MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY

“KHARKIV POLYTECHNIC INSTITUTE”

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Introduction

An unmanned aerial vehicle (UAV) is an aircraft that carries no human pilot or passengers. UAVs sometimes called “drones” can be fully or partially autonomous but are more often controlled remotely by a human pilot.

This research has contributed to the public discussion on the use of drones for warfare and surveillance.

The Unmanned Aerial Vehicle (UAV) Drones Market has seen tremendous growth in the past five years and as the new players are entering into market with latest innovation and cost effective methods, the market is expected to grow tremendously during the forecast period. North America is one of the technologically advance region which is driving the market growth however growing Asian regions such as China and India is also fueling the market.

If you are interest in the Unmanned Aerial Vehicle (UAV) Drones industry or intend to be, then this study will provide you comprehensive outlook.

This research will also give you information different models UAV technology.

Unmanned Aerial Vehicle (UAV)

The UAV is an acronym for Unmanned Aerial Vehicle, which is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems.

UAVs are currently used for a number of missions, including reconnaissance and attack roles. For the purposes of this article, and to distinguish UAVs from missiles, a UAV is defined as being capable of controlled, sustained level flight and powered by a jet or reciprocating engine. In addition, a cruise missile can be considered to be a UAV, but is treated separately on the basis that the vehicle is the weapon.

The acronym UAV has been expanded in some cases to UAVS (Unmanned Aircraft Vehicle System). The FAA has adopted the acronym UAS(Unmanned Aircraft System) to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles.

Officially, the term 'Unmanned Aerial Vehicle' was changed to 'Unmanned Aircraft System' to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles. The term UAS, however, is not widely used as the term UAV has become part of the modern lexicon.

The military role of UAV is growing at unprecedented rates. In 2005, tactical and theater level unmanned aircraft (UA) alone, had flown over 100,000 flight hours in support of Operation ENDURING FREEDOM (OEF) and Operation IRAQI FREEDOM (OIF). Rapid advances in technology are enabling more and more capability to be placed on smaller airframes which is spurring a large increase in the number of SUAS being deployed on the battlefield.

The use of SUAS in combat is so new that no formal DoD wide reporting procedures have been established to track SUAS flight hours. As the capabilities grow for all types.

UAV, nations continue to subsidize their research and development leading to further advances enabling them to perform a multitude of missions. UAV no longer only perform intelligence, surveillance, and reconnaissance (ISR) missions, although this still remains their predominant type.

Their roles have expanded to areas including electronic attack (EA), strike missions, suppression and/or destruction of enemy air defense (SEAD/DEAD), network node or communications relay, combat search and rescue (CSAR), and derivations of these themes. These UAV range in cost from a few thousand dollars to tens of millions of dollars, and the aircraft used in these systems range in size from a Micro Air Vehicle (MAV) weighing less than one pound to large aircraft weighing over 40,000 pounds. **(The Uav - Unnamed Aerial Vehicle, 2019)**

Unmanned aerial vehicles (UAV) are a class of aircrafts that can fly without the onboard presence of pilots [WAT 12]. Unmanned aircraft systems consist of the aircraft component, sensor payloads and a ground control station. They can be controlled by onboard electronic equipments or via control equipment from the ground. When it is remotely controlled from ground it is called RPV (Remotely Piloted Vehicle) and requires reliable wireless communication for control. Dedicated control systems may be devoted to large UAVs, and can be mounted aboard vehicles or in trailers to enable close proximity to UAVs that are limited by range or communication capabilities.

UAVs are used for observation and tactical planning. This technology is now available for use in the emergency response field to assist the crew members. UAVs are classified based on the altitude range, endurance and weight, and support a wide range of applications including military and commercial applications. The smallest categories of UAVs are often accompanied by ground-control stations consisting of laptop computers and other components that are small enough to be carried easily with the aircraft in small vehicles, aboard boats or in backpacks. UAVs that are fitted with high precision cameras can navigate around the disaster area, take pictures and allow the crew members to perform image and structural analysis. As UAV operations require onsite personnel, it will be helpful for onsite crew members to access the disaster area first before entering the disaster affected area. UAVs that are suitable for outdoor operation and can fly at reasonable altitude are used for disaster impact analysis. The important aspect of such UAVs is that the initial assessment gives a clear disaster planning direction. After the survivors are detected via image analysis, crew members can then try to make contact with the survivors and perform quick rescue operations. Nano UAVs can be used in-built and combined with robots capabilities and can be a very useful in detecting structural damages to buildings and detect survivors trapped inside debris.

