The MIDAS system was developed in the Netherlands by Track’Air b.v. together with several partner companies to provide the aerial survey community with a professional non vertical digital photographic system. The system is uncomplicated, trouble free and has been in operation worldwide for three years.

**History**

Airborne tilted photography (also known as low oblique) is as old as the first aerial photo. In the 30's sophisticated professional equipment such as the 1934 Fairchild T-3A five cameras systems (shown here) were common. In the 50's, large format metric cameras were combined together to increase coverage as with the Zeiss Trimetrogon camera which used one vertical and two tilted cameras. Many military reconnaissance camera systems also make use of this configuration. But in the recent years aerial operators have often depended on makeshift systems which have been unreliable, costly and even sometimes unusable. A modern professional affordable digital oblique camera system was much needed.

The first MIDAS system was introduced at the Reno ASPRS meeting in May 2006. The twenty seven systems that have been installed until now have successfully acquired many millions of aerial photographs.
Future of oblique photography

Since the introduction of Midas other manufacturers have started producing similar systems, thus confirming that multi cameras oblique aerial photography is a recognized new activity with a great potential future. The purpose of oblique photography is ultimately to help provide a lifelike three dimensional <<immersion>> (B. Gates) to the users of mapping, games, simulators, etc. Shaded 3D models, wire frame digital models, etc, will give place to realistic virtual 3D panorama where the façade of buildings and other features are extracted from actual oblique photographs.

The MIDAS solution

It is important to point out that the MIDAS system is a complete turn-key solution, not just a cluster of cameras: The Midas camera system includes all the components required for its operation: It comes with a dedicated mount allowing the system to be installed rapidly in any aerial survey aircraft. It includes a dedicated Flight Management System (F.M.S.) allowing the planning and execution of complex survey missions. Finally it is delivered with a fully integrated Applanix POSAV IMU to which Applanix has added special MIDAS support.

To sum up MIDAS is a well thought comprehensive turn key system that will allow operators to get immediately into production and start generating revenues from the first day of flight.

Midas development

Since 2006 Track Air is operating its own airplane fully dedicated to the Midas system. This Cessna 182 is only used to test, develop, and improve the Midas features. The aircraft is fitted with two 10 inch camera holes side by side, a full 19 inch hole and a side opening in the cargo door for oblique views. This airplane is being entirely automated, including auto pilot control by the flight management so it is possible to fly hand free a complete aerial survey project while keeping the eyes out of the cockpit to insure the safety of everyone. This is a guarantee that the Midas system is really designed under actual conditions by qualified professionals capable of judging the performance of the system and make changes accordingly.
MIDAS Description

The standard system consists of four tilted and one vertical cameras connected to a dedicated data acquisition computer. The 5 cameras are installed in a special platform called <camera array> which fits in or above standard 19 inch or larger camera holes. The flight management and cameras are under the control of the recognized XTRACK flight management system. As a result MIDAS is a turn-key system which can be installed in any aerial survey airplane and fully operational within a day.

MIDAS cameras

Since March 2008, MIDAS uses 5 off the shelf digital reflex Canon EOS 1Ds Mk3 cameras. This camera produces a spectacular 21 Mega pixel image that we enhanced by using Zeiss lenses, which are now offered in or delivery. The 1Ds camera is a very dependable camera; very few failures have been reported during the first years of operation with the earlier Mark2 cameras, of which more than 100 units have been used in several Midas systems. Some of these cameras have logged more than a million pictures and their shutter (supposedly the weakest point) is still working fine.

The Mk3 can be calibrated and its geometry remains satisfactorily stable with time. At a relatively low cost, approximately US$ 8,000 per unit at the time this is written, this camera has proven to be a true aerial camera perfectly suited for the job. In addition, thanks to the exceptional SDK (Software Development Kit) provided by Canon, this camera can be completely remote controlled by the MIDAS computer on board the aircraft, allowing the users to change any setting on the fly without ever touching the cameras.

To insure the perfect rigidity of the lens and the camera body, each camera is fitted with a specially designed exoskeleton. This system prevents any movements of the lens relative to the camera body and is essential to the geometric quality of the Midas system.

Please note that the Canon cameras can be provided by TRACK’AIR only within Europe and the USA, in other countries the customer should preferably purchase the cameras locally to insure proper services and guarantees. The 5 Zeiss lenses are provided readily calibrated by Track air.
MIDAS Data Computer MDC

The data unit consists of 3 sub systems built into a compact 19 inch housing: The photo unit, the navigation unit and the mount unit.

