The ekranoplan: back on top of the waves

The Flying Ship Company’s ekranoplan

From time to time, developers revisit technologies that have long since fallen into oblivion, as it has already been proven that a particular technical solution is viable; it was simply that circumstances were not favourable. Monorails, RTGs and ammonia-based cooling systems are being presented to the public once more – naturally in a new guise, and in many cases genuinely reimagined, with new, state-of-the-art control systems and recalculated efficiency and return-on-investment figures.

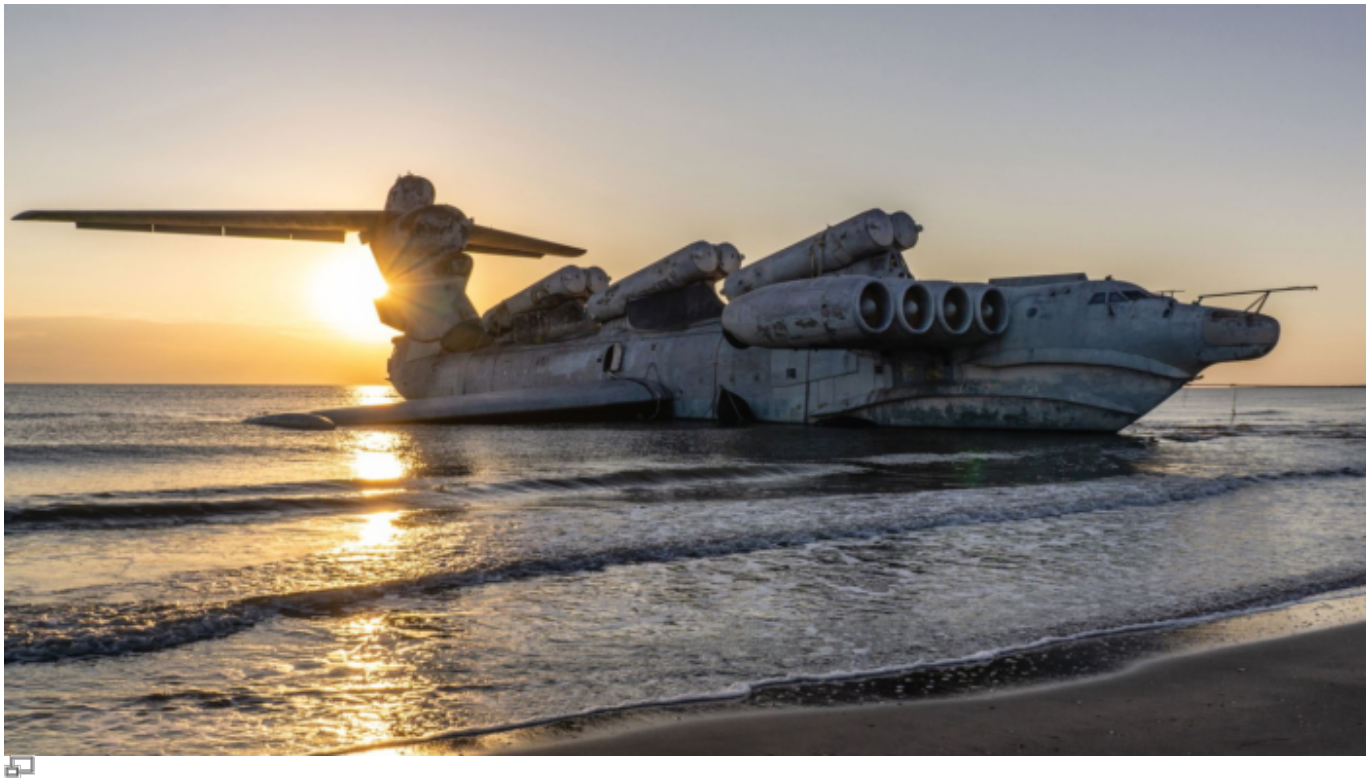
Fitting into this line-up of developments is the old/new ekranoplan, made famous – and infamous – by the former Soviet megaproject, the Caspian Sea Monster:

The Caspian Sea Monster

It was not Western intelligence and military circles that first uncovered one of the Russian army’s best-kept secrets, but the German **ZDF’s ‘Frontal’** magazine, which published video footage of the strange military contraption; this footage was **David R. Huff**, a former US Navy intelligence expert, described as sensational.