In recent years, increasing research efforts and developments are improving UAV for various application and reliability. UAV is still in experimental stages at the moment. Also, a shortage of skilled onsite crew member is a bigger problem. [PRA 06] highlights that a minimum of three staff members is required to operate a UAV.

Airworthiness of Unmanned Aircraft Systems (UAS)

Unmanned Aerial Vehicles (UAVs), *Uninhabited Aerial Vehicles*, and also *Remotely Piloted Vehicles*, or Remotely Operated Aircraft were some denominations of these aircrafts.

The term chosen by International Civil Aviation Organisation (ICAO) is Unmanned Aircraft Systems (UAS), making clear that the vehicle is an aircraft operating as part of a *system*.

In order to differentiate the aircraft with automatic (internal) control from those remotely piloted as manned aircraft, the last – as systems – are denominated Remotely Piloted Aircraft Systems (RPAS), as subsets of UAS.

The term *drone* is generically used, particularly by the media, as a description of all types of unmanned aircraft.

UAS have been used by the world’s armed forces for wartime operations for more than 60 years for battlefield observations, and more recently, as a wartime tool for kinetic operations. We can therefore argue that UAS have already reached a technical maturity, and this will continue to evolve as for any other kind of aircraft. However, up to the present, UAS missions have been normally limited to restricted flying areas, outside the zones open to civil aircraft operations.

Now that the great potential of this type of machine has been recognised, the global industry has requested the opportunity of using them also commercially in civil airspace. This possibility is even of interest to the defence industry and military stakeholders, because, for example, they could achieve better operational flexibility in the case of transfer flights or they could be used in para-military operations to ensure surveillance and security of urban areas.

We have mentioned the potential of UAS for civil applications. We now consider what kind of applications these might be.

As a first example, thousands of rotary wing UAS are already used for agricultural purposes in Japan (crop-spraying pesticides and fertilisers). These machines, all built in Japan, carry a useful load of 25–150 kg. The country has been utilising UAS-like technology for its crops since 1990.

Some classifications have been drafted and the following list includes few examples taken from the multitude of possible UAS uses:

- Forestry services – fire control and other kinds of surveillance
- National weather services – atmospheric sampling, meteorology
- Agriculture and wildlife – agricultural monitoring, river and estuary surveys, illegal waste disposal surveys, crop dusting, mapping, and fishing law enforcement
- Electricity authorities – monitoring nuclear facilities and power line verification
- Postal services – urgent package delivery in remote areas
- Coastguards – surveillance for counter-narcotics, illegal alien intrusion detection, illegal fishing control, and search and rescue missions

- Civil aviation – noise measurement for aircraft certificationpurposes.

- Telecommunications – as telecom relays (replacing satellites), local TV coverage

Fire-fighting – search and rescue and police surveillance in urban areas

It is clear from these examples that, in many cases, the scope of UAS is to carry out the '*dirty jobs*', that is, dangerous tasks, or tasks too long or too tedious for a crew.

Can UAS be legally defined as *aircraft*?

The *aircraft* definition of the ICAO Annex 2 is clearly applicable to the unmanned vehicles.

Furthermore, the Chicago Convention in the Article 8 *Pilotless aircraft*declares that.

« No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft. »

Therefore, the real problem is now to develop concepts for the safe integration of UAS in general air traffic. It is then necessary to develop rules harmonised with the existing rules for air traffic control.

The issues concerning the above rules can be easily classified, as for '*manned*' aircraft, into three basic segments: (1) Personnel licenses, (2) Air traffic management (ATM), and (3) Airworthiness.

Hence, we return to the main safety factors discussed in Chapter 1: *Person*, *environment*, and *machine*.

