

February 2009 saw the acceptance of all the partial deliveries of the 7500 km² AHN 2 2008 (Actual Height Model of The Netherlands). This means that 20% of the Netherlands has been delivered in accordance to the high specifications and high demand end deliverables and reporting within the scheduled timeframe of the contract. The excellent co-operation between Fugro Aerial Mapping and several other Fugro OpCo's in the Geospatial Division resulted in this landmark achievement with only minimal re-deliveries.

Summary of the major points which contributed to this success:

- The flying of 23,109 km's (754,000 ha) was finished within 2½ months with 3 helicopters + 3 FLI-MAP systems (1x Fugro SESL)
- Different Fugro OpCo's contributed to the success: Fugro SESL, Fugro BKS and Fugro Geoid assisted with field personnel
- Fugro Geospatial Hong Kong was able to filter all data (98.026.930.147 points) within the given time and at high quality
- Fugro BKS assisted with the Quality Control on the filtering

While the 2008 project was going through its final stage, the 2009 project was started. Approximately 8% of the Netherlands needed to be covered and the project area was located in the South West of the Netherlands. Flying with one, and occasionally two FLI-MAP systems, the field team was challenged by the weather conditions to complete the survey before the March 31st deadline. With the experience of the last two years behind them, the FLI-MAP staff succeeded to finish this year's project in the middle of March, well before the contractually indicated deadline for data acquisition.



Not filtered 0.5 m grid of the city center of Leeuwarden



Filtered 0.5 m grid of the city center of Leeuwarden

Fugro Aerial Mapping ISO- and OHSAS-certified



At the beginning of 2008 the Aerial Acquisition division of Fugro-Inpark separated from its parent company to create a new independent company called Fugro Aerial Mapping. This initiated a need to revise the ISO and HSSE

accreditations. It was decided to rigorously review the complete Quality Management System as well as the Health-, Safety- and Environment Management System.

In late November 2008 the Certification Agency DNV, granted the ISO 9001-certificate to Fugro Aerial Mapping. The auditor observed that the quality system is being integrated and used throughout the organization.

In early 2008 it was decided to set-up the Health-, Safety- and Environment Management System according to the OHSAS 18001-norm. The first certification audit was successfully passed in January 2009 and after handling some 'minor non-conformances' and 'observations', we are confident that Fugro Aerial Mapping will also be granted this important certificate in the 2nd quarter of 2009.

The main focus for both the ISO- and the OHSAS-system is the continuous improvement of the performance; the actual management systems offer a sound basis for this.

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FOCUS

Fugro's European Airborne Fleet

As part of Fugro's strategy to expand its Aerial Mapping services business in Europe, Fugro acquired in February the assets of the international aerial survey business of Arcadis, which formerly traded under the name 'KLM Aerocarto'. The assets involved include two survey aircraft and various sensors.



The Piper Chieftain with two holes for LiDAR and photogrammetry projects

Furthermore early summer Fugro also acquired three survey aircraft, various sensors and other related equipment which were formerly owned by the company Scankort A/S. To provide Aerial Imagery and LiDAR services in Scandinavia, a new Fugro company has been established in Denmark, called Fugro Aerial Mapping A/S.

In total the European airborne fleet of Fugro consists of six aircraft: one Piper Aztech, two Piper Chieftains, one Piper Navajo, one Partenavia and one Cessna. With the two DMC's (Digital Mapping Camera) and the one already being owned and operated by Fugro BKS, large photogrammetric projects can be executed allocating one or more aircraft throughout Europe. On both Piper Chieftain aircraft two sensors can be installed simultaneously, for example a DMC and the FLI-MAP system. This is very useful for those projects requiring two different data capturing techniques (photogrammetry and LiDAR). However it is also a benefit from a logistic point of view, which can result in cost saving for the client. Both sensors do not need to be exchanged, but can be operated simultaneously and be activated depending on the specific project requirements.

These aircraft can fly at 350 km/hour and have a large range of approximately 1800 kilometers. Therefore also projects located far away from the base can be reached enabling that from Teuge airport (the Netherlands), Roskilde airport (Denmark) and Belfast airport (Northern Ireland) photogrammetric and LiDAR work can be executed in the whole of Europe.



Piper PA31-310 Navajo Piper PA31-350 Chieftain Cessna T-207 A "Skywagon"

Personalia

On 1st August 2009, William Waggeveld joined Fugro Aerial Mapping BV as a Sales Manager. After 3.5 years working as Sales & Product Manager in previous positions, William was looking for a new challenge in a highly professional surrounding.



New business developments and managing projects have been his main business in the past and as sales manager at Fugro Aerial Mapping, he will get the opportunity to further build on his experience and knowledge to date and offer the innovative FLI-MAP possibilities to clients throughout Europe.

