GUIDEKEEPER SECURITY CONCEPT OF OPERATION (SECOP) TO IMPROVE THE OPERATION OF UNMANNED PLATFORMS FOR WIDE AREA LAND AND SEA BORDER SURVEILLANCE IN EUROPE

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Keywords

Security; Surveillance; Radar; Guidance; Control

Abstract

GUIDEKEEPER aims at defining the Security Concept of Operation (SECOP) and promoting the deployment in Europe of an open architecture platforms for the use of UAVs for border surveillance: 1.Several UAV system concepts will be considered. Of particular interest to the GUIDEKEEPER project will be a High Altitude Platform Security Surveillance Tower (HAP Tower) with real time constraints to provide prospective options for independent open architecture system for the operation of unmanned (including UAVs) air-to-ground wide area land and sea border surveillance platforms, using independent GCS (Ground Control Station) with real-time constrains to comply with the SECOP to control cost and maximize the efficiency of operation of unmanned aerial system; 2.The open architecture system will perform automation technologies for guidance and control (including landing and take-off) of unmanned air-to-ground surveillance platform guided by the HAP-Tower, including relevant radars and sensors and secure data up-and- down links; 3.The SECOP also includes the Methods and the Tools to be used at existing security related sites.
Main business objectives are: 1) International leadership in the deployment of new platforms and sensors to comply with the SECOP; 2) Experience to be gathered with the applicability of Methods and Tools resulting from other areas-projects in which the consortium members are involved or have knowledge; 3) As end-product of the project a SSA - Strategic SECOP Agenda for Intelligent and Enhancing Border Security will be proposed to the EC.

Introduction

The strategic objectives and the expected achievements to be realized from the project are:
- To improve the operation of unmanned air-to-ground wide area sea border surveillance platforms in Europe, beyond the planned state-of-the-art.
- To provide new technology for deploying an open architecture system for automatic guidance and control of unmanned air-to-ground platforms.

As stated already GUIDEKEEPER aims at defining the Security Concept of Operation (SECOP) and promoting deployment in Europe of an open architecture platforms for the use of UAVs for border surveillance. The SECOP also includes the Methodology and the Tools to

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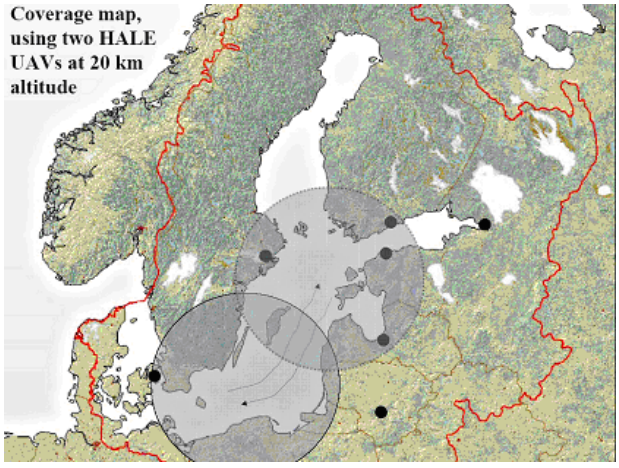
be used at existing security related sites to define a new approach to guide and control unmanned surveillance platforms with total automation including:

a) Long endurance high-altitude unmanned platform equipped with Synthetic Aperture Radar (SAR), Moving Target Indicator (MTI) and surveillance radar and sensors to detect, to track, and to guide and control the unmanned surveillance platform along predicted trajectory;
b) High rate data link transmitter and 28-31GHz relay for deploying telecom backhaul in the sky in case of emergency, to be based on CAPANINA (www.capanina.org) Stratospheric Broadband project;
c) GCS command centre system for controlling cost-effectively the landing and the taking off the unmanned flight platform and tracking the ground vehicles and the security related objects included in the open architecture system; and
d) A real-time information system connected with existing security sites data (track) to Sense and Avoid (S&A) targets alarms, either Management or Security related;
e) Ground Control Station information to be collected, processed, fused and distributed among various information centres related to security control and management contexts.