Studies and conferences on the above subjects have been taking place for many years. In Europe, there are institutes and associations dealing with these issues. One is the European UVS International (formerly EURO UVS), similar to the Association for Unmanned Vehicle System International (AUVSI) in the United States. A great contribution to this discussion has also been made by EUROCONTROL, particularly concerning ATM matters. Other initiatives have been taken all over the world. **(Science**

Direct - Unnamed Aerial Vehicles, 2019)

UAV Types

Target and decoy - providing ground and aerial gunnery a target that simulates an enemy aircraft or missile

Reconnaissance - providing battlefield intelligence

Combat - providing attack capability for high-risk missions (see Unmanned Combat Air Vehicle)

Research and development - used to further develop UAV technologies to be integrated into field deployed UAV aircraft

Civil and Commercial UAVs - UAVs specifically designed for civil and commercial applications.

Degree of Autonomy

Some early UAVs are called drones because they are no more sophisticated than a simple radio controlled aircraft being controlled by a human pilot (sometimes called the operator) at all times. More sophisticated versions may have built-in control and/or guidance systems to perform low level human pilot duties such as speed and flight path stabilization, and simple prescripted navigation functions such as waypoint following.

From this perspective, most early UAVs are not autonomous at all. In fact, the field of air vehicle autonomy is a recently emerging field, whose economics is largely driven by the military to develop battle ready technology for the warfighter. Compared to the manufacturing of UAV flight hardware, the market for autonomy technology is fairly immature and undeveloped. Because of this, autonomy has been and may continue to be the bottleneck for future UAV developments, and the overall value and rate of expansion of the future UAV market could be largely driven by advances to be made in the field of autonomy.

Autonomy technology that will become important to future UAV development falls under the following categories:

Sensor fusion: Combining information from different sensors for use on board the vehicle

Communications: Handling communication and coordination between multiple agents in the presence of incomplete and imperfect information

Motion planning (also called Path planning): Determining an optimal path for vehicle to go while meeting certain objectives and constraints, such as obstacles

Trajectory Generation: Determining an optimal control maneuver to take to follow a given path or to go from one location to another

Task Allocation and Scheduling: Determining the optimal distribution of tasks amongst a group of agents, with time and equipment constraints

Cooperative Tactics: Formulating an optimal sequence and spatial distribution of activities between agents in order to maximize chance of success in any given mission scenario

Autonomy is commonly defined as the ability to make decisions without human intervention. To that end, the goal of autonomy is to teach machines to be "smart" and act more like humans. The keen observer may associate this with the development in the field of artificial intelligence made popular in the 1980s and 1990s such as expert systems, neural networks, machine learning, natural language processing, and vision. However, the mode of technological development in the field of autonomy has mostly followed a bottom-up approach, and recent advances have been largely driven by the practitioners in the field of control science, not computer science. Similarly, autonomy has been and probably will continue to be considered an extension of the controls field. In the foreseeable future, however, the two fields will merge to a much greater degree, and practitioners and researchers from both disciplines will work together to spawn rapid technological development in the area.

To some extent, the ultimate goal in the development of autonomy technology is to replace the human pilot. It remains to be seen whether future developments of autonomy technology, the perception of the technology, and most importantly, the political climate surrounding the use of such technology, will limit the development and utility of autonomy for UAV applications.

Under the NATO standardization policy 4586 all NATO UAVs will have to be flown using the Tactical Control System (TCS) a system developed by the software company Raytheon. **(The Uav - Unnamed Aerial Vehicle, 2019)**

