ΔSPEARX ↑ MULTIFUNCTIONAL UAV

Short summary

This project aims to develop an advanced aerial defense system to protect critical military and civilian infrastructure against hostile UAV threats.

Leveraging cutting-edge real-time Edge AI technology, the system will feature both automatic and semi-automatic patrolling capabilities to monitor airspace effectively. It will incorporate sophisticated recognition algorithms to identify and classify various types of enemy UAVs, enabling precise pursuit and targeted neutralization.

Additionally, the system will facilitate comprehensive surveillance, intelligence operations, and ground object detection, tracking, and analysis to gather critical operational data.

Innovative

We are developing a modular unmanned aerial vehicle (UAV) designed for both military and civilian applications.

Key Innovative Features:

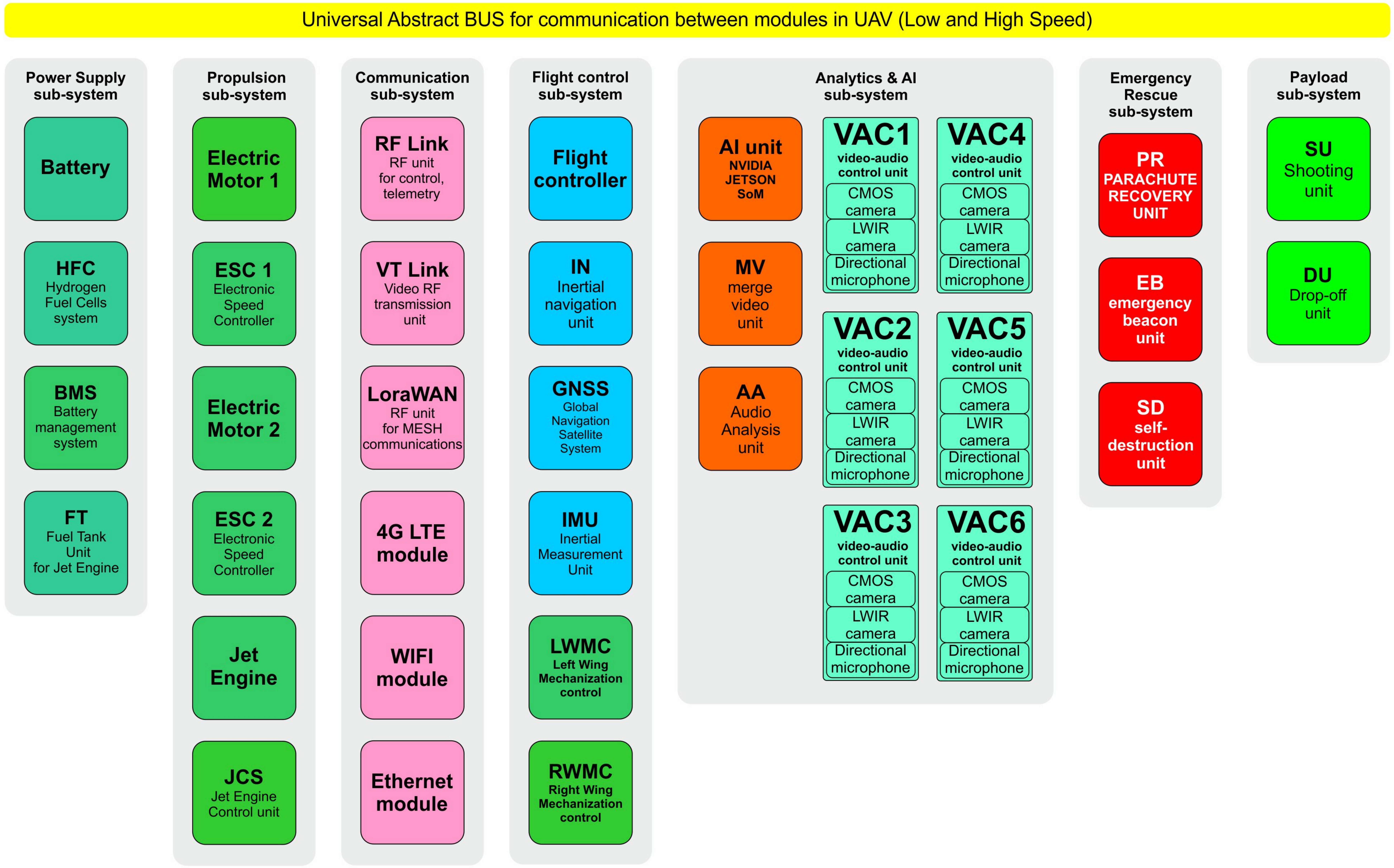
1. Hybrid Propulsion System:
The UAV combines electric motors with a turbojet engine, enabling multi-mode flight across a wide range of speeds.
Electric propulsion is used for reconnaissance, surveillance, and silent operations.
Turbojet propulsion activates for rapid-response interception missions.