Following are shortly described the BALTIC WATCH II SECOP developed by relevant Baltic countries, and a proposed SECOP to monitor the important European infrastructure of Natural Gas Transmission System, while the GUIDEKEEPER open architecture system guarantees a successful secure protection.

GUIDEKEEPER FOR BALTIC WATCH



GUIDEKEEPER FOR PIPELINES MONITORING

The BALTIC WATCH II SECOP project aims at enhancing sea and coastline surveillance thereby increasing security in society.

The Baltic proper extends from Denmark in SW to Finland and Estonia in NE. There are five larger islands in the Baltic belonging to three different countries. Tankers, bulk freighters, general freight vessels and heavy ferry traffic connect the nine countries around the Baltic. In the summer season tens of thousands pleasure boats of all kinds are present at sea and in adjacent archipelagos. Organized crime has grown strong after the fall of the communist hegemony in the region. At present Swedish coastal areas are patrolled regularly by surveillance aircraft from the Coast Guard, however, thee is no complete continuous area surveillance of the Baltic. The BALTIC WATCH II initiative is aimed at providing improvements in safety and security for people living in the coastline of the Baltic. The focus of BALTIC WATCH II is on advanced sensors, communications- and aerospace technologies.

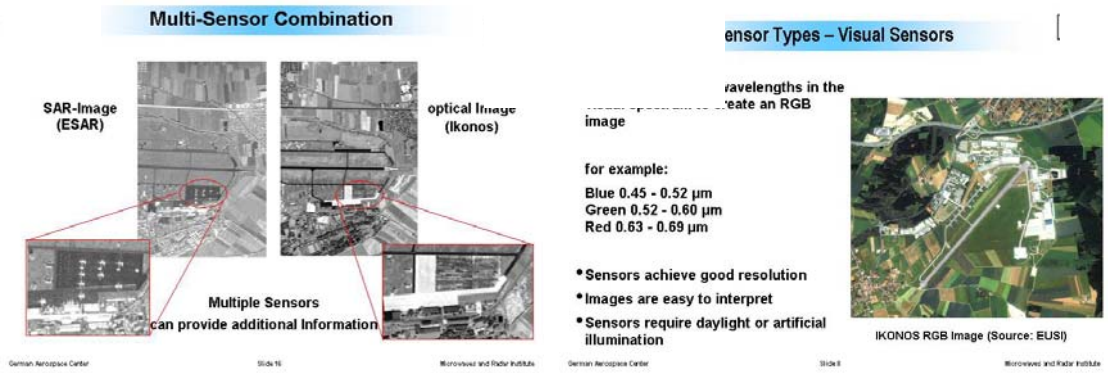
Theory and Method

The main theory and method objectives are:
2) Analysis and Proof of Concept of the following scenarios operation modes:

a) Extremely long range of air-to-ground detection and tracking of designated hostile objects;
b) Air-to-ground automatic guidance and control of unmanned surveillance platforms included in the open architecture system;
c) Air-to-ground commands for automatic landing and take off of an unmanned platforms;
d) Air-to-ground management of flying/moving security related objects by the HAP Tower;

The advantages of the new technology and methodology can be proved by analysing variety of tests that have been done by the HERMES 1500 HALE UAV to guide and control unmanned platforms through the GCS, including provision of SAR information on moving objects in the site vicinity.