In the video footage, a thick cloud of spray was poured onto the sea as a huge craft – which looks like the illegitimate offspring of an aeroplane and a warship – raced past just a few metres above the surface.

As early as the beginning of the 1980s, American spy planes had spotted a strange object in the region, which was flying at incredible speed at an extremely low altitude – invisible to all radar – over the Caspian Sea. The *“Caspian Sea monster”* – as the Americans dubbed the craft, named **KM** – had never been captured in photographs or on video until then. Even in classified documents, only sketches and models of this extremely well-hidden aircraft-like craft – known in Russian as the ekranoplan – had ever appeared.



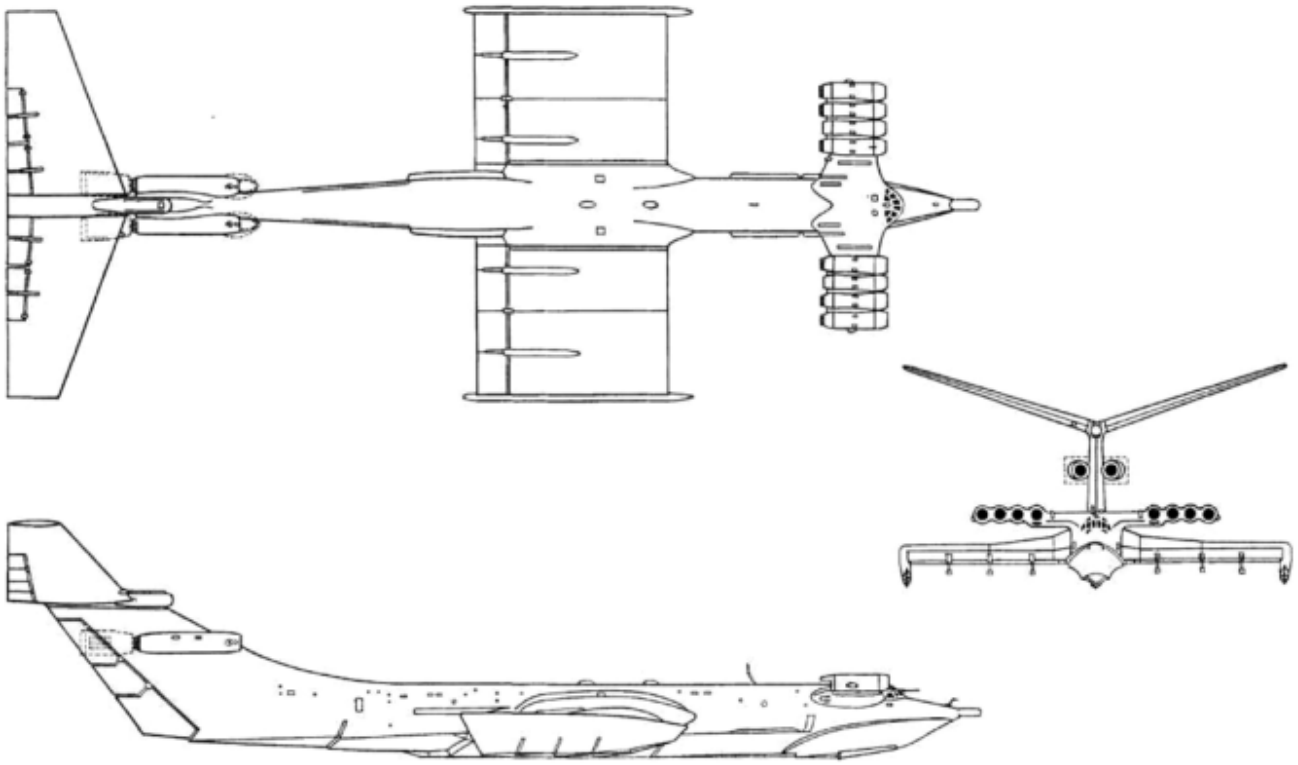
The LUN-class MD-160 after it ran aground, photo: Lana Sator