Benefits and benefits to humanity

The Situation of the UAV Application in Line Inspection of Transmission Lines

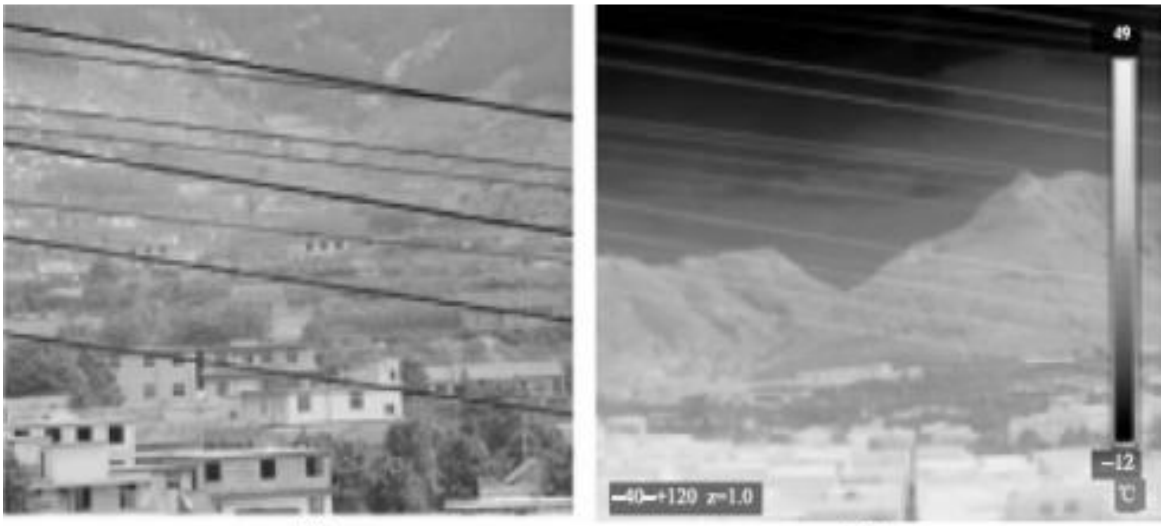
The simplest UAV line inspection method is fixing a small video camera and camera in the aircraft nacelle. Only one person is needed to control the UAV when the conductors and insulators are photographed, and the resulting video cassette can be observed after inspection. Because of aircraft shake and indeterminable focus, obvious phenomena, such as collapsed or inclined tower, broken lines, fallen insulators, and lines in the forest touching trees, etc., can be analyzed and identified rapidly, but the problems of line heating and defects in the insulators, as well as other problems, are still not identified.

UAV line inspection enables the remote transmission of visible light and the infrared thermal imager sends signals to the ground monitor screen to be analyzed, in communication with the controlled data link. UAV line inspection is executed by two people. One operates the aircraft professionally, the other monitors the ground screen. When suspicious objects are found, the UVA can hover or fly back and forth and inspect carefully. Real-time monitoring and video can be done at the same time, as can high definition camera shooting. After the aircraft return, the figures are analyzed.

If a visible camera is used, detection must be done on sunny days; if an infrared thermal imager is used, it must be done in the morning before sunrise, in the evening after sunset, or on a cloudy day without rain, so that heating points on the lines can be identified better. In general, when lines are inspected with aircraft, the aircraft should fly along the conductors and above them to one side. The aircraft and the sun should be located on the same side of the conductors, so that backlighting can be avoided; and the lens axis shall be at a specified angle with the horizontal plane. In general, the lens direction (in general, focal length can be adjusted automatically) shall be determined in advance, and will not change in the process of flying. If the lens direction needs to be changed, this can be achieved depending on the changing flight path. If a moving airborne vehicle has a gyrostabilized system, scan automatically, one image at a time. Data can then be analyzed carefully.

The UAV shall have the flight control functions of autonomous navigation control by GPS, geography matching automatic control, automatic tracking of line tower, and others. Line tracking and flight control can be achieved automatically with UAV line inspection, in taking into consideration the transmission lines' route, altitude, and intersection angle. The UAV flies stably, and has a stable shooting platform carrying visible shooting equipment and infrared shooting equipment together, and these have an automatic shooting function, and can shoot high resolution aerial images of towers. The UAV has automatic tracking and identification technology for line towers, and rapid focus and imaging technology for shooting. Installed visible imagers and infrared thermal imagers are automatically focused on towers and other targets, and they can be exposed rapidly, generating high resolution visible light images and infrared images of ground towers, lines, forests, insulators, and fittings, and other relevant details. Installed visible imagers and infrared thermal imagers have the functionality of identifying faults, which can help transmission line inspection to develop in the direction of automation. See Figs. 3.41–3.43 for all kinds of UAVs.

On April 17, 2009, in the Xueye Lake section of 500 kV Chuantai transmission I, II line, a UAV, with a length of less than 3 m, and a height of less than 1 m, flew steadily to the No. 88 tower of Chuantai transmission II line. In accordance with a 3D model, transmission lines and towers were shot with a camera and a video recorder. Detected data and images were transmitted in real time to the monitoring unit in a ground measurement and control vehicle. It was the first time that Shandong Electric Power Corporation had used a UAV for tour inspection. This test flight lasted 15 min. The tour inspection lines were 1.6 km in length. The terrains of the tour inspection areas were complex. The UAV tour inspection systems were tested comprehensively. The UAV tour inspection system consisted of two parts, the helicopter platform and the detection system. The helicopter platform was used to finish flight missions, and the detection system was used to finish detection on transmission lines and towers. This system was used to inspect transmission lines of 110–750 kV. It can fly for 1 h every time, and inspect 20 km of lines per hour. Four sorties can complete missions equal to a whole day's workload for 20 patrolmen, and there are no restrictions as to geographical environment. At present, the UAV tour inspection system has achieved such functionalities as one-click automatic lifting, automatic tracking of flight lines, real-time track display, three-dimensional program flight control, double detection with visible light and infrared light, automatic tour inspection, multiway, bidirectional and synchronous transmission, security warnings, and infrared thermal images analysis.