His primary focus will be expanding the current business into new product/market combinations at both existing and new clients in Europe. Besides his degree in Geodetics, William studied Business Economics at "De Vrije Universiteit" in Amsterdam.

CALENDER

7th International FLI-MAP Partner Day

Date: ??
 Location: UK

GIN Conference

Date: November
 Location: Amsterdam – The Netherlands



Watching real 3D of FLI-MAP data

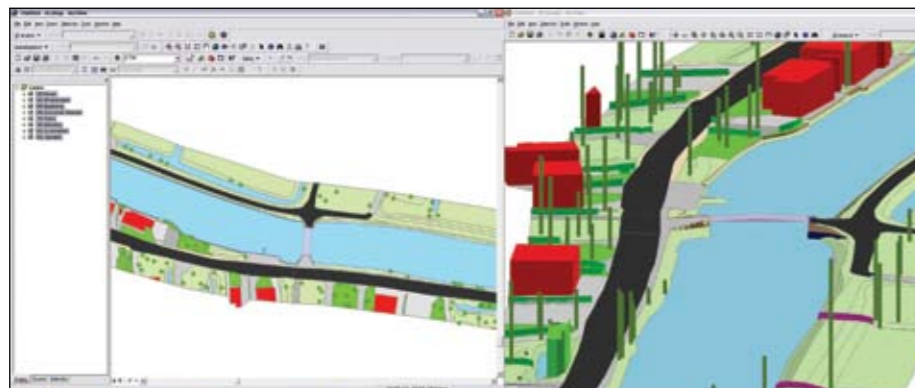
Fruitful co-operation between Waterboard Rivierenland and Fugro Aerial Mapping

Since 2005, Fugro Aerial Mapping has been supplying the Waterboard Rivierenland with LiDAR data for their river catchments and dikes. The breadth of services that has been supplied until now shows the value of the FLI-MAP LiDAR data and its derived products and services.

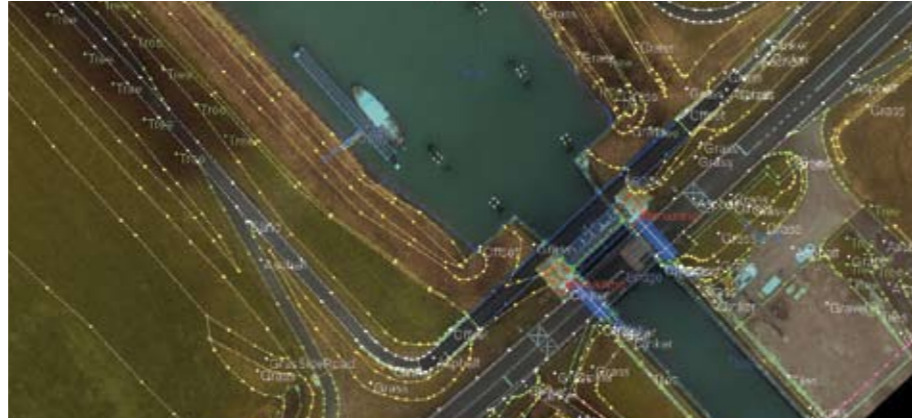
In 4 separate campaigns, Fugro has surveyed nearly 500 km of river embankments for the Waterboard. In addition to these corridor surveys, Fugro has collected accurate, high density LiDAR data of a large river catchment ('Alblasserwaard'), measuring 280 km² in size. This survey was conducted in the beginning of 2007 and marked a new era in the FLI-MAP history. Until that moment, FLI-MAP had only been used as a corridor survey instrument.

Waterboard Rivierenland, identified the opportunity of using the high definition FLI-MAP data not only for their dikes but also for river catchments. On average, the dikes were captured with an average point density of approximately 30 pts/m², whereas the Alblasserwaard catchment was surveyed with an average point density of 10 pts/m². Thijs Trompetter, responsible for all geometric data related to the Rivierenland dike system, was visited by the author. Together, they looked back at the past years of co-operation and had a glimpse at the future.

The FLI-MAP LiDAR data has been used to accurately determine the exact locations of the dikes. Additionally, the dike survey data has been used by the Waterboard to meet its 5-yearly legal obligation to test all dikes on geometric parameters such as the slope, height and width. These geometric parameters are some of the determinants of the stability of dikes. In order to perform this test and to present it in the required formats, Rivierenland decided to use the FLI-MAP analyst tool that runs under ArcGIS. This tool was developed by Fugro Aerial Mapping to make the FLI-MAP data easy to use in the all day operations of



Example of 3D-mapping of levees



Detailed mapping supported by ortho-rectified photo mosaic

the Waterboards. The tool makes it easy and straightforward to use FLI-MAP data, which is presented as an ESRI GRID, to check the geometry of the dikes. Embedded within the functionality of FLI-MAP Analyst is a tool that with which one can create longitudinal sections and cross-sections at any desired location and to output these in any desired format.

