a few years time.

Two schools - two species

With no communication between them, the evolutionary path of wing-in-ground effect craft pursued by these two entirely independent teams has resulted in two principal schools of thought regarding WIG vehicle design. The USSR-Russian school, which ultimately produced a vehicle of over 500 tonnes, was led by the great Rostislav Yevgenyevich Alekseyev, and is characterised by stubby-winged craft of aircraft configuration. The German school, pioneered by the brilliant German scientist Dr Alexander Lippisch, is characterised by a reverse delta wing configuration. Dr Lippisch found that the combination of reverse-delta wing and high mounted tailplane gave inherent natural stability against the centre of pressure movement and pitch-up/pitch-down moments when flying in and out of ground effect. In this configuration, a ground effect vehicle could be made inherently stable at a predetermined height without input from the pilot.

A manned experimental craft of this configuration, X-112, was successfully tested in the USA by Collins-Lippisch Research Corp, circa 1963, after which Dr Lippisch returned to Germany to work with aircraft designer Hanno Fischer at Rhein Flugzeugbau GmbH (RFB). Here, two further experimental manned craft were built – the X-13 (1971) and X-14 (1973) — to a military specification for an aircraft which could operate in sustained flight below an enemy’s radar horizon.

Hanno Fischer continued to develop the Lippisch wing-in-ground effect concept with his partner Klaus Matjasic (later to form AFD) at his company Fischer Flugmechanik. In contrast to the military requirements of the earlier work, the focus at Fischer Flugmechanik was on the commercial application of the WIG principle, and primarily on the economy of airborne transport to be had from the aerodynamic efficiency attainable in ground effect. At the same time, one major design objective was to remove the free-flight capability, so that future craft would be ‘surface vehicles’ that could be classified, built and operated as boats.

This work led to the Airfish series of craft: Airfish 1 (1987), Airfish 2 (1988), Airfish 3 (1990), and Airfish 8 (FS8) (2001). Flightship, 8/FS8 is the market name for the eight-passenger-seat FF/AFD-developed Airfish 8, owned, operated and currently being put into series production by Flightship Ground Effect Pty, of Cairns, Australia.

A new generation

In 1997 Fischer Flugmechanik also produced its first second-generation two-scat ground effect vehicle, the Hoverwing HW 2VT. The HW 2VT was a scale model concept demonstrator of an 80-seat passenger ferry craft. The Hoverwing concept differs from the Airfish series of craft in two major ways.

Firstly, it employs a retractable air cushion, which enables a very power-efficient take-off from water and allows the craft to carry a greater payload than would otherwise be possible. Secondly, it uses a lifting-body-type fuselage/hull that contributes up to 40% of the total lift of the craft and so improves the overall aerodynamic and transport efficiency.

Skimming just above the surface of the water in the ‘dynamic air cushion’ created by the ground effect, both the Airfish and the Hoverwing prototypes have demonstrated their performance and high manoeuvrability. This is achieved without the sea motions which cause seasickness to passengers, particularly in fast marine transport.

Fischer Flugmechanik/AFD has now developed proposals for the next craft of the Hoverwing series, the HW 20. This is intended for series production in both civil and paramilitary variants.

The civil variant offers high speed (90kts [167km/h] over water), high efficiency/low running costs, and simplicity, with a payload of 20 passengers or freight.

The paramilitary variant offers stealth, high speed, long endurance, and low cost with interception, patrol, medevac, special operations, amphibious assault capabilities, and a payload of 12 fully-armed troops, and can be fitted with a variety of weaponry.

The second-generation craft are intended for areas of the world where sea conditions are favourable. Markets include the Caribbean, the Gulf of Mexico, East Asia and the Mediterranean, as well as the thousands of miles of major rivers in each continent.

Fischer Flugmechanik/AFD, together with Hypercraft Associates, is currently seeking strategic partners for the production and operation of the HW-20. The project has attracted interest from parties in several countries, particularly the East Asian region, for the both the civil and paramilitary craft.