(A) (B)

In October 2009, a UAV flew at 15 km/h along 220 kV transmission lines. Towers were detected from top to bottom. Fig. 3.44 shows the visible light image and infrared image, taken when towers were detected. The visual condition of the transmission equipment could be seen from the visible light image so that any physical defects could be seen. Physical defects might include conductors with broken strands, whether loose fasteners, broken insulators, abnormalities in vibration dampers, and so on. From the infrared image, heating points caused by equipment defects at conductors, connectors, clamps, strained tubes, splicing sleeves, insulators, and so on can be seen.

Unnamed Aerial Vehicles For Governments

A comparative evaluation of several samples of UAV is

related to the statement and solution of multi-criteria optimization problem. The known methods to solve multi-criteria optimization problems are the formation of generalized
criterion, selection of basic criterion, hierarchy analysis.
A method for selecting the basic criterion implies that
a multi-criteria original problem is reduced to a single-criteria optimization problem. The formation of the problemis carried out after obtaining an answer to the problem on criteria ranking and defining the constraints for criteria. A method for the formulation of generalized criterion is limited in its application by the fact that, when considering applied problems on compiling a generalized criterion, it causes the difficulties that are difficult to overcome. The method of successive concessions also requires first and foremost solving a problem of criteria ranking and bringing their measurement to one scale, determining the magnitudes of concessions for each criterion. A method of hierarchy analysis, which is considered in terms of its application for solving multi-criteria optimization problems of different physical nature, has no disadvantages or “nuisances”. Moreover, the criteria can match the factors that reflect both the quantitative and qualitative attribute .

According to main UAV TTC include:

– flight duration;

– flight speed;

– flight altitude;

– activity range;

– cost of manufacturing;

– demand in the market of armaments;

– competitiveness.

When considering prospective UAV designs, their basic above-mentioned TTC will take predicted values. We note that if a researcher has statistics, for example, on the values of activity range while observing the battlefield, then thetask on predicting the value of this characteristic can bestated and solved under conditions of stochastic uncertainty. Smoothing stochastic values in time.

Most Advanced Models

Global Hawk

The Northrop Grumman Global Hawk has its origins in the 1994 High-Altitude Endurance Unmanned Aerial Vehicle Advanced Concept Technology Demonstrator (HAE UAV ACTD) program initiated by the Defense Advanced Research Projects Agency (DARPA) and Defense Airborne Reconnaissance Office (DARO). This effort was undertaken as a reaction to the perceived excesses of the highly classified and enormously expensive Lockheed/Boeing Advanced Airborne Reconnaissance System (AARS) program initiated in the mid-1980s. A loitering long-range strategic reconnaissance UAV designed to penetrate contested airspace and carry a wide range of sensors, AARS was cancelled in May 1993 due to cost overruns and the loss of its main mission with the end of the Cold War.

Predator A

The Predator, a growth evolution of the proven GNAT system, uses common avionics and mechanical systems and incorporates a Rotax 4-cylinder engine. Configured with a satellite data link system, Predator has an endurance of 40 hours and is equipped with an EO/IR stabilized gimbal containing two color video cameras and a forward-looking infrared (FLIR) camera as well as a synthetic aperture radar (SAR).

The Predator has been configured with air-to-air or air-to-ground weapons as well as a laser designator. Since 1995, Predator has logged over 65,000 flight hours, of which over more than half have been during combat area deployments to the Balkans, Southwest Asia, and the Middle East where Predator operates in support of U.S. and NATO forces. Based upon the success of the program, the U.S. Department of Defense transitioned the Predator program to full rate production in August 1997, marking it as the first Advanced Concept Technology

Demonstration (ACTD) program to be designated an Acquisition Category II Program.