2. Intercept Capability:
A dedicated combat module can be integrated for drone interception tasks. It features a semi-automatic 12-gauge shotgun, optimized for neutralizing enemy UAVs.

3. Hydrogen Fuel Cell Compatibility:
The platform supports integration with hydrogen fuel cells, dramatically increasing flight endurance and enabling long-range missions.

4. Autonomy & AI Integration: The drone supports multiple levels of autonomy, from manual control to advanced autonomous modes depending on mission profile.
It is equipped with an on-board edge AI system for real-time data processing and situational awareness.
Multispectral Detection Suite:
The UAV is equipped with a multi-spectral optical and directional audio detection system for identifying and tracking enemy drones.

ARCHITECTURE DESIGN OF UAV



Architecturally, the drone consists of 7 subsystems.

1. Powering sub-system
Which includes:
1.1. Battery unit. Rechargeable batteries for powering the on-board electronics and electric power engines of the aircraft.

1.2. HFC unit. Hydrogen Fuel cells - an electricity generation system based on a “hydrogen >> electric power” converter with composite hydrogen tank for low weight.

1.3. BMS unit. Battery management System, which manages the distribution of electricity.

1.4. FT unit. A Fuel tank with fuel for a turbojet engine.

2. Propulsion sub-system
Which includes:
2.1. Electric Motor 1 and Electric Motor 2. Two electric engines for vertical takeoff/landing and cruise fly. Each engine is attached to the wing using a quick snap-fit or click-lock system with bolt-nut-cotter-pin fixation. The fastest possible replacement of units is very important on the battlefield (combat experience in Ukraine).

2.2. ESC 1 and ESC 2. Electronic Speed Control units for electric engines.

2.3. JCS - Electronic control module for the micro TurboJet engine (start, stop, adjust the thrust of the jet engine).

2.4. Micro TurboJet engine with a thrust up to 400N. The same snap-fit or click-lock scheme with bolt-nut-cotter-pin fixation as with electric motors.

3. Communication sub-system.
We try to implement a modular architecture even for Communication Subsystems. For different tasks, it is possible to use different communication modules.

3.1. RF-Link. Two-way RF communication module with a ground operator for manual control of the drone and transmission of UAV telemetry to the operator. Frequency Band: 862MHz-912 MHz, Transmit power: 0.1W-1W (Adjustable by Software). Range - up to 40km.

3.2. VT Link. One-way video data transmission module from UAV to the ground operator. Frequency Band: 300MHz-2.7GHz, Transmit power: 0.1W-1.2W (Adjustable by Software). Range - up to 40km.

3.3. LoraWAN low-speed short-range communication module. Designed for communication between aircraft in flight to organize SWARM operations, friend-or-foe recognition, partial implementation of the air collision avoidance system. Range - up to 500 meters.

3.4. 4G LTE module as a backup communication channel for two-way data transmission (video data, telemetry, control).

3.5. WiFi module for use only on the ground for: upload mission tasks, software update, data updates for the AI subsystem.

3.6. Ethernet module - It is used for the same purposes as a Wi-Fi module in conditions of radio-electronic interference or where the use of Wi-Fi radio transmitters is prohibited.

4. Flight control sub-system

4.1. Flight Controller. The flight controller controls the aircraft subsystems - based on data received from: navigation systems (GNSS and / or inertial navigation system), analytics systems, control data from the ground.

4.2. IN. Inertial navigation module allows the UAV to carry out missions in conditions of unstable (Jamming) / incorrect (Spoofing) GNSS signal.

4.3. GNSS. GNSS navigation module - multiband (GPS, Baidoo, Galileo, Glonass).

4.4. IMU module including high-precision accelerometers, gyroscopes, magnetometer, barometer, Airspeed sensor.

4.5. LWMC and RWMC - modules for controlling mechanisation (ailerons, rudders) on the wings and vertical stabilisers.

5. Analytics & AI sub-system

5.1.1. AI Unit. The AI unit based on the NVIDIA Jetson is designed for: mission planning based on tasks, Analysis of situations in real time and making independent decisions in flight, Flight control of the UAV.

