



# AUTONOMOUS UNINHABITED UNDERWATER APPARATUS TRANSPORT TYPE (VSPN-3 project)

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**Mykolaiv- Kherson  
2023**



**Introduction** . Applied production problem of underwater transportation payload (KB) in automatic mode to current problems of marine robotics. This is determined lower costs for HF transportation and low dependence maritime transport operations from hydroclimatic conditions operation \_

At this time, the design and construction of autonomous uninhabited transport-type underwater vehicles ( ANPA-T ) engaged in many leading maritime countries of the world.

The following companies can be attributed to the main global manufacturers of ANPA-T :

- [Lockheed Martin](#) , [Teledyne Technologies](#) ,  
Oceaneering International , Oceanserver Technology ,  
[Boeing](#) (all - USA);
- [Kongsberg Gruppen](#) (Norway) ;
- Saab AB (Sweden) ;
- Subsea 7 (Luxembourg) ;
- Shenyanskyi and institute automation \_ (PRC).

**We will determine the relevance of the creation of ANPA-T for the maritime industry of Ukraine.**

**LOCKHEED MARTIN**



**TELEDYNE  
TECHNOLOGIES**  
INCORPORATED



**OceanServer**<sup>TM</sup>  
TECHNOLOGY, INC



**KONGSBERG**



**subsea 7**





**Relevance of research.** Ukraine is a major European maritime power that has its own economic interests at sea. It has one of the longest sea borders in Europe with a length of 1,355 km (1,056.5 km - the Black Sea, 249.5 km - the Sea of Azov, 49 km - the Kerch Strait), as well as a 200-mile exclusive (maritime) economic zone with an area of more than 72 thousand square meters km with the sovereign right to exploration, development and conservation of natural resources, as well as the implementation of other types of economic activity.

Territorial waters of Ukraine are coastal sea waters 12 nautical miles wide with a total area of 29,454 square meters. km After the occupation of Crimea by the Russian Federation, the Verkhovna Rada of Ukraine adopted the Law of Ukraine on the creation of an adjacent zone of Ukraine.

So, ***Ukraine has significant marine water areas where underwater transport activities for nature protection, industrial and defense purposes can be deployed.***

**Formulation of the problem.** Preliminary studies by the authors indicate that at this time, in the interests of the domestic maritime industry, it is expedient to create ANPA-T for underwater transportation of cargo weighing up to 1,000 kg and more, at a distance of up to 120 km and more, at a depth of at least 20 m at a cruising speed of 3 m /with.

## Adjacent zone of Ukraine



According to the definitions of this law, the adjacent zone of Ukraine is a strip of sea outside the territorial sea of Ukraine, which is adjacent to it, the outer limit of which is at a distance of 24 nautical miles (44,455.2 meters - ed. ) , counted from the same starting lines, as well as the territorial sea of Ukraine.

Currently, the total area of the territorial sea of Ukraine is 29,454 square kilometers. These are coastal sea waters with a width of 12 nautical miles.



# Admiral Makarov National Shipbuilding University Zaitsev Vasyl Oleksandrovych Limited Liability Company



The relevance of the development, creation and implementation of ANPA-T in Ukraine is confirmed by a number of international documents and decisions of the President and Government of Ukraine. It is worth noting some of them, in particular:

- the proclamation in 2017 by the UN General Assembly of the Decade of Ocean Sciences for Sustainable Development (2021-2030), aimed at stimulating the science of the World Ocean and the accumulation of knowledge with the aim of stopping the trend towards the deterioration of the ocean ecosystem and stimulating new opportunities for its conservation and sustainable development;

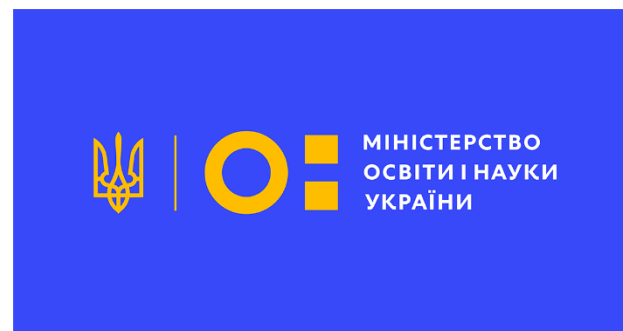
- decrees of the President of Ukraine and resolutions of the Government of Ukraine regarding the need to develop robotic marine technologies ;

- the presence of a significant number of artifacts in the territorial waters of Ukraine , for the examination and lifting of which it is necessary to involve ANPA-T (program of the National Academy of Sciences of Ukraine) ;

- training of domestic and foreign specialists in the National Technical University (Mykolaiv) in the direction of " Sea Robotics " according to one of the strategic directions of the development of higher education in Ukraine.