Ekranoplan

Ekranoplanes are, by their design, aircraft, yet they are restricted to water or flat terrain. During flight, they utilise the so-called cushion effect, also known as the boundary layer effect, which every novice pilot is familiar with if they have ever attempted to land their aircraft at high speed.

The **boundary-layer aircraft**(*in English: ground effect vehicle*, **GEV**) exploit the physical phenomenon whereby 40 per cent more lift is generated above the ground than in the air. The eight huge turbines positioned in front of the wing on the aircraft are primarily used to *'hovering'* rather than for its forward motion; the thrust was actually provided by two turbines situated beneath the vertical stabiliser. The turbines used – all ten of them – were Dobrinyin WD–7 jet engines, each producing 13,000 kp (130 kN, **a total of 1,300 kN**) of thrust.

By way of comparison, the PW4062 engine on the Boeing 747-400 provides approximately 276 kN (62,100 lbf) of thrust during take-off, meaning that the four engines together produce roughly 1,080 kN at this stage.



Diagrams of the KM-1

Thanks to the cushion effect, this massive craft could be deployed not only over the sea but also on flat land. It was practically immune to radar, minefields or, thanks to its speed of 400 km/h, any kind of defence system.

The ekranoplan, with a standard range of 1,500 kilometres (though its range could obviously be extended with reserve fuel tanks), posed one of the greatest threats to the US, according to David R. Huff, as it was capable of carrying nuclear missiles alongside 850 soldiers on board – despite the fact that the craft never left the Caspian Sea region.

Igor M. Wasilewsky, director of the Nizhny Novgorod shipyard in Russia, stated that the *"the largest version of our Caspian Sea monster weighed 540 tonnes."* If we classify the ekranoplan as an aircraft, it was the largest aircraft ever built.

Rostislav Alekseev

KM-1

Of this colossal ekranoplan – although opinions on this vary – only one example was probably built in 1964 in Gorky, under the designation KM-1 (*корабль-макет; 'demonstration model ship'*). The craft was **was commissioned by** commissioned **by Rostislav Alekseev** – he is also credited with designing the **Meteor** type of hydrofoil, which was also used in Budapest for many years.

Incidentally, Rostislav Alekseyev was just as influential a figure in the development of hydrofoils and ekranoplans as his contemporary, **Sergei Pavlovich Korolev** in the Soviet space programme (I have already written about his role in the Szputnyik-sokk post). The hull was dismantled into sections and transported at night over the course of almost a month to the **Kaspis**on the Caspian Sea. The efforts to conceal it were, in a sense, unnecessary, as the Americans quickly spotted the 'monster' in the dry dock on the Caspian Sea via CIA satellite imagery.

KH-8 Image of Kaspiysk Special Research and Development Facility on the Caspian Sea in the Former Soviet Union, 19 March 1968

CIA satellite image of the Caspian Sea monster, from 1968

On 16 October 1966, the KM-1 was prepared for its maiden flight. Alekseev himself was on board at take-off, which of course contravened the rule stipulating that designers were not permitted to be on board the vehicles they had designed during testing. The giant ekranoplan rose from the waves without a hitch and, powered by its ten turbines, accelerated to a speed of 400 km/h. Then the engines fell silent, and the KM continued to fly on the wings of the expected cushion effect. During the 50-minute flight, the fuselage bent slightly, but this fault was rectified by reinforcing the body's stiffeners – yet the test proved the designer right: the monster worked.


