PRELIMINARY STATEMENT

Ethics Statement

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About this document

This Ethics Statement brings together the main ethical considerations surrounding the Boreas Focusproject. It is intended to provide a basis for discussion with the Ethics Commission and to support the development of final internal and external Ethics Statement.

The project team welcomes the opportunity to work closely with the ETH Ethics Commission in establishing an appropriate framework for research concerning drone technologies and automated engineering. The intention is not only to address the specific questions raised by Boreas, but also to contribute to the development of responsible research and publication practices at ETH. The experience and principles developed through this project may thereby serve as a useful reference for the Ethics Commission when considering similar technological developments and future projects. In this way, the collaboration can contribute to sustainable and responsible research practices extending beyond Boreas itself.

1 Project and Subject Matter

Boreas investigates a digital design and manufacturing pipeline that automatically derives customized aircraft designs from user-defined requirements. The project combines three main engineering areas: electronics, aerodynamics and control.
The case study is a conventional X-configuration quadrotor interceptor for collision-based interception. Relevant user-adjustable parameters may include range, speed or interception time, and cost. Simple assembly and low-threshold commissioning are additional design objectives.

A central distinction for the ethical assessment is that the primary product is the engineering pipeline, not the interceptor drone itself. The drone is an integral and explicitly defined case study through which the methodology is evaluated.

The scientific contribution therefore lies in the systematic transformation of requirements into technical parameters and concrete system designs as well as automating and integrating engineering processes which are conventionally distributed across several disciplines.

The central contribution of Boreas is the automation and integration of engineering processes that are conventionally distributed across several disciplines.

This has potential value beyond counter-UAS applications. Comparable methods could be applied to autonomous aircraft, inspection drones, rescue systems, or other specialized UAV platforms.
The interceptor provides a particularly demanding test case because it combines high dynamics, short reaction times, limited mass, and strong coupling between aerodynamic, structural, propulsion, and control requirements.
It is important to emphasize that the project is not intended as a commercial product but rather represents an opportunity for to-be-engineers to develop crucial technical skills and gain work experience.

2 Interception as a Case Study

Physical interception is an established category within counter-UAS technology, alongside approaches such as electronic countermeasures, directed energy, and capture systems. It therefore provides a technically defined problem in which one aircraft must reach another under specified geometric, dynamic, and temporal constraints.

The choice of interception is primarily methodological. Using an established operating principle allows Boreas to investigate the engineering pipeline without simultaneously having to establish the feasibility of a completely novel interception concept.

This does not imply that collision-based interception is considered universally appropriate or preferable for civilian applications. Capture and net drones, for example, represent alternative approaches with different technical requirements. The same design methodology could potentially be transferred to such systems once their system architectures and requirements are sufficiently defined.

3 Dual-Use and Engineering Gap

The engineering methods used by Boreas — including aerodynamics, simulation, flight control, lightweight construction, and optimization — are inherently dual-use. Their applicability to civilian and military systems is therefore not itself unusual.
The more relevant ethical question concerns the degree of practical enablement created by automation.
Today, technically experienced individuals can already access extensive public information, including DIY drone designs, CAD models, electronics documentation, flight-controller configurations, and tutorials. However, these resources generally consist of individual pieces of information and still require substantial technical integration.
Boreas could reduce this integration effort by automatically transforming abstract requirements into a concrete, manufacturable system. This can be understood as closing an

engineering gap between publicly available technical knowledge and a functioning, optimized overall system.
This characteristic is simultaneously part of the scientific value of the project and its principal ethical concern.
A complete publication of the pipeline would therefore have a different effect from a conventional scientific publication. A paper describing a method primarily disseminates knowledge; a fully configured pipeline could substantially reduce the practical engineering effort required (as well as the knowledge needed) to produce a specialized aircraft.
This leads to a proportionate conclusion:
The scientific methodology could be made transparent; the immediate automation of a deployable design, however, should not be published without further review and appropriate restrictions.

4 Integrity of Information

Responsible handling of information is considered an integral part of the ethical responsibility of the Boreas project. This includes not only scientific publications, but also source code, configuration files, design files, documentation, datasets, system specifications, and other technical information that could substantially reduce the engineering effort required to construct or deploy a specialized aircraft.
Cybersecurity and information security are therefore prerequisites for responsible publication and collaboration. Sensitive project information should be protected against unauthorized access, disclosure, or transfer beyond its intended scope.
The project team considers it its responsibility to protect sensitive information independently of sponsorship arrangements or other affiliations.
At the same time, this principle should not prevent legitimate scientific or engineering collaboration. Where collaboration with a third party is appropriate, joint development within a clearly defined scope may be possible. Information sharing should remain proportionate to this scope and should not unnecessarily extend access to sensitive information from other parts of the project. In doubt, the Ethics committee is to be consulted.