1) The photo unit uses an array of computers dedicated to high speed image collection, transfer and storage. The unit was designed to take full advantage of the capabilities of modern digital cameras such as the Canon EOS 1Ds Mk2/Mk3. MIDAS is capable of continuously firing 5 cameras at their maximum interval (2.5 second interval for the Mk2/Mk3) and save all the images to one single hard drive (for safety, a real time backup is also saved on a second disk). From an operational point of view, the advantage of having all the photos saved to a single drive are many: The crew does not need to manipulate any data, they simply keep one drive as backup and send the other one to their office for processing. The drive not only contains the images but also the entire flight data recorded by the XTRACK FMS including IMU data. All the required information is accessible on the drive and further communication with the aircrew is not necessary. With projects that count in the hundreds of thousands of photographs, errors are greatly minimized. Additionally, the project management is uncomplicated because the photos are already renamed and sorted out in real time according to your specifications. MIDAS uses normal commercial SATA disk drives which are available in sizes up to 750 GB and can contain up to 100,000 photos! The photo unit is completed by a display which continuously shows the 5 thumb nails of all photos being taken. The pilot display can also be used to show photos in full size to check image quality and exposure on the fly.
2) **The navigation unit** is built around our well-known TRACK’AIR XTRACK flight management system. State of the art computing technology allows the user to fly aerial missions with maximum efficiency and success. Contrary to XTRACK itself, the MIDAS system does not require a laptop computer although the crew may also decide to operate the system from a computer connected to the unit. Normal operation is via a touch screen display which allows for single pilot operation when the display is installed on the control yoke or in the cockpit with our articulated arm. The navigation unit also includes a built in GPS receiver or can be connected to any external GPS receiver.

The MIDAS is built on the proven and popular Track Air Xtrack Flight Management System (F.M.S.) which has been in use worldwide for almost 15 years and is now the core of the Applanix POSTRACK integrated IMU/FMS system. The Xtrack system was completely redesigned to operate the MIDAS cameras system even to the extent that it allows efficient single pilot operation. Only a company with the extensive flight management experience of Track Air is in the position to design, manufacture and market such a complex system. Surely cheaper oblique camera system will appear on the market in the next future, but be aware that without a powerful FMS such as Track Air Xtrack, it will be virtually impossible to operate them.

The MDC is a highly modular system intelligently designed for easy fault pinpointing and exchange of parts. Numerous LED’s on the front panel and several software tools allow for rapid identification of any hardware issue so that the faulty module can be exchanged in a few minutes. MIDAS is specifically designed to eliminate down time due to equipment issues.

The normal power required by MIDAS is approximately 12-13 Amps at 24V. This, together with the relative light Weight, 20kg (+44 lbs.) for the data computer + 20kg (+44 lbs.) for the camera system + 30kg for the mount (+65 lbs.) allows the system to be successfully operated from very small airplanes such as the Cessna 172.
Camera mounting system

For quality photography a proper mount is indispensable to compensate the drift, to allow leveling in all directions and to suppress all vibrations and shocks.

Track Air has designed such a mount that can be controlled manually or can be partly to fully automated (drift, pitch, full leveling, etc). Virtually indestructible, it is built to be field reparable. By combining a unique pneumatic suspension with sufficient weight, it is virtually vibration free.

The MIDAS mounting platform is a cleverly designed system which allows the cameras to be rapidly installed in many airplane types quite easily. Thanks to an original design with the cameras hanging under the drift rotation table, the Midas can be used with any existing 19 inch camera hole or even placed outside of the airplane with the help of our external fairing.

The mount control unit includes the control system for the drift compensation and optionally for the pitch compensation. Experience has shown that roll compensation does not seem to be necessary for this type of operation while pitch correction might be required to compensate attitude changes due to fuel weight variation during the flight. Drift is automatically corrected using the input of the IMU.

The MIDAS camera array

The camera angles can be ordered per customer specifications from 35 to 50 degrees. Forty-five (45) degrees has been the standard so far. Because of the required rigidity with regards to the IMU, the angle is not settable. If different angles are necessary, for example for certain city coverage, a different array should be ordered.

It is interesting to note that thanks to its 24x36mm sensor the Canon Mk2/Mk3 fitted with a 50mm lens orientated at 45 degrees approximates very well the perspective of the human eye. As a result the tilted photographs have a natural and appealing look.
The Midas mount extension

In order to accommodate any aircraft camera hole and floor thickness, the Midas comes with an extension system which allows the camera to be exactly at the right level with the aircraft skin.

Camera array remains above the floor

Camera array is in the camera hole

The MIDAS camera pod for a Cessna 172

Fully tested in the Cessna 172/182 airplanes, our FAA certifiable external fairing allows the MIDAS to be installed externally in an airplane with a hole as small as 20 cm (8 inches) in diameter!
**Midas IMU**

Midas is operated with an Applanix POSAV IMU type 310. This allows MIDAS to be smoothly integrated with the IMU system which was found to be the most suitable for this type of work. Outside the USA, MIDAS is taking advantage of the IMAR IMU which is not subject to US export regulation and allows the POSAV to be moved across countries without special permission.