The KM-1 in flight

In the meantime, however, the political winds in the Soviet Union (those bright breezes, you know, blow-blow) had changed, Khrushchev was removed from office in 1964 and replaced by Leonid Brezhnev (codename: *bushy-browed*). He was deeply sceptical of the oversized KM ekranoplan and had its development halted.

As a sort of compromise, Rostislav's team set about building the *'Orlyons'* (*eagle chicks*). This was also an ekranoplan, but was only capable of carrying 140 marines or two fully loaded armoured vehicles. Alexeyev's design bureau also worked on another military ekranoplan, the *'Lun class'* , but only a single prototype of the 280-tonne, 74-metre-long craft, the **MD-160** , was ever built. A half-finished prototype of the LUN class, the **Spasatel**, has been left to decay on the seafront in Nizhny Novgorod since 1990:

The downfall of Rostislav Alekseev

Piloting ekranoplans required a great deal of expertise to ensure that pilots could maintain the optimum altitude of 20 metres above the water. In 1975, during a test flight of one of the Orlyonok craft, one of the rear engines broke off and the vertical stabiliser was also damaged on the choppy sea. Fortunately, Alekseyev was on board once again; he took control from the pilot and brought the damaged craft safely back to port.

The KM-1 in a contemporary photograph

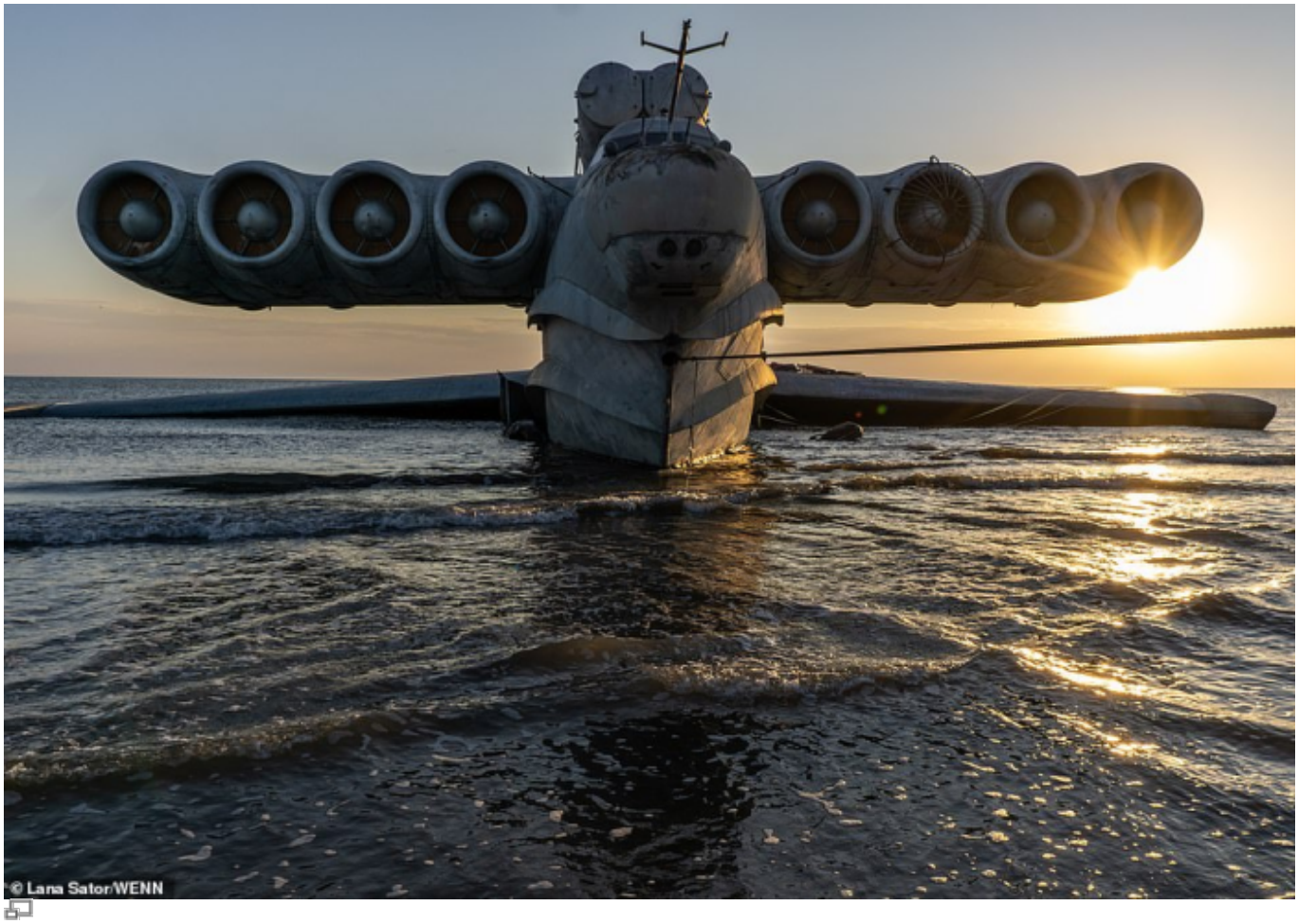
Although he had saved the crew and the aircraft, the military leadership blamed Alekseyev for the accident and removed him from his post as chief designer. Of course, the real reason for this was that the designer's headstrong nature was incompatible with the rigidity of the organisation (not the first time, nor the last, in history). Alexeyev subsequently gave up his research and devoted himself entirely to his hobby, sailing. In his final years, he told his daughter, with a heavy heart: *"I didn't achieve what I wanted to"*.

