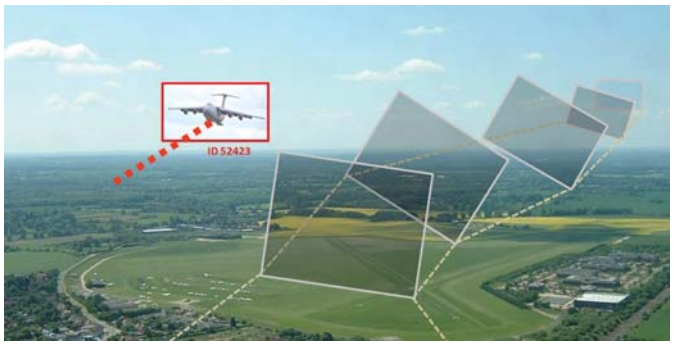
UAS & Related Activities in Austria

AeroSpy Sense & Avoid Technology develops navigation and control technology for unmanned systems. One of the actual research topics concerns avoidance-control for sense and avoid. The AeroSpy avoidance-control is a module, independent of the navigation process, which simplifies the integration into autopilot systems. The simplest and safest solution for collision avoidance would be to try to escape critical objects by maximizing the distance to those. However this is



the worst from an economical point of view. The collision avoidance algorithm by AeroSpy provides a technique to approach to critical objects as closely as allowed, but also to guarantee safety in the worst case scenario under the limit of separation distance. Based on geometric interpretation the avoidance problem is solved for objects of different types, both cooperative and non-cooperative. Furthermore, the avoidance control technology can handle different types of uncertainties (e.g. radar and ultrasonic beams) to guarantee safety without any numerical optimization. Other benefits of the geometric interpretation are the direct consideration of physical limits and the guaranteed computability in real time. AeroSpy also conveys how the Austrian visual flight rules are implemented, and that the avoidance-algorithm works with a limited sensor range whereby multiple objects can be handled. The field of applications for the AeroSpy Sense and Avoid technology is not only limited to fully autonomous vehicles. It is applicable for assistance in manned and remote controlled systems.
For additional information: www.aerospy.at/en/index.html

Rotax aircraft engines, designed and built **BRP-Powertrain**, are the most popular engines to power small aircraft up to approximately 650 kg. Actual more than 60.000 units are in use, installed in hundreds of different aircraft applications and operating under a variety of conditions. A research and development project was set up to support the integration of the successful Rotax 912 engine series into future UAS applications and platforms. This research project was funded by the Austrian Federal Ministry for Transport, Innovation and Technology. To be able to fully integrate the engine into modern UAS electronic systems, the project has defined an electronic engine management system that controls and monitors engine parameters like ignition, injection, and critical temperatures. The air/fuel ratio is controlled by a closed-loop algorithm. All relevant data are presented on a CAN bus system for display or storage. This allows the full integration into autonomously flying systems as no pilot input is requested for safe engine operation. The strategy and layout of the system was based on an in-depth System Safety Assessment including Functional Hazard Assessment, Fault Tree Analysis and Failure Mode and Effect Analysis. One of the results of these activities was the definition of necessary redundancies in the system. Special care was taken, that the system components such as sensors, injectors and actuators do not change the outside dimension of the existing engine and do not add weight to the existing basic design, which is unmatched in its class.
For additional information: www.rotax-aircraft-engines.com & www.rotax.com

Diamond Aircraft Industries has entered the manned/ unmanned aerial systems market with the twin-engine, Diesel/ Jet-fuel powered DA42 MPP (Multi Purpose Platform) produced in Wiener Neustadt, Austria, that optionally can be operated piloted or unmanned. The DA42 MPP is a specially designed platform for carrying multi-functional aerial sensor and communication equipment. In order to exploiting its full UAS potential Diamond Aircraft Industries has been engaged since 2007 in a number of security studies i.e.:

- Conditions, Opportunities and Risks for an Intellectual Property Cluster 3Airborne Security3 for the protection of Austrian People and Critical Infrastructure. The 12 month

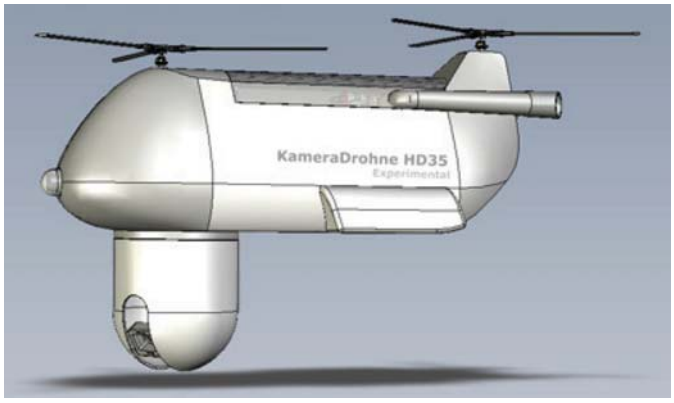
study (KIRAS, Austrian National Security Research Programme) started in fall 2008 and aims at drafting a national capable and international competitive Intellectual Property Cluster «Airborne Security» by networking the key actors of administration, industry, science and research in Austria.
- Periodical Surveillance of Critical Infrastructure. This 24 month study (KIRAS) started in summer 2007 and aims at developing an airborne surveillance system for the protection of people and critical infrastructure that is unrivalled, in terms of performance, universality and costs.
- Comparative Assessment of Security Centered Training Curricula for First Responders (FR) on Desaster Management in the European Union. This 24 month study (Seventh Framework Programme (FP7) EU) started in spring 2009 and aims at adapting disaster management skills of the EU FR community to meet new challenges i.e. in conducting search and rescue operations, policing and fire fighting after the deployment of a WMD by terrorists in a contaminated environment (radioactive, biological or chemical contaminants).