- the tasks of the defense of the state from the sea direction in connection with the full-scale invasion of the Russian Federation into Ukraine.

**Let's consider in more detail the features of ANPA as a whole.**





## APPLIED SCIENTIFIC RESULTS AND FUTURE DIRECTION OF WORK

The main tasks of creating ANPA-T included:

- solving the issue of construction and strength of the ANPA-T cargo compartment ;
- the ANPA-T propulsion and steering complex ;
- determination of the type and power of the ANPA-T autonomous energy source ;
- solving the issue of ensuring the given buoyancy of ANPA-T ;
- ANPA-T navigation with determination of absolute geographic coordinates;
- construction of an intelligent automatic control system of ANPA-T .

As a result of the implementation of the draft project, **the following results were obtained** regarding the list of the main components of ANPA-T :

- 1) supporting frame with hydrodynamic shock absorber (external light body);
- 2) propulsion-steering complex consisting of four marching electric propulsion devices;
- 3) battery power source;
- 4) ballast leveling system;
- 5) navigation system;
- 6) hydroacoustic system;
- 7) video system
- 8) automatic control system
- 9) remote communication system.

**In addition, it is necessary to develop the following sets:**

- a set of spare parts and devices;
- a set of operational documentation;
- a set of mounting parts ANPA-T .



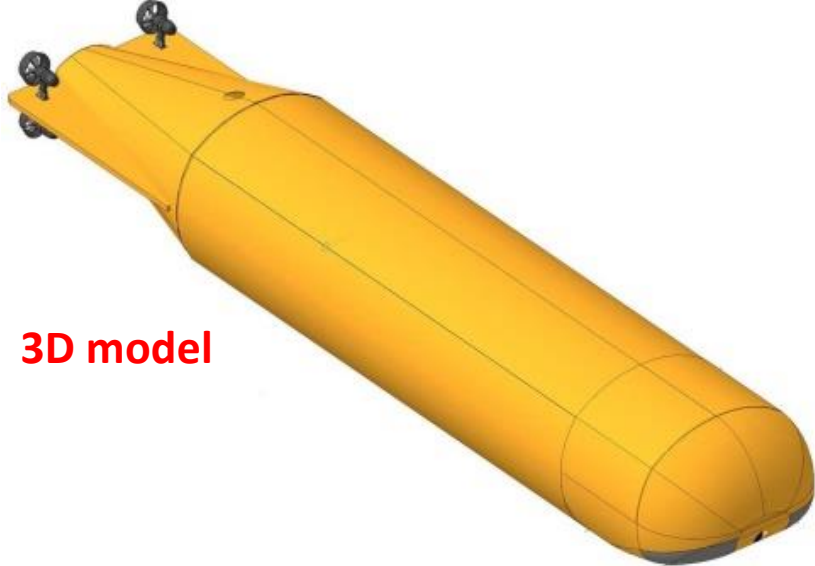
ON THE HOLDING PRODUCTION RESULTS REGARDING THE CREATION OF THE UNDERWATER APPARATUS OF THE "VSPN-3" PROJECT