Predators are currently in production for the U.S. and Italian Air Force. Land-based Predators have demonstrated the ability to support maritime forces including carrier battle groups, amphibious ready groups, and submarines. Predator is the only reconnaissance system available in the U.S. inventory that can provide near real-time video imagery day or night in all weather conditions via satellite worldwide - without exposing pilots to combat fire. As the first successful unmanned aircraft surveillance program, Predator provides tactical and strategic intelligence to operational commanders worldwide. In July 1995, Air Combat Command commissioned the 11th Reconnaissance Squadron, the U.S. Air Force's first operational Predator squadron. The second Predator squadron, the 15th Reconnaissance, was commissioned in August 1997. The third Predator squadron, the 17th Reconnaissance, was commissioned in March 2002.

Predator B

The Predator B aircraft was developed in 2000 with first flight commencing in February 2001. Powered by a turboprop engine, the Predator B series was designed as a long-endurance, high-altitude unmanned aircraft for use as a multi-mission system by a variety of customers. From reconnaissance, surveillance, targeting, and weapons delivery to scientific research and other civilian applications, Predator B has the capacity to conduct multiple missions simultaneously due to its large internal and external payload capacity.

X-47A

Northrop Grumman designed and built the X-47A with its own funds to demonstrate low-cost, rapid prototyping; robust unmanned vehicle management; and tailless aerodynamic qualities suitable for autonomous launch and recovery flight operations from an aircraft carrier. Lessons learned from the development and testing of X-47A will be used in support of the company's X-47B Unmanned Combat Air System UCAS program. Built largely with composite materials and powered by a Pratt & Whitney JT15D-5C engine providing 3,200 pounds of thrust, X-47A measures 27.9 feet long with a nearly equal wingspan of 27.8 feet. The X-47A incorporates advanced autonomous flight control laws to account for directional control of its tailless design. The X-47A was designed in El Segundo at the Western Region business area of Northrop Grumman Integrated Systems. The vehicle was built at Scaled Composites in Mojave, Calif.

X-47B,

The goal of the X-47B UCAS program is to demonstrate the technical feasibility for an unmanned system to effectively and affordably conduct surveillance, strike and suppression of enemy air defenses missions within the emerging global command and control architecture. The X-47A program played a significant role in supporting this effort.

Mariner

Mariner, a derivative of the highly successful Predator B, is a high-altitude, multipurpose aircraft suited for long endurance maritime and border surveillance missions. Configured to carry additional fuel, Mariner can operate on missions up to 49 hours, providing real-time and persistent intelligence, surveillance and reconnaissance (ISR) intelligence to users around the globe. In addition to over 800 lb of internal payload capacity, Mariner can also carry up to 3,800 lb of external payloads providing for multiple and simultaneous mission capacity from one aircraft.

The Mariner is designed to meet the requirements of the U.S. Navy's Broad Area Maritime Surveillance (BAMS) program as it can provide intelligence data directly into the C4 system architecture for both "on target" tracking and regional surveillance requirements. In addition, Mariner is the system of choice for homeland security as well as for several international maritime opportunities requiring a reliable, cost-effective unmanned aircraft system.

Altair

The Altair, a high altitude version of the Predator B, was specifically designed as an unmanned platform for both scientific and commercial research missions that require endurance, reliability and increased payload capacity. Built in partnership with NASA, the Altair has an 86 ft wingspan, can fly up to 52,000 ft and can remain airborne for well over 30 hours. Marked as the first remotely piloted aircraft that will meet aviation authority requirements for unmanned flights in National Air Space, Altair is configured with a fault-tolerant dual-architecture flight control system and triple redundant avionics for increased reliability. Altair is currently being integrated with an automated collision avoidance system as well as an air traffic control voice relay that will increase responsiveness and communication for flights in National Airspace.

Fire Scout

The Navy Fire Scout Vertical Takeoff and Landing Tactical Unmanned Air Vehicle System (VTUAV) system provides unprecedented situation awareness, precision targeting support for the U.S. Navy of the future. It has the ability to autonomously take off and land from any aviation-capable warship and at unprepared landing zones.

The system includes advanced Ground Control Stations that encompass the U.S. Navys Tactical Control System (TCS), Tactical Common Data Link (TCDL), and Robust Communications. A modular mission payload capability allows continued growth into new payloads, and a highly reliable air vehicle meets or exceeds all performance criteria.