For additional information: www.diamond-air.at

The JXP (JOANNEUM EXperimental Platform) is developed by the Degree Programme in Aviation at **FH JOANNEUM**, University of Applied Sciences, Graz, Austria. The Unmanned Aerial Systems (UAS) development is in accordance with modern teaching concepts. Students broaden their knowledge from sophisticated theory to scientific implementation in and outside the classrooms. The JXP is set up as a multi-disciplinary project, which integrates all groups of the degree programme: aircraft design, avionics, aerodynamics, stress analysis, flight dynamics and control, materials science, production technology, human factors theory and economics. Taking into account latest trends in aircraft development with project groups distributed all over the world, further university

partners are invited to co-develop the JXP in a concurrent engineering approach. State-of-the-art methods are employed with the aim of stretching the limits of modern aircraft development technologies. Thus, the JXP is an ideal platform for R&D projects with industrial and scientific partners. With respect to environmental protection, the JXP will be a prototype of a «green aircraft». The JXP is developed in two stages. The first layout, the JXP-S, is characterized by stable flight qualities and a modular assembly. The JXP-S with a wingspan of about 7m, a take-off weight less than 25kg and a payload of 3kg, will be able to fly at a speed as low as 15 m/s. The second, new generation JXP-NG will be optimised in terms of aerodynamics, weight and production technology, always using the JXP-S as a demanding benchmark.
For additional information: www.fh-joanneum.at/lav

The target of **KameraDrohne** is to develop and distribute (rental & sales) a flying platform for stabilized, qualitative outstanding pictures for the film industry/broadcasting/aerial photography and various technical measurements. Therefore we will develop a self-stabilizing, multi-axis camera-gimbal and a suitable UAS in the shape of a double rotor UAS helicopter (2 meter, 40kg). Our target markets are the established equipment-vendors for the film & broadcast industry, film directors, documentary film producers, GIS solution providers and city planners (visualization and cartography), property developers (inspection of infrastructure) and diverse marketing companies (real estate, travel- and



event agencies, ..)
For additional information: www.kameradrohne.com

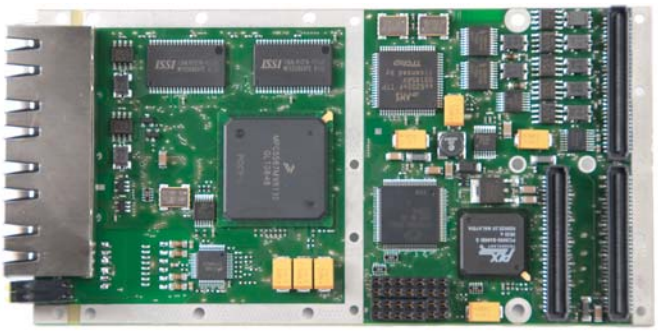
The **Schiebel Group** of companies is at the forefront of mine detection and unmanned helicopter development and production. Due to of the recent demand for reliance on UAVs in warfighting and peacekeeping operations, Schiebel´s latest UAS - the Camcopter® S-100 - is a flexible solution that meets today´s needs. The Camcopter® S-100 is a highly versatile and fully autonomous UAS that has been proven around the world in both land and maritime environments, by day and night. The Camcopter® S-100 System is built around a compact helicopter drone that can be fitted with a wide variety

of payloads, tailored to meet diverse user requirements, and is coupled with state-of-the-art networking capabilities. As a Vertical Take-off and Landing (VTOL) system, the need for launch and recovery equipment or prepared sites is eliminated, offering significant flexibility. This unrivalled capability has also been extensively tested from 'single spot' helicopter deck-equipped ships. With its variable speed from 0 to over 200 kph (100 kts) and altitudes up to 18,000 ft, together with its ease of mission planning, the Camcopter® S-100 is a true multi-role system. The UAS is able to fly out to a radius of 180 km from its controlling vessel on missions lasting up to 10 hours, carrying multiple payloads including multi-role sensors up to a total weight of 50 kg. With headquarters in Vienna, Schiebel currently maintains production facilities in Wiener Neustadt, Austria, and Abu Dhabi, UAE, as well as offices in Warrenton, VA, USA, and Phnom Penh, Cambodia.
For additional information: www.schiebel.net