In 1980, at the age of 63, he died from injuries sustained in an accident whilst testing a new ekranoplan, which he had hoped to showcase at the 1980 Moscow Olympics. That same year, Alekseyev's greatest invention was also destroyed. On 15 December, the KM-1 prototype, already in a rather worn-out condition, set off on a test flight. According to accounts, the inexperienced pilot attempted to lift the craft too early, causing it to tip over, plunge back into 20 metres of water and sink. A few years later, in 1984, the chief supporter of the ekranoplan project, Defence Minister Dmitry Ustinov, also died, after which funding for the project came to a complete standstill.

MD-160

The instrumentation of the LUN-class MD-160, photo: Lana Sator

The 280-tonne LUN-class MD-160, which still survives today **MD-160** – although only half the size of the former KM-1, is still a rather formidable vessel. The sole surviving example was being towed – with typical Russian thoroughness – from a naval base to the Maritime Museum in Dagestan when it broke free and drifted for a while on the open sea, before finally running aground on a sandy beach. Its security is also typically Russian; fortunately, as many people – including photographer Lana Sator – managed to bribe the guards, she was able to climb aboard the aircraft and document the final days of the last Caspian Sea monster in photographs.



The LUN-class MD-160 beached, photo: Lana Sator

Ekranoplán reloaded

Although the original ekranoplan was not a success story, many of the developers were perhaps taken aback by the fact that the boundary-layer effect generates a good 40 per cent more lift than in the air. The problem with the original models – the extremely difficult-to-control altitude – could now be managed even with a cheap Arduino (microcontroller). Add composite technology to the mix, and we're talking about a very promising technical solution indeed.

The team at Flying Ship Company came to the same conclusion; they initially put their plans into practice on a small scale, in a test aircraft measuring just a few metres, but honlapjuk according to the description at, they are now considering a much more ambitious development. I'm rooting for them.


The Flying Ship Company’s solution, photo: Flying Ship Company

By linkre click here to watch a video of the craft.

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Sources

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Flying Ship Company
Wikipedia: Határfelület-repülőgép
YouTube: What What happened to the Ekranoplan? – The Caspian Sea Monster

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