With a total endurance of 7+ hours, the Fire Scout can provide more than 5 hours time on station with a standard payload at 110 nm (200 km) from the launch site. A system of two Fire Scouts can provide continuous coverage at 110 nm. Utilizing a baseline payload that includes electro-optical/infrared sensors and a laser rangefinder / designator, the Fire Scout can find and identify tactical targets, track and designate targets, accurately provide targeting data to strike platforms, employ precision weapons, and perform battle damage assessment.

ER/MP UAS

Multi-mission aircraft for U.S. Army operations based on the Predator and the U.S. Army I-GNAT ER, which are deployed in combat in Iraq. The ER/MP UAS provides the U.S. Army with a long-endurance, persistent ISR and tactical strike capability featuring a heavy-fuel engine for increased supportability in the field.

Hunter,

The Hunter tactical unmanned system allows commanders to look deep into enemy territory by collecting and relaying real-time day/night video surveillance back to ground control and mission monitoring stations for intelligence-gathering and target-acquisition information. Since it entered the Army inventory in 1996, the fleet of Hunter UAVs has accumulated more than 37,000 flight hours, including more than 10,000 hours supporting Operation Iraqi Freedom.

I-GNAT

The GNAT systems offer the combination of long endurance (over 40 hours), large payload capacity, ease of use and low maintenance while providing a very low cost-per-flight-hour. The I-GNAT is an improved version of the original GNAT-750 and is designed to takeoff and land conventionally from any hard surface. GNAT aircraft systems are in operation with U.S. and foreign customers.

Army IGNAT ER

The GNAT systems offer the combination of long endurance (over 40 hours), large payload capacity, ease of use and low maintenance while providing a very low cost-per-flight-hour. The ARMY I-GNAT ER is a multi-mission ISR asset for military applications providing cost-effective, long endurance, medium-altitude tactical reconnaissance support to U.S. Army troops.

Improving Technology

Usa Tech

The US Army revealed in December that it was also developing new helicopter-style drones with 1.8 gigapixel colour cameras, which promised "an unprecedented capability to track and monitor activity on the ground".

Three of the A160 Hummingbird sensor-equipped drones are due to go into service in Afghanistan in either May or June this year.

The drones will take advantage of the Autonomous Real-time Ground Ubiquitous Surveillance-Imaging System first or Argus-IS, which can provide real-time video streams at the rate of 10 frames a second. The army said that was enough to track people and vehicles from altitudes above 20,000 feet (6.1km) across almost 65 square miles (168 sq km).

The US Defense Advanced Research Projects Agency (DARPA) is also working with the UK-based defence contractor BAE Systems to develop a more advanced version of the Argus-IS sensor that will offer night vision.

It said the infrared imaging sensors would be sensitive enough to follow "dismounted personnel at night".

British capability

British forces also use a variety of remotely piloted aircraft. The British Army has used the Hermes 450 UAV in Iraq and Afghanistan, as well as smaller UAVs to help check for roadside bombs ahead of patrols.

The Hermes 450 is being upgraded to the Watchkeeper which, like the Reaper, can be armed. It is due to enter service in 2012.

The RAF also uses the higher-spec Reaper aircraft. In May last year, the RAF announced a new squadron of the drones would be controlled for the first time from a UK base. The Reaper had previously been controlled by RAF crews in the US.

In July 2010, the UK Ministry of Defence unveiled Taranis, its prototype unmanned combat air vehicle which is designed to be able to fend off attack as well as perform the intelligence gathering, surveillance and strike roles of other UAVs.

(BBC - Drones: What are they and how do they work?, 2019)

RESOURCES

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https://www.sciencedirect.com/topics/engineering/unmanned-aerial-vehicles adresinden alındı

***The Uav - Unnamed Aerial Vehicle*. (2019, 05 26). 05 2019, 2019 tarihinde The Uav - Unnamed Aerial Vehicle:**
https://www.theuav.com/ adresinden alındı

**** SELECTING A MODEL OF UNMANNED AERIAL VEHICLE TO ACCEPT IT FOR MILITARY PURPOSES WITH REGARD TO EXPERT DATA -***

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***BBC - Drones:* (2019, 05 26). 05 26, 2019 Date BBC - Drones: What are they and how do they work?:**
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