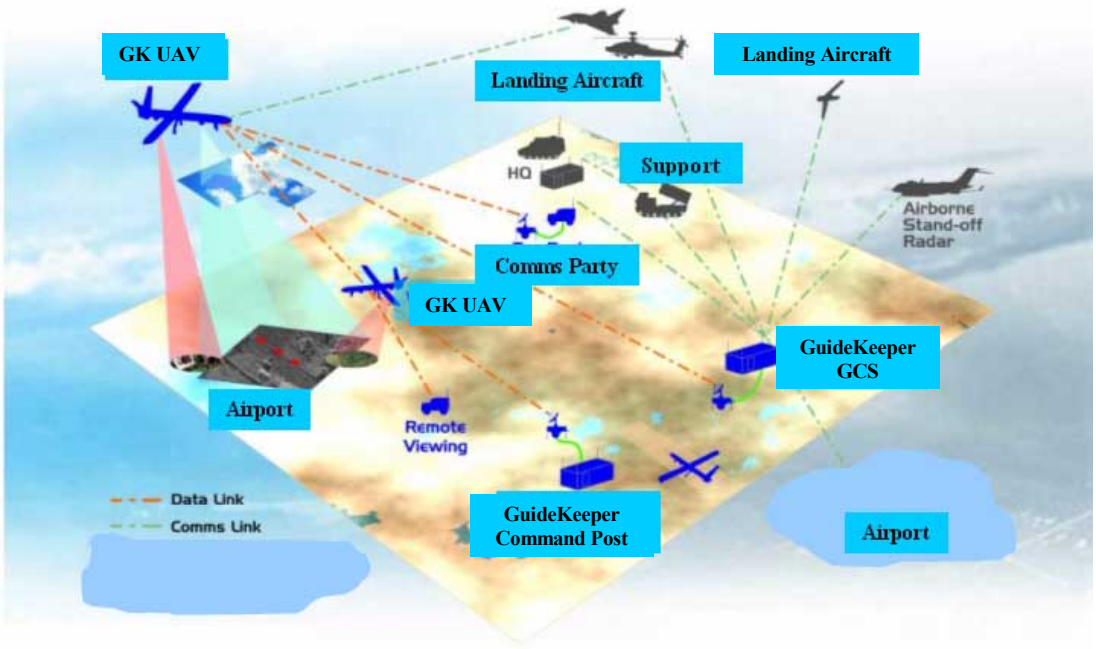
Following is presented a Multi-Sensor Combination that can provide extremely good surveillance coverage of wide area land and sea borders.



The GUIDEKEEPER potential impact in the European Security industry and organizations will be:
1) International leadership in the deployment of new platforms and sensors to comply with the SECOP
2) Experience to be gathered with the applicability of methods and tools resulting from other area-projects in which the GUDEKEEPER consortium members are involved or have knowledge of:

- a large military project of network of command and control (the UK WATCHKEEPER) by which the GUIDEKEEPER consortium members intend to promote the deployment of an open architecture security system;
- USE HAAS project (EC Contract No 516081 www.usehaas.org) on Developing Strategic Research Agenda for the High Altitude Aircraft Sector;
- ATENAA,MINERVAA and NEWSKY (www.atenaa.org;www.minervaa.org;www. newsky-fp6.eu) projects dealing with communications backbone;
- the BALTIC WATCH security sea border surveillance platform project defining the SECOP of the Baltic Countries;

Corresponding objectives



The corresponding objectives will be defined following the UK WATCHKEEPER military project reoriented to cover the relevant civil security aspects as defined in the Security Work Programme 2009,including:

a) To define the GUIDEKEEPER system (including the HAP-Tower with the radars and sensors installed there, the automatic guidance and control of unmanned platform, including the GCU) Statement of Operational Needs (SON), focused on security aspects for prospective continuity and coverage monitoring services dedicated to guidance and control of unmanned security platforms tasks.
b) To develop and define radars, remote sensing and airborne sensors to be integrated in a HALE UAV payload (a mini-scale HAP-Tower),as function of planned applications, to improve overall Security Concept of Operation (SECOP) performances & increase the security affordability to comply with the relevant SON.
c) To define a real-time Command, Control, Coordination and Communication (C4) Ground Control Station where information is gathered, processed, fused and securely distributed for operation control and management context following the System-Wide Information Management (SWIM) concept and architecture as defined for SECOP.
d) To analyse and define security and interfacing new technologies to be integrated in the GUIDEKEEPER system, and to test and verify the compliance of command, control and coordination tasks in a real-time security operation management, to the relevant SON.
e) To determine the GUIDEKEEPER open architecture system array, assessing the use of different platforms (such as the “HERMES 1500” high-altitude UAV) to automatic guide and control (including automatic landing and take off) an unmanned surveillance platform which can be tested and analysed to assess findings of the project, and provide potential operating users with collected data regarding cost-effectiveness of increased affordability of SECOP management to be prospectively applied in accordance with the relevant SON objectives.
f) To create a forum of potential users to stimulate follow-up activities, and convince EC to consider deployment the of GUIDEKEEPER system to be supported by specific end-users.