5 Integrity of Personnel

All students participating in the project as Focus students commit to conducting their work in accordance with this Ethics Statement, general standards of scientific integrity, and the applicable ETH Code of Conduct and institutional requirements.
The same principles apply to other persons who have substantial access to technically relevant project information. For the purposes of this Ethics Statement, the term “Project-Associated Personnel” includes ETH students and employees, freelancers, contractors, and other third parties who obtain relevant access to sensitive technical information in the course of their involvement with the project.
Project-Associated Personnel are expected to handle sensitive information responsibly and to respect the limitations established by this Ethics Statement, irrespective of their formal employment or affiliation.
The institutional framework of ETH provides an important basis for ensuring the integrity of students and employees involved in the project. Where access to sensitive technical information is granted to persons outside the established ETH framework, appropriate additional measures may be required.
In particular, background checks or equivalent suitability assessments may be introduced for non-ETH freelancers or other external personnel where the sensitivity of the information and the nature of their involvement justify such measures.

6 Project Continuity

Following completion of the Focus project, the project results will, under the usual arrangements for Focus projects, transition to the responsible organizing laboratory. Professor Mirko Meboldt, as Head of the PDZ Laboratory at ETH Zurich, endorses this Ethics Statement and, by signing it, confirms his commitment to upholding its principles in the subsequent handling of the project results following their transfer to the laboratory, also in consultation with the ETH Ethics Commission.
The project team welcomes the opportunity to establish appropriate principles for future ETH research concerning drone technologies and automated engineering together with the ETH Ethics Commission. The intention is not only to address the specific questions raised by Boreas, but also to contribute to sustainable and responsible research beyond this individual project.

7 Overall Ethical Assessment

Boreas addresses a technically demanding engineering problem with a potential civilian application context. Its primary scientific objective is the development of an automated methodology for designing complex aircraft under multiple constraints.
The interceptor is used as a technically established and clearly defined case study rather than as a commitment to collision-based interception as a long-term technology. The methodology is intended to remain transferable to other aircraft and counter-UAS approaches.
The principal ethical issue arises from the ability of automation to reduce the engineering effort required to turn abstract requirements into concrete, manufacturable designs. This creates a dual-use concern that should be addressed primarily through responsible system design, information security and publication practices rather than by excluding dual-use engineering research altogether.
The following guidelines therefore apply:

1. **Transferability:** The pipeline should remain applicable to other platforms, including capture and net drones.
2. **No autonomous weapon effects:** Target classification, target selection, autonomous attack decisions, weapons, and explosive payloads remain outside the project.
3. **Responsible publication:** Scientific methodology and general findings may be published openly, while directly deployable implementations should undergo separate review. By Necessity this also includes secure handling of information.
4. **Information security:** Sensitive technical information, source code, design files, configurations and other enabling materials should be protected against unauthorized access or disclosure.
5. **Responsible collaboration:** Collaboration with external parties may take place where it contributes to scientific or engineering objectives of the project, provided that information sharing remains proportionate to the jointly defined scopa and follows the projects information handling requirements.
6. **Project-associated personnel:** All persons with substantial access to sensitive project information are expected to follow this Ethics Statement, applicable scientific-integrity requirements, and relevant ETH rules and regulations. Additional suitability or background checks may be applied to external personnel where appropriate.
7. **Human responsibility:** The pipeline supports engineering decisions but does not make operational or societal decisions concerning actual interception.

Under these conditions, Boreas can be understood as a research project focused on making complex engineering processes more systematic, rapid, and adaptable, while considering the foreseeable consequences of its technological output.

The project team considers responsible research and publication to be a continuing responsibility rather than a one-time assessment. The ethical framework established during Boreas should therefore inform not only the completion and publication of this project, but also the subsequent institutional handling and potential further development of the underlying engineering methodology.

By signing this Ethics Statement, the undersigned confirm that they have read and understood the principles set out above and commit, in good faith and to the best of their knowledge, to uphold and implement these principles within the scope of their respective responsibilities and involvement in the project.

“Placeholder signatures”
{
8x team;
3x coaches;
Julian Bürkli, Mark Zander, Mirko Mebolt
Others needed?
}

(signatures on separate files for freelancers etc.)