

Ukraine, a Silent Aerospace Power before 2014

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Before the destabilizing events of 2014, which led to the annexation of Crimea and the conflict in Donbas, Ukraine was recognized as a prominent player in the global space sector, a direct heir to the massive technological and industrial legacy of the Soviet Union. At the time of independence in 1991, Ukraine inherited a significant part of the Soviet military-industrial complex, transforming into a nation with unique and complete capabilities in the space sector.



Soviet Legacy and National Capabilities Ukraine was one of the few countries capable of preparing special missile systems and managing a complete space production cycle, from fuels and launchers to spacecraft. Already in 1991, this production capacity allowed for the preparation of up to 100 space and military rockets and about 10 satellites annually, mainly for remote sensing.

The pillar of the industry was represented by Yuzhmash (Yuzhny Machine-Building Plant) and the nearby Yuzhnoye Design Office (KB Yuzhnoye), both located in Dnipropetrovsk (now Dnipro). These structures were responsible for the

production of some of the most powerful and reliable space launchers and intercontinental ballistic missiles in the world, including the famous Tsyklon rockets and, above all, the Zenit launch vehicles.

The industry was mainly concentrated in the region between the cities of Dnipro, Kharkiv, and Kyiv. Among the most important companies are "Khartron-ARCOS" (Kharkiv), Yuzhnoye, and Yuzhmash (Southern Machine-Building Plant).

Ukraine also possessed important space infrastructures in Crimea, particularly linked to the Sevastopol naval base and the Kherson Cosmodrome (or Novofedorivka/Saki). The State Space Agency of Ukraine (SSAU), founded in 1992, had the task of coordinating research, development, and cooperation. Before the Russian invasion, it had about 16,000 employees, almost as many as NASA, and controlled 20 state-owned companies.

International and Commercial Collaboration Ukraine, operating as a reliable and low-cost partner, capitalized on its technology through numerous international programs that attracted investors such as Boeing, Martin Marietta, Lockheed, Alenia Spazio, and others.

- **Sea Launch (Zenit):** Ukraine was a fundamental partner of the international Sea Launch consortium, providing the Zenit-3SL carrier rocket, essential for launching commercial satellites from the equator via an ocean platform. This system, a "technological

marvel" managed by the USA, Ukraine, the Russian Federation, and Norway, was born from the studies of the "Buoyancy" project entrusted to Yuzhnoye in 1992.

- **Antares (USA):** The first stage of the American Antares rocket, used to resupply the International Space Station (ISS), was designed and built by Yuzhnoye/Yuzhmash, demonstrating the deep integration of the Ukrainian industry into the NASA and United States supply chains.
- **Vega (ESA):** Yuzhnoye Design Bureau provided the engine commissioned by ESA for the fourth stage of the Vega rocket.
- **Cooperation with Russia:** Despite political tensions, the Ukrainian and Russian (Roscosmos) industries were deeply interconnected, with Yuzhmash providing critical components and engines for Russian launchers. An example is the Dnipro project, in collaboration with the Russian Federation, for the conversion of intercontinental ballistic missiles into civilian launchers.

Satellite Capabilities, Components, and Research Beyond launchers, Ukraine maintained a solid base in the research and development of payloads and satellites. It had launched several satellites, including Earth observation and scientific ones (e.g., the Sich, Ocean, and Tsilyna-2 series), and was actively engaged in developing new platforms for remote sensing and communication.

Ukraine also contributed to the International Space Station (ISS) with the Zorya module and the Igla and Kurs orientation and docking systems. It produced control systems for carrier rockets such as Soyuz, Proton, Rokot, Zenit, and Dnipro. In 1996, the SSAU established the National Center for the Management and Testing of Space Facilities, effectively creating military-space forces composed of over 3,500 specialized officers. Their task was also to maintain the integrity of the navigation field and the unified time system, using the Galileo system.

The Role of 2014: A Turning Point Before 2014, Ukrainian capabilities rested on three pillars: inherited technology, integration into Western (USA) programs, and close interdependence with the Russian industry. The annexation of Crimea and the conflict in Donbas acted as a cataclysm for the sector. The crisis immediately interrupted the collaboration with Russia, which was essential for the supply of key components (particularly for the Zenit rocket).