The technologies used in aeronautical communications have limited capabilities both on data rate transfer and on internal and external aircraft networking. The idea of the project was to use the paradigm “bringing the technologies from the lab to the aircraft” and thus validate

those technologies for use in aeronautical communications. The project also developed further research on previous areas studied by **ATENAA** project.The focus of the project is on OOL (Outside-aircraft optical link), IOPN (inside-aircraft optical link) and ka-band avionic phased-array antennas.

NEWSKY

Information availability and sharing resulting in global situation awareness will be a key enabler for future aeronautical systems. To achieve this aim the NEWSKY project will develop concept of global mobile communication network for AERO communications.

NEWSKY pursues the vision of "Networking the Sky" by integrating a range of data links based on different communication technologies (ground based, satellite based, air- to-air) as well as different applications classes (air-traffic services, airline operational & administrative communication, aeronautical passenger communication) into a single, seamless network.

GUIDEKEEPER Surveillance Platforms and Sensors Enhancing Border Security

HERON HALE UAV

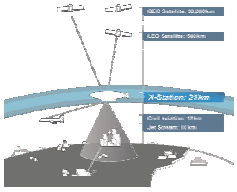
Global Observer HALE UAV

HERMES 1500 HALE UAV

GLOBAL HAWK HALE UAV

Lockheed-Martin HAA

X - STATION



a) The **HERMES 1500** high altitude operational UAV flies today at altitudes of up to 10 km for more than 30 hours, carries payload of 250 kg (including: SAR-AESA radar, high resolution IR/EO sensors for remote sensing and observation, location sensors, RF communications relay).

The HERMES 1500 UAV and its main characteristics are following described:

Specifications and technical data of the "HERMES 1500" UAV:

Max Range	3,300 km
Endurance	50 hours (to be upgraded to 84 hours)
Max Altitude	32,000 ft (to be upgraded to 45,000 ft)
Max Take-off Weight	1,150 kg
Max Payload Weight	250 kg
Speed	84-112 ktas

Available Payloads; High resolution EO/IR sensors; SAR and MPT radars; ESM; COMINT;

Radio relay; Navigation and positioning sensors

b) The **Global Observer** USA NASA/AeroVironment stratospheric UAV, presented in the picture below flies today for one week endurance at altitude of 20 km (with liquid Hydrogen), carrying payloads of 35-100 kg mainly for telecom and remote sensing. By year 2008 **Global Observer** will fly for one month with solar/regenerative fuel cell propulsion and payloads of 400 kg. At the 3rd year of the project it will be demonstrated to potential European end-users for prospective purchase and operational deployment.

c) The **Lockheed-Martin** stratospheric airship, presented in the picture below, will be available by year 2009 for 1 month endurance to fly in a quasi-geo stationary position for persistent on station-keeping as a telecommunications relay, a weather observer, or surveillance platform, and will be able to carry payloads of 1000 kg upon customer requirements. Lockheed-Martin has built more than 300 low/medium altitude airships and has the largest air-dock in USA able to build airships of up to 375 m length and 100 m wide, if required, for stratospheric flights. The GUIDEKEEPER Consortium is currently informed on the development progress of this airship.

d) The ATG **StratSat** stratospheric airship, similar to the Lockheed-Martin one developed mainly for communications applications to be available by year 2010.ATG claims to negotiate with the Malaysia Government to deliver **5 StratSat** airships above the country, including islands in the Indian Ocean, and to deploy "Telecommunication Backhaul in the Sky" to compensate with the luck of terrestrial infrastructure. The GUIDEKEEPER Consortium is currently informed that the ATG company is temporarily out of business.

e) The **GLOBAL HAWK,**RQ-4A is high altitude, long endurance unmanned aerial reconnaissance system designed to provide high resolution, near- real-time imagery of large geographical areas. Advanced technology sensors, a range greater than halfway around the world and the ability to remain in flight for long periods of time, enables the Global Hawk to provide surveillance and intelligence data. The new version of the Global Hawk will perform more than 50 hours endurance flight, 65,000 ft altitude and 16,000 nautical miles range.