Together with Track Air, Applanix has added Midas support to the photogrammetric tools delivered with the POSAV IMU. The Applanix software suite now allows the automatic generation of exterior orientation (EO) for direct georeferencing of the Midas oblique images. This allows the operator to add the value of the EO to his product and to sell orientated imagery to his customers.

In addition, the software also supports the calibration of boresight angles and datum as well as mission specific quality checks for the oblique cameras. As a calibration flight (boresight) is required to determine the IMU orientation with regards to the cameras, a clear and efficient procedure to achieve a successful calibration was prepared together with Applanix.

For those who do not use an IMU, tilted photographs can be orientated using common photogrammetric methods which are published in all handbook of photogrammetry, including the ones published by the ASPRS since many years.

**Midas calibrated lenses**

The Midas is also delivered with pre-calibrated Zeiss lenses. Optical distortions are precisely computed and a calibration report is delivered with the lenses. Currently the actual calibration is carried out by Applanix in their calibration facility in Toronto.

**Patents and other issues**

The Midas system is entirely developed and produced in The Netherlands. The MIDAS development was started by Track Air in 1997 with the help of a Dutch government subsidy based on European funds. The first design of Midas was filed in 1997 with the Dutch authorities. Since then it has been fully documented on a yearly basis. By design Midas only uses technologies which are commercially available or publicly known since many years. It has been insured that the Midas does not infringe on any existing European patent, brevet, etc. The design of the Midas is copyrighted according to European and Dutch laws.
TECHNICAL SPECIFICATIONS

Technical specifications MDC
- Power requirements: 24-28 Volts at 12-13 Amp
- Weight: Approx 20 Kg
- Size: 19 x 13 x 15 inch (490 x 330 x 390 mm)
- Navigation/camera control: Integrated XTRACK flight management system
- GPS: Integrated Garmin 15 or any external receiver
- FMS interface: Flat panel touch screen
- Single pilot operation: Possible with automated drift correction
- Drift correction: Integrated drift motor controller
- Drift measurement: Integrated vertical video with display
- Cameras: 5 Canon EOS 1Ds Mk II (1 vertical + 4 tilted)
- Sensor: 14 bits
- Images: 5 x 21 Mega pixels raw images
- Image quality control: Integrated real time viewer with display
- Image storage: 2 Regular SATA hard disk drives
- Performance: 2.5 second interval with Canon EOS 1Ds
- Altitude: Max 13,000 feet
- Operation temperature: 32-140 Fahrenheit (0-60 Celsius)
- Chock/vibration: Pneumatic shock absorbers
- IMU: Integrated Applanix POSAV 310

Technical specifications camera mount
- Weight: Approx 30 Kg
- Weight cameras: Approx 10 Kg
- Drift correction: Motorized
- Pitch/roll leveling: Manual (optional motorized pitch)
- Camera angle: Fixed (30 to 60 degrees brackets available)
- Chock/vibration: Pneumatic shock absorbers

Technical specifications camera pod/fairing
- US certification (each airplane must be individually certified): Cessna 172/182 (other airplanes possible, ask)
- Weight: Approx 25 Kg

Weight and balance
- MDC: 20 kg
- Mount: 30 kg
- Cameras: 10 kg
- Accessories: 10 kg
- Total: 70 kg
**PRICES VALID UNTIL DECEMBER 31 2009**

**CANON CAMERAS NOT INCLUDED!**

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<thead>
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<tr>
<td><strong>Complete system with Track'Air mount</strong></td>
<td>Call</td>
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<tr>
<td>1 MIDAS MDC unit</td>
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<td>1 camera assembly unit</td>
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| **Complete system with Track'Air mount and TRACK'AIR fairing**            | Call       |
| 1 MIDAS MDC unit                                                           |            |
| 1 Image quality control display                                            |            |
| 1 8.4 inch pilot display with yoke mount                                   |            |
| 1 Integrated GPS with antenna                                              |            |
| 1 XTRACK software suite with 8 seats                                      |            |
| All required cables                                                       |            |
| 1 Video drift camera and display                                           |            |
| 1 Supplemental navigation display                                          |            |
| 1 camera assembly unit                                                     |            |
| 1 Track'Air mounting platform                                              |            |
| 1 Complete fairing (FAA authorization only for Cessna 172/182. Require 8 inch hole and individual certification of each modified airplane) | |
| Installation and training on site                                          |            |

| **Additional camera bracket assembly**                                     | Call       |
| 1 assembly at any angle between 30 and 60 degrees (focal lens limitations may arise) |            |