Option-1: Uninhabited / Piloted

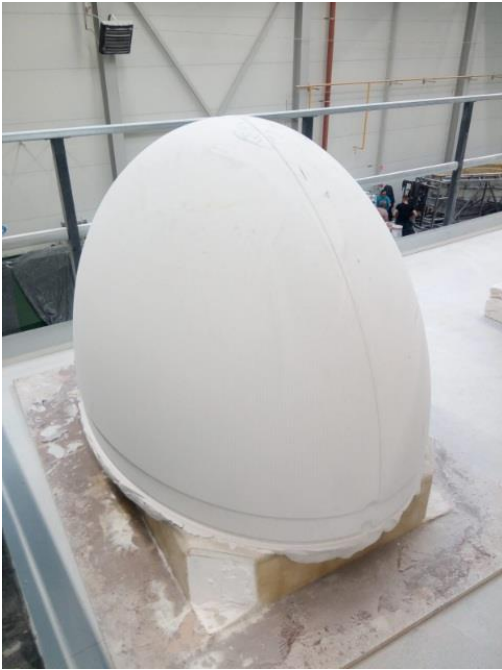
Specifications

- Working depth, m ..... 50
- Overall dimensions, m ..... 8.7×1.5×1.1
- Underwater speed  
Marshova, m/s ..... 3
- Weight of the underwater vehicle, kg ..... 6100
- Range, nautical miles ..... 130
- Payload mass, kg ..... 1200

The stage of production of body elements



3D model





## ON THE HOLDING PRODUCTION RESULTS REGARDING THE CREATION OF THE UNDERWATER APPARATUS OF THE "VSPN-3" PROJECT

### Option-1: Uninhabited / Piloted

#### **Purpose and scope of application**

It is used for underwater transportation of useful cargo - tools, devices and special equipment - to water areas or coastal areas, where it is necessary to carry out work on their operational environmental protection survey.

#### **The essence and main characteristics of the development**

The presence of a cargo hold makes it possible to place transport containers in which tools and devices can be placed, as well as special equipment for solving a wide range of environmental protection tasks. The underwater method of transportation ensures prompt delivery of useful cargo to places of ecological disaster, regardless of the hydroclimatic conditions on the route.

The presence of hydroacoustic, video and GPS devices installed on the telescopic mast ensures reliable transportation of the payload without raising the underwater vehicle to the surface.



## ON THE HOLDING PRODUCTION RESULTS REGARDING THE CREATION OF THE UNDERWATER APPARATUS OF THE "VSPN-3" PROJECT

### Option-2: Uninhabited

#### The main advantages and state of development readiness

The most important advantages of the development are the guaranteed delivery of aviation drones to places of ecological disaster and the low dependence of their transportation on hydroclimatic conditions on the route.

**The project is at the stage** of installation and commissioning .

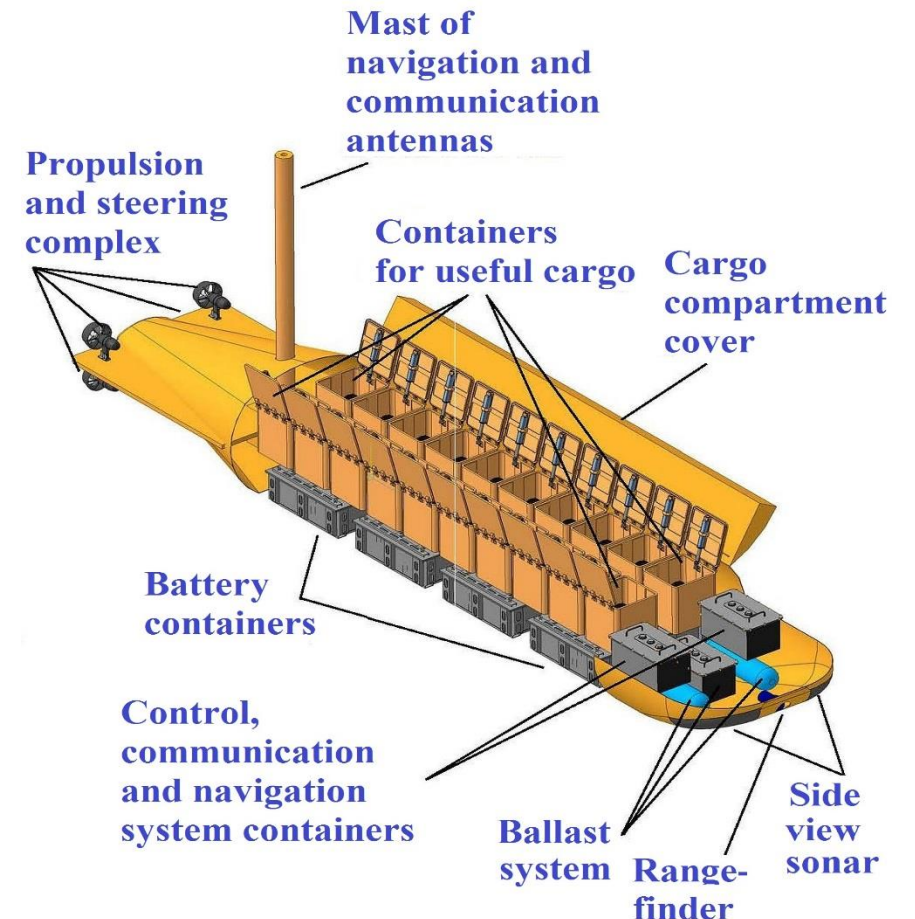
**The project was carried out** at the National University of Shipbuilding named after Admiral Makarov.