5.1.2. VAC1…VAC6 - video and audio control module provides comprehensive 360-degree video/audio control of the space around the aircraft. Each VAC module is the “eyes” and “ears” of the system. Each VAC module consists of a CMOS camera (VIS and NIR spectral range), a thermal imaging (LWIR spectral range) camera and a directional MEMS microphone.

5.2. MV. The Merge Video Unit - designed to merge video data from six VAC modules into 1 frame on the fly for further processing in the AI Unit.

5.3. AA. Audio analysis unit - a module for analyzing the audio situation received from directional microphones in the VAC modules. Performs sound reconnaissance of the situation around the aircraft.

6. Emergency & Rescue sub-system

6.1. PR. Emergency parachute system. Designed to ensure emergency immediate landing in case of emergency situations.

6.2. EB. Emergency radio beacon - designed to search for the aircraft in the event of an emergency fall of the drone. The radio beacon has its own power source.

6.3. SD. UAV destruction module - designed to destroy the electronics of the aircraft in case of loss.

7. Payload sub-system

7.1. SU. Shooting Unit. Designed for shooting at air targets (enemy UAV).
Initially, this subsystem is supposed to be equipped with a 12-gauge semi-automatic shotgun, which supports a wide range of ammunition for various purposes.

7.2. DU. Drop-off unit.
The drop-off module is designed to deliver and drop various cargoes depending on the mission of the aircraft.

DUAL-USE potential

In the military sector, it is an interceptor UAV for destroying enemy UAVs (with a Shooting Unit installed) or a drone for reconnaissance operations.
Typical scenario:
In the event of a potential penetration of enemy UAVs into our area of responsibility, the operator take-off the drone for observation. Since our solution does not require a catapult and can take off vertically from any hard surface, the time to launch the aircraft is minimal.
The drone uses electric motors to fly slowly in its area of responsibility, scanning the surrounding space 360 degrees horizontally and vertically.
For scanning, we use audio and video control tools. Our aircraft can detect enemy aircraft, both with the help of directional microphones (an enemy drone with an internal combustion engine can be heard several kilometers away), and with the help of six VAC modules. Each VAC module has two cameras that see in the visible and thermal spectrum (LWIR) and a directional microphone.
In case of detection of an enemy drone by sound and no detection by visual means - our drone pays attention to it and flies towards the enemy drone.
If the enemy drone is detected by visual detection means and its speed is high - our aircraft accelerates (up to 420km/h) towards the enemy drone using a Turbojet engine.
For approximate measurement of the distance to the target, target direction and target speed - we use an AI visual stadiametric rangefinder based on data received via the visual channel.
Our aircraft approaches the enemy drone at some distance, equalizes the speed and shooting from the SU (Shooting Unit).
Automatic visual control means to confirm the successful destruction of the target if the enemy drone abruptly changed its direction towards the ground or an explosion occurred (if the drone was carrying an explosive charge).

In the civil sector - this aircraft can be used for:
Border patrol service - border surveillance, search for migrants as an example.
Rescue services - search for people, rescue operations on land, in the mountains, on water.
Police - surveillance of mass events in the open air. Air support (surveillance) during various special operations.
Fire service - surveillance / search for fire sources in forests.
Security services - patrolling protected areas.

Scaling Strategy & Commercial Outlook

We plan to scale production within the European Union, Bulgaria, establishing a localized manufacturing facility.

All current development is funded by the founding team. We are in the process of negotiating and signing agreements with key industry partners and suppliers.

We treat this product as intellectual property, as the concept integrates at least four unique technical innovations.

It is difficult to project revenue at this stage due to the absence of comparable UAV systems on the market offering our full feature set in a single platform.
Pricing is highly dependent on configuration. The estimated unit cost of the minimal configuration (excluding Shooting Unit, Hydrogen Fuel Cells, and Turbojet module, with only basic communication suite) is expected to be in the range of €120,000 to €250,000, based on contracts starting from 100 units.
Ground control station pricing is still under evaluation.

We will adopt standard communication and navigation protocols such as Wi-Fi, Ethernet, GNSS, RS485, and others.