f) The **StratXX LTA Platforms**

The X-Station (from StratXX AG) is LTA platform, developed in Switzerland by the company StratXX AG. Such platform has several unique innovative aspects, leading to competitiveness in terms of mission profile, payload transportation, system safety, low cost for production and operation. The X-Station 100 concept shows an ultra-light lifting body, resistant to the harsh thermal environment of the lower stratosphere, and a so-called Payload Plane, being connected underneath the LB, and containing all the electronics, propulsive system, Electric Power System, etc.

The X-Station would be able to lift 100kg payload, to keep geo-stationary position at 20000m.s.l. to cover an area up to 1000 km in diameter at ground and slightly lower area at the altitude of common airliners.

The X-Station is at advanced stage of prototyping, with studies, laboratory tests and in-flight demonstrations being largely exploited in order to aim to commercialisation within 2 years.

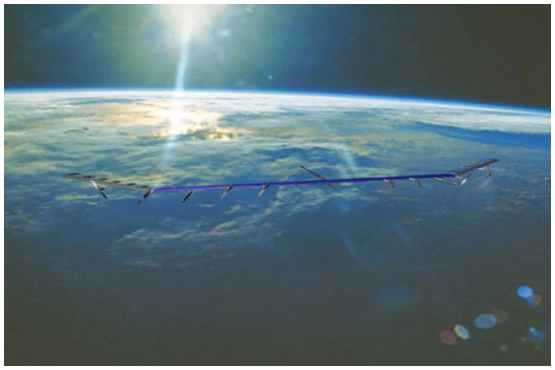
The PhoeniXX(from StratXX AG) is a LTA all weather platform, developed in Switzerland by the company StratXX AG. Such platform has several unique innovative aspects, leading to high competitiveness in terms of mission profile, payload transportation, system safety, low cost for production ad operation. The PhoeniXX would be able to lift 20kg useful payload, to keep geo-stationary position or roaming at 5000m.s.l., to cover an area up to 250 km in diameter.

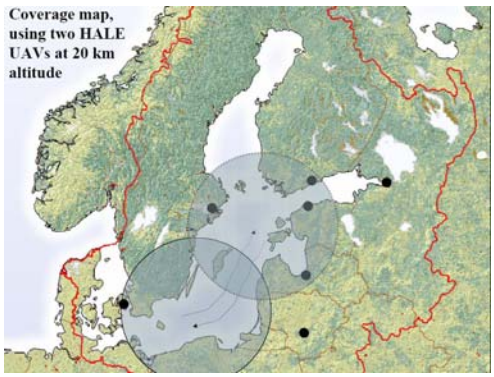
The PhoeniXX is at advanced stage of prototyping and testing, ready to market at Spring 2009.

The X-BUGS (from StratXX AG) is a LTA all weather platform, developed in Switzerland by the company StratXX AG. Such platform has several unique innovative aspects, leading to high competitiveness in terms of mission profile, payload transportation, system safety, low cost for production ad operation. The X-BUGS would be able to lift 5kg useful payload, to keep geostationary position or roaming at 2000m.s.l., to cover an area up to 50 km in diameter for high resolution pictures. The X-BUGS is at advanced stage of prototyping and testing, ready the market at on December 2009.

Results and Discussion

GUIDEKEEPER: European coastline control – BALTIC WATCH II:
Mediterranean or Baltic sea two GUIDEKEEPER platforms are able to observe +/- whole Baltic Sea area Integrated System using HAAS equipped with multiple Sensors (SAR, IR, optical) Could also provide telecom- services for Baltic sea area (Multi-mission concept).





GUIDEKEEPER: Pipeline Monitoring
Develop a pipeline monitoring system to improve safety reduce survey costs using remote monitoring.

- Observation of gas transmission pipelines (external threats).
- Detection of gas leakage
- Monitoring of soil subsidence and upheavals
- Very high resolution needed (down to 5 cm)
- Sensors: Optical, IR, SAR/IFSAR, Lidar, ...