#### Construction , installation and commissioning works

performed by an individual entrepreneur ( FOP )  
Vasyl Oleksandrovych Zaitsev.

#### Market demand

The development can be applied for prompt delivery of environmental and scientific payloads in the territorial waters of the country in the interests of units of the Ministry of Environmental Protection and Natural Resources of Ukraine, the State Emergency Service of Ukraine and other domestic organizations.







ON THE HOLDING PRODUCTION RESULTS REGARDING THE CREATION OF THE UNDERWATER APPARATUS OF THE "VSPN-3" PROJECT

Option-2: Uninhabited

Navigation sensors



Underwater electric cables



Accumulator containers



combs electric motors



Electronic modules and their sealed housings



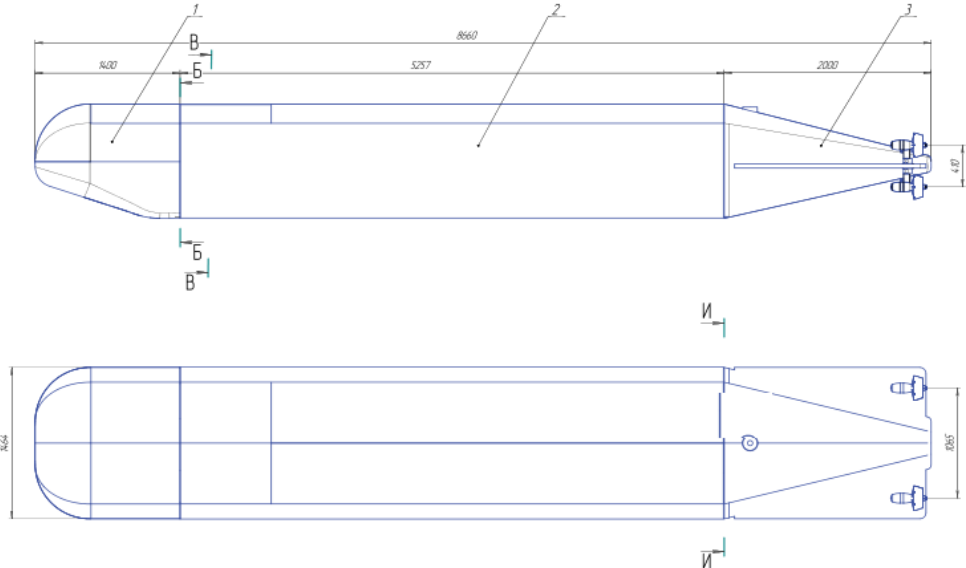


**ON THE HOLDING PRODUCTION RESULTS REGARDING THE CREATION OF THE UNDERWATER APPARATUS OF THE "VSPN-3" PROJECT**

**Option-2: Uninhabited**

**Technical characteristics of ANPA-T**

- Working depth, m..... 20
- Dimensions (  $L \times W \times H$  ), m .....8.0×1.6×1.15
- Cruise speed, m/s ..... 3.0
- Weight (empty), kg ..... 1980
- Range, miles .....120
- Number of transport containers, pcs .....6
- The maximum weight of the payload, kg...1450
- The volume of the useful cargo hold, cubic meters  
.....2.43



**ANPA-T with a raised communication mast**

