

Analysis of the Kerch Bridge operation: multi-stage SEAD and long-range delivery systems

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The attack carried out by the Ukrainian armed forces (SBU and General Staff) on the night of November 16–17, 2026, against the **Kerch Strait Bridge** represents a significant case study in the coordinated use of **electronic warfare**, **suppression of enemy air defenses (SEAD)**, and **long-range precision strikes** using domestically produced weapons. The operation, structured in **seven phases prepared over several weeks**, resulted in the **structural collapse of the central arch span** of the road section and **severe damage to the parallel rail infrastructure**.

Operation architecture: the 7 phases and SEAD doctrine

The Kerch Bridge (19 km long) is protected by one of the world's densest layered air-defense networks, including **S-400, Pantsir-S1, and Tor-M2 systems**, floating barriers, and electronic warfare (EW) equipment designed to jam GNSS signals. To penetrate this **anti-access/area-**

denial (A2/AD) bubble, Kyiv did not attempt a single saturation raid, but instead implemented a **progressive seven-stage attrition campaign**:

- **Phases 1–5 (Degradation of the A2/AD bubble):** In the weeks before the final attack, long-range strike systems and attack drones systematically struck sensor nodes along the approach routes in Crimea and Krasnodar Krai. The primary objective was **the destruction of surveillance and engagement radars, air-defense batteries, and EW stations**, creating a **"blind corridor"** toward the strait.
- **Phase 6 (Structural weakening – first strike):** On Monday, an initial wave of jet-powered drones struck the central arch of the road span. The strike did not cause an immediate collapse, but it produced **plastic deformation in the steel load-bearing beams** and compromised the structural joints, preventing Russian engineers from securing the structure before the subsequent phase.
- **Phase 7 (Coup de grâce and final saturation):** On the night between Monday and Tuesday, a mixed package comprising **11 different types of weapon systems** (including *Dovbush*, *Vendetta*, *Da Vinci*, *Sichen*, *MICH 2000*, *An-197*, and *FP-1*, performing decoy, reconnaissance, and electronic warfare functions) **saturated the remaining defenses**, clearing the way for the heavy strike systems tasked with the final demolition.

Strike systems: analysis of the weapons employed

In the seventh phase, Ukraine assigned specific targets to two distinct groups of precision munitions, all of **domestic development**:

Weapon system	Type / Propulsion	Assigned target	Estimated range	Warhead / Payload	Key characteristics

Palianytsia	Missile-drone / Turbofan (AI-PBS-350)	**Road section (central span)**	650 – 1,000+ km	~50 – 100 kg (high explosive)	Launched with a solid-propellant booster, **speeds of up to 900 km/h**, low-altitude flight (15-500 m).
FP-5 Flamingo	Cruise missile / Turbofan (Ivchenko AI-25TL)	**Rail section**	**Up to 3,000 km**	**1,150 – 1,200 kg**	Radar-transparent composite airframe, cruising speed of 850-900 km/h, **CEP ~14 m**.
R-360 Neptune	Cruise missile (land-attack variant)	**Rail section**	~300 – 400 km	~150 kg (fragmentation/HE)	***Sea-skimming* profile at extremely low altitude**, inertial guidance + active radar/terminal IR.
Ruta	Jet-powered missile-drone	**Rail section**	~300 km	~100 kg	High subsonic speed, used for precision strikes and rapid engagement.

The decisive role of the FP-5 Flamingo

Developed by the Ukrainian company *Fire Point*, the **FP-5 Flamingo** proved decisive in damaging the massive rail structures. With a takeoff weight of around 6 tons, a wingspan of 6-7 meters, and a **warhead weighing more than one ton** (often derived from FAB-1000 or Mk 84 aerial bombs capable of penetrating reinforced concrete), the Flamingo delivers **far greater kinetic energy and explosive power than Western cruise missiles** such as Storm Shadow/SCALP.

Its **fiberglass and carbon-fiber structure reduces its radar cross-section (RCS)**, while its low-altitude flight profile (around 50 meters above sea level) limits the defenders' radar horizon.

Terminal guidance and resilience against electronic countermeasures

One of the operation's most significant aspects concerns terminal guidance. Footage released immediately after the attack shows the first-person view (from the weapon's electro-optical sensor) of an **FP-5 Flamingo** missile diving onto the target until the moment of impact.

The maintenance of a **real-time two-way data link (*datalink*)** during the final seconds of flight — in an area subjected to extremely intense satellite *jamming* — points to two key technological factors:

1. **Jamming-resistant hybrid navigation:** Integration of **inertial navigation (INS)**, **controlled reception pattern antenna (CRPA) GNSS antennas** (designed to filter out ground-based jamming signals), and optical sensors for terminal target recognition (*DSMAC/visual recognition*).
2. **Alternative communications architecture:** In light of recent operational restrictions on using the Starshield satellite network near the front line, the stability of the video feed through impact suggests the use of **airborne radio-relay mesh networks** (using relay drones positioned at high altitude over the Black Sea) or new satellite terminals resilient to interference.

4. Structural and maritime-logistics impact

From an engineering standpoint, the collapse of the road span over the **Kerch-Yenikale navigable channel** creates a dual operational problem for the Russian Federation:

- **Rail bottleneck:** Although rail traffic has been partially restored at reduced speeds, structural damage to the railway spans imposes **severe axle-load restrictions**. This prevents or drastically slows the **movement of heavy trains carrying armored vehicles, artillery, and ammunition** toward the southern front.
- **Passive naval blockade:** The steel span that fell into the water **blocks the main channel linking the Sea of Azov to the Black Sea**. Removing thousands of tons of submerged steelwork requires heavy floating cranes and complex underwater cutting operations, exposing recovery assets to further attacks and **effectively paralyzing**

Russian merchant shipping (grain, fertilizers, and petroleum products) in the region.