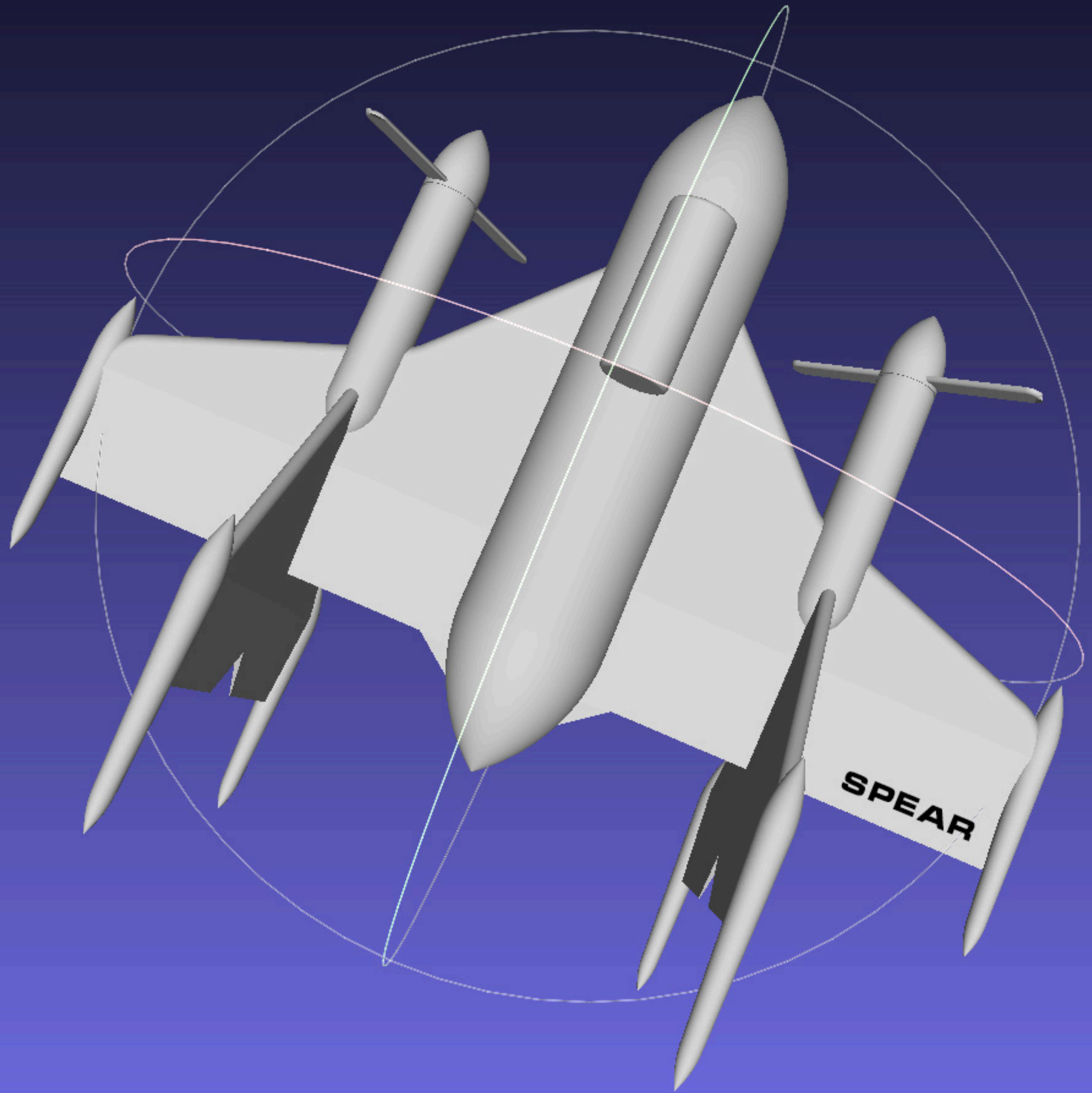
Our solution addresses both civil, defense, and security sectors, as outlined above.

TRL & roadmap

Current TRL
The current TRL is in the middle of Level 2–3: analytical proof of critical function and characteristics (proof-of-concept phase).