In times of an ever increasing amount of data rate the demand for alternative Communications technologies for information exchange arises also for unmanned aircraft systems. Since 2005 the **research group for Optical Communications at TU Graz** has ongoing research projects relative to UAS with EADS (in Ottobrunn) Germany. Also a co-operation between TU Graz and IJS (in Ljubljana) for considering Optical Wireless (so called Free Space Optics, FSO) links on Airborne Platforms (like HAP's) has been established within SatNEx and COST IC0802. High-performance laser systems have an inherently high level of link transmission security due to the very narrow transmitter beam width.
A first feasibility study has shown the use of light as alternative communication technology between UAS swarms. Additional calculations and simulations for low cost FSO links between UAS for short ranges up to 2 km with Data-rates up to 1.25 Gbps for larger beam spot areas were investigated and developed at TU Graz. Different types of FSO systems were compared with on-the-market available FSO equipment in relevance to the specified link distance and link power budgets. Auto-tracking was used to maintain the communication link between non-stable objects. Because tracking is very tricky and expensive, various kinds of turrets were investigated and the concept of autonomous tracking

with GPS was considered.
The research group of Optical Communications at TU Graz has been doing measurements on Optical Wireless Links and developing FSO-equipment and hybrid systems (combining FSO and RF) since more than 15 years.
For additional information: http://optikom.ibk.tugraz.at

FH JOANNEUM GesmbH, and **TTTech Computertechnik AG**, the leading supplier of solutions in the field of time-triggered data communication, successfully launched the CAPTAIN research project. CAPTAIN stands for «COTS Airborne PMC card for Time-triggered Aerospace Interfaces and Networks» and aims at developing a commercial off-the-shelf (COTS) embedded platform for low-cost flight control systems in UAS and General Aviation aircraft. CAPTAIN is co-funded by TAKE OFF, the Austrian national aerospace research program.
The PMC (PCI Mezzanine Card) standard is widely used in the aerospace industry for rapid prototyping, testing and flight hardware in UAVs. The UAS market is a booming industry that requires highly reliable COTS at low cost. Within the CAPTAIN project a TTPPMC Card based on the time-triggered communication protocol TTP was developed. This TTPPMC card facilitates and accelerates the development of TTP-based onboard electronic systems for safety-critical applications. It represents an essential part of the TTP-based fly-by-wire



platform to be used in the FH JOANNEUM's UAS project JXP. «We are looking forward to expanding our avionics know-how with the application of TTP in flight control systems,» says Dr. Holger Flühr, Team Lead Avionics and ATC Technology.
The intended use of UAS in civil aerospace necessitates a high level of on-board system safety. TTTech's technology and highly modular TTP products are certified according to the aerospace standards in the commercial air transport industry and have been selected for Airbus A380 and Boeing 787.
For additional information: www.tttech.com

The JAviator project is a research project of the **Computational Systems Group at the Department of Computer Sciences at the University of Salzburg**, Austria. The first goal of the project is to develop a high-level, real-time, and concurrent programming abstractions and methodologies (for Java and other programming languages) that enable time-portable programming of high-performance, hard real-time applications. Time-portable programs do not change their relevant real-time behavior, even across different hardware platforms and software workloads. The second goal of the project is to develop a low-cost and easy-to-reproduce test platform for time-portable programming, called the JAviator, which supports high payloads for carrying a variety of complex devices such as different sensors and computers. The JAviator is a high-performance quadrotor model helicopter that is built around a high-integrity frame, which is horizontally and vertically symmetric, and supports high payloads through light-weight materials and advanced brushless motors. The JAviator is 1.3m in diameter, weighs 2.2kg in total, and generates a maximum lift of 5.6kg, which translates into a theoretical maximum payload of 3.4kg. Without payload the maximum flight time is around 40min. The JAviator has been designed and manufactured completely from scratch, and enhanced for CNC-based series production. There is already a first series of five helicopters and a second series of another five in production.
For additional information: www.cosy.sbg.ac.at

The **Machine Design and Rehabilitation Engineering Division** at the Technical University of Vienna teaches and works scientifically on the basics of mechanical engineering and thus deals with the design and calculation of the basic elements of machine design. Special courses are held about the design of transmissions for aviation applications like helicopters and UAS, comprising theoretical and practical studies. Main research fields are power transmissions for various fields of application, especially aviation. Theoretical investigations can be conducted with modern CAD – and Finite-Element-Analysis tools. Mockup parts can be generated with a 3D printing device. The laboratory of the institute enables experimental investigations of transmissions like power tests, certification runs, measurements of wear and acoustical characteristics; it is capable of testing unmanned aircraft drivetrains in full scale. Vibrations and sound emissions of drivetrains are a special focus. The target ist low emission, based on acoustical measurements, including sound pressure and sound intensity. The institute has a test field with six separate test beds for power transmission systems. One of the test beds is placed in a special room for acoustical investigations. Several frequency inverters are installed for flexible power supply. Measuring equipment for vibration and sound analysis is available and in the phase of complete modernization with new instruments at the moment. A standard FZG teststand and a Schenck balancing bench are permanently installed. The experimental activities in the laboratory are supported by a workshop that is operated together with other institutes and that a.o. has several milling and turning machines.
For additional information: www.ikl.tuwien.ac.at/mel