For almost all the dikes, FLI-MAP data has been used to create large scale object oriented maps (see picture). In combination with the other data sets (grids and ortho mosaics) and in combination with the use of FLI-MAP Analyst, the total FLI-MAP dataset provides complete geometric information of the dikes and their immediate surroundings (the 'protection zone'). Where possible, the identified objects have been provided with attribute information such as the nature of the surface cover, e.g.: grass, concrete, asphalt.

The catchment survey data was subsequently used to analyze surface

subsidence and occasional uplift of the terrain. For this purpose, the FLI-MAP data was compared, with legacy terrestrial survey data. Notwithstanding the fact that the old survey data was sparse and of a very different nature than the FLI-MAP data, this exercise showed yet another use of the FLI-MAP data: detection of surface motion.

As always, Waterboard Rivierenland is determined to make optimal use of its existing information sources and looking for innovative ways of using existing and new technologies. As a result of this, Thijs Trompetter reveals that the Waterboard shall use the FLI-MAP data to accurately monitor subsidence of the dikes and differences between subsidences at locations close to each other. In some areas, uplift rather than subsidence is expected. The nature of deformations of the dikes can be clearly and accurately visualized after multiple FLI-MAP surveys. In the near future, the FLI-MAP data and especially the ortho rectified imagery provided by FLI-MAP will be used to grant permissions for those who want to build or excavate in the vicinity of the dikes.

Rivierenland has experienced the development of the FLI-MAP technology and the maturing of the derived products. In the Rivierenland organisation it was realised that once the FLI-MAP data was available for use, more and more possible applications emerged. The outlook shows that this process has not yet come to an end.

For more information, please contact **Maarten Bomers** (m.bomers@fugro.com) or **Thijs Trompetter** (t.trompetter@wsrl.nl).



High Quality Aerial Photographs

An important part of the continuous development of the FLI-MAP system has always been to focus on the accurate FLI-MAP laser scanner and its features. This resulted in the FLI-MAP 1000 system with a maximum flying altitude of 1000 m. As most of our clients are also interested in the delivery of high quality ortho rectified aerial photography, we were challenged to significantly improve the quality of the photo imagery. This is only possible by using the latest developments in digital photography.

The FLI-MAP 1000 system is equipped with 16 Mpixel forward and dual 16 Mpix downward cameras. To date, various projects have been successfully carried out using this set-up and it can be concluded that the quality of the cameras is excellent. Both the resolution and the radiometric quality of the orthorectified products have improved. Furthermore, the operational flexibility has been improved due to the wider swathe that the two crosswise mounted cameras cover.

There is a healthy demand for the use of the FLI-MAP 1000 system, due to its wide range of new possibilities concerning flight altitude, point density and also the further improved photo quality. Meanwhile several large scale mapping projects using the new high resolution photo imagery have been successfully carried out in Portugal, The Netherlands and Belgium.



Example of the new high resolution camera



Example of the new high resolution camera



Completed projects using FLI-MAP 1000 include:

- Road survey in Portugal
- Mapping project Belgium
- DTB revision Province of Zeeland The Netherlands
- Various embankments for Waterboards The Netherlands



FLI-MAP CSI Leiderdorp

Fugro Aerial Mapping was contacted by the "Politie Hollands Midden" for a special survey. A small area measuring only 600 m² in Leiderdorp, very near to the A4 motorway, needed to be surveyed as soon as possible. A fast, detailed and accurate survey with an immediate delivery were of the highest importance.

This was not to support the ongoing construction works near the highway but to assist the forensic department. The police had requested our services because the previous day had seen two criminals murdered at this location. The goal for the forensic team was to obtain a very detailed digital terrain model for reconstruction purposes. 18 hours after the request was granted the area was surveyed by Fugro Aerial Mapping and two days later laser data with an average of 35 points/m² and photo imagery with an amazing 3 - 4 cm pixel resolution were delivered. The fast response time of the FLI-MAP team was exactly what was hoped for by the police and the high quality data was extremely appreciated. Due to the ongoing investigation the area was closed by the police but thanks to the dedication of the FLI-MAP team, the delay for the construction workers was kept to a minimum.

This was the second time in 2 years that forensic teams of the Dutch police force, who use the 3D modeling possibilities of detailed laser data for precise reconstruction purposes, contacted Fugro Aerial Mapping (the previous project being the survey of the Katendrecht district in Rotterdam in 2007).