Geopolitical stability failed, causing uncertainty for major international contracts. For example, the Sea Launch program underwent restructuring, and checks at the Kherson Cosmodrome (Crimea) were canceled. These disruptions also had repercussions on international programs: the ESA Schiaparelli mission, in which Ukraine participated, failed its soft landing partly due to the lack of checks on the descent system.

Project / Program	International Partners	Ukraine's Role
Sea Launch	USA, Russia, Norway	Provision of the Zenit-3SL carrier rocket
Antares	USA (NASA)	Design and construction of the first stage
Vega	ESA (European Space Agency)	Provision of the engine (RD-843) for the fourth stage
Dnipro	Russia	Conversion of ICBM missiles into civilian launchers
ISS (Space Station)	International	Supply of the Zorya module and Igla/Kurs docking systems
Galileo	European Union	Management of the time system and navigation
Schiaparelli (ExoMars)	ESA	Participation in the mission's descent system
Cyclone-4	Brazil	Development of the proposed carrier rocket
Control Systems	Russia	Production of control systems for Soyuz, Proton, and Rokot

ANNEX - UKRAINIAN TECHNOLOGICAL SUCCESSES PRE-2014

LAUNCH VEHICLES AND PROPULSION SYSTEMS

Through its key facilities such as Yuzhmash and the Yuzhnoye Design Office in Dnipro, Ukraine was responsible for producing some of the most powerful and reliable space launchers in the world.

- **Zenit Family:** Zenit launch vehicles were the industry's flagship rockets and even attracted the attention of Elon Musk.
- **Sea Launch Programme:** Ukraine was a fundamental partner in the international Sea Launch consortium, providing the Zenit-3SL carrier rocket for commercial satellite launches from the equator (via an ocean platform).
- **Antares Programme (USA):** The first stage of the American Antares rocket, used to resupply the International Space Station (ISS) with the Cygnus cargo spacecraft, was designed and built by Yuzhnoye/Yuzhmash.
- **Vega Programme (ESA):** The RD-843 engine for the fourth stage of the European Vega launcher was commissioned by the European Space Agency (ESA) from the Yuzhnoye Design Bureau.
- **Missile Conversion:** The Dnipro project, in collaboration with the Russian Federation, aimed to convert intercontinental ballistic missiles into civilian launchers, receiving orders from 25 countries.
- **Other Launchers:** Ukraine had the Tsyklon rockets in production or development, including the Cyclone-4 (proposed to Brazil), and variants such as Zenit-38B and Zenit-38LB.

SATELLITES AND SPACECRAFT Ukraine maintained a solid foundation in the development of satellites and payloads.

- **National Satellites:** Ukraine had launched several Earth observation and scientific satellites, including the Sich series (Sich-1, Sich-1m, Sich-2).
- **Other Vehicles:** The list of developed spacecraft and satellites includes Tsilyna-2, AUOS, Ocean, Egyptsat, and various Microsatellites.

COMPONENTS AND SPECIALISED SYSTEMS

The Ukrainian industry was essential for the supply of critical components and advanced control systems.

- **Control Systems:** It produced the control systems used for Russian Soyuz, Proton, and Rokot carrier rockets, as well as for its own Zenit and Dnipro rockets.
- **International Space Station (ISS):** Ukraine was a direct contributor to the ISS with the supply of the Zorya module.
- **Docking Systems:** It developed the Igla and Kurs orientation and docking systems for space probes, with 138 sets produced by 2019.

STRATEGIC CAPABILITIES AND RESEARCH

- **Full Production Cycle:** At the time of independence, Ukraine was one of the few countries capable of preparing special missile systems and managing the entire space production cycle.
- **Space Infrastructure:** It possessed important space infrastructure in Crimea, particularly linked to the Kherson Cosmodrome ("Novofedorivka"/"Saki") and the Sevastopol naval base.
- **Contribution to Galileo:** Ukraine was involved in the development of the European satellite navigation system Galileo, which it continues to develop despite the war.
- **Military-Space Force:** In 1996, the National Center for the Control and Testing of Space Facilities was established, providing the Space Agency (NSAU) with military-space forces consisting of over 3,500 specialised officers.