Roadmap
As in a Gantt-style plan, we are launching several parallel processes:

1. Development and construction of the first UAV fuselage prototype according to NATO standards.
2. Calculation, selection, and testing of UAV propulsion systems.
3. Development and creation of electronic systems based on the UAV architecture design.
4. Preparation of technical documentation and testing protocols.
5. Assembly of the first UAV prototypes and flight testing under maximum calculated overloads in real flight conditions. Testing of recovery systems and analysis of test results.
6. Consultations with Ukrainian experts working in domains aligned with our goals (interceptor drones, reconnaissance, SIGINT, EW).
7. Consultations with NATO experts and third-party specialists with authorized access levels.
8. Training and preparation of UAV operator(s).
9. Coordination of special permits for integrating weapons and explosives into the UAV and completing the necessary procedures.
10. Testing at a certified range at operational altitudes up to 7 km with high-speed targets and full combat operation.
11. Delivery of the final UAV version for combat testing in Ukraine.
12. Further development of the UAV based on combat testing results (control, detection, AI, overload tolerance, EW environment, adverse weather, etc.).
13. Submission of classification documentation to NATO following successful final testing.
14. Preparation for mass production.
15. Monitoring UAV use in real-world operations, supporting end users, and implementing changes based on their feedback.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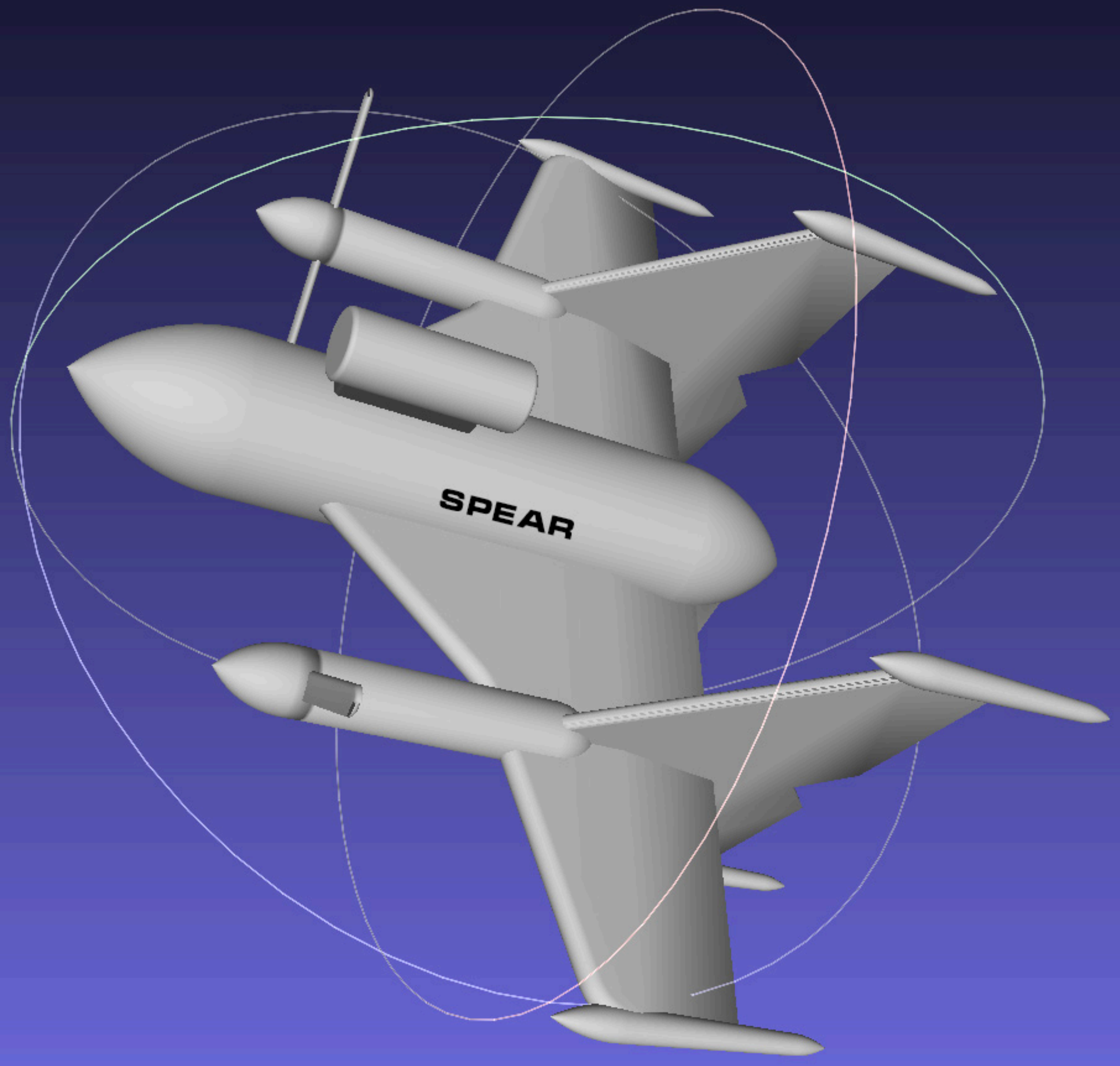
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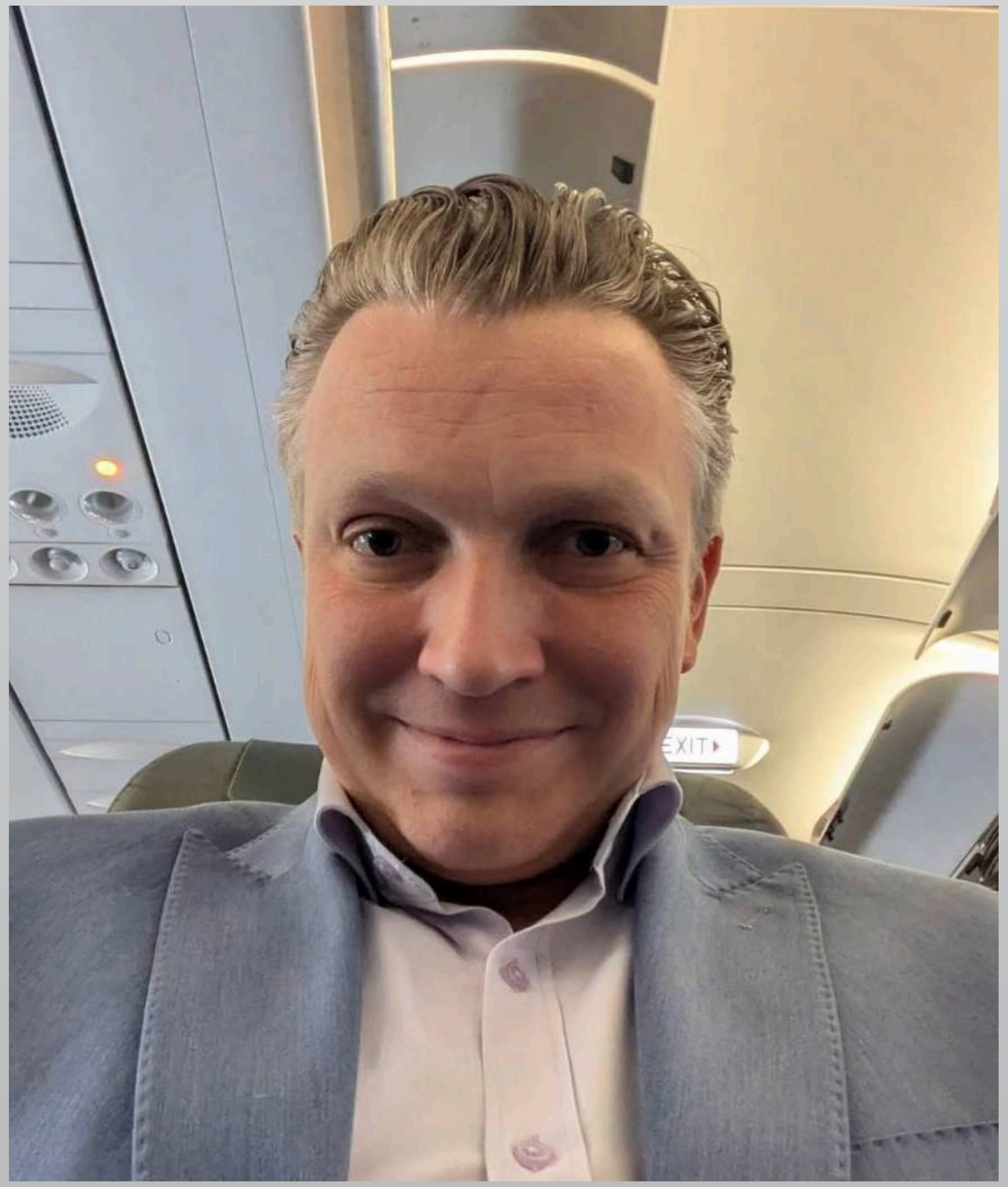

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