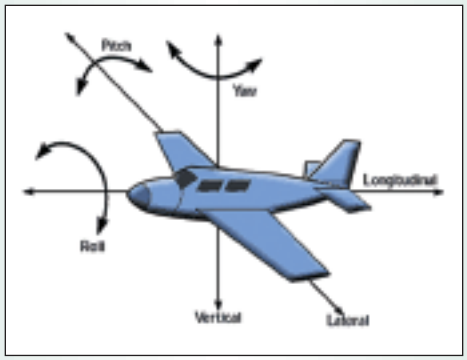
Surveyors DO WHAT??

By Paul Francis, O.L.S., O.L.I.P.

Well, since the AOLS opened the doors to the expanded profession in 1989, the answers to "Surveyors DO WHAT??" have taken many new directions. Geodetic survey crews are now a one or two-person crew with a GPS system, tied to an existing network, collecting data. Hydrographic Surveyors may be found not only on the water, but in an aircraft firing multiple laser pulses to determine the depth of water. And the newest members of our profession, the Geographic Information Managers, are data integrators. These folks use the geographic data collected by the other AOLS disciplines and link it to existing databases about land areas, points on the ground or linear features, above or below the earth's surface to determine all kinds of relationships between geographic position and other informational databases. In Photogrammetry, the changes have been many and as a professional in this group, I will give you some insight about the changes, and what we do in the following few words.

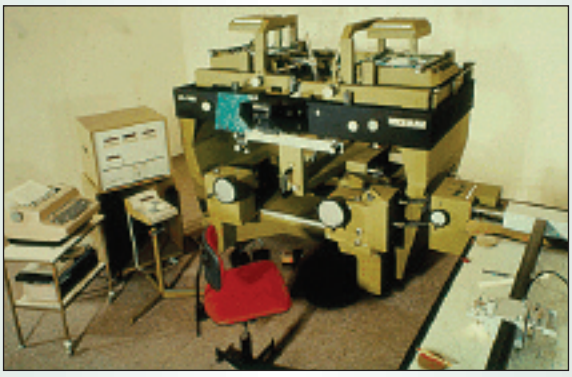
Generally speaking, Photogrammetrists collect accurate information from aerial photography flown with an overlap, which allows for the re-creation of the eyes' parallax such that we can perceive depth and capture the information in three dimensions. So in photogrammetry we need the following inputs: aerial photography, control surveys, and an area to map. Each of these inputs and the tools we need to process the data have changed dramatically since 1984 when I entered the mapping industry. Depending upon the project area, topographic surveys from new aerial photography can often be completed less expensively than field topographic surveys that use existing aerial photography or laser scanners.

Aerial photography is typically thought of as a film-based process that is completed from an aircraft sent on a mission to capture the project documentation. Well, we still do this for



some projects but we have many options for the photo mission. We can replace the film-based camera with a 90-megapixel digital camera and capture data at 3 cm-ground pixel size. We have added airborne kinematic GPS to the aircraft so we know exactly where the principle point of each image is positioned, and we have added an IMU (Inertial Measurement Unit) which provides the angles (tip, tilt, and yaw) that the aircraft is experiencing at the exposure time. With all of this information available for airborne collection, we need very few ground control points to complete the project.

Some of you will remember the old stereoplotting instruments, Zeiss Multiplex, Wild A8 or Wild A10, or the Wild AMH, which are now being sold for their weight in scrap metal. The next



progressive step was the analytical stereoplotter, which looked similar to its larger older brothers, but was a bit of optics and a large computer controlling the system. Since the system calibrated itself every time you turned it on, the weight wasn't critical. Now we just throw these expensive instruments in the garbage. The newest systems use personal computers and a viewing system that allows the operator to view the two images in 3D (stereo) and collect the data.

As for final product delivery, it is no longer a film-based cronaflex, or a pencil manuscript, or even a $3^1/_2$" or $5^1/_4$" floppy; it is digital format, emailed or transferred through an FTP site. Our automated scribing tables and 48" x 48" vacuum frames have been loaded into the dumpsters and sent to the recycling stations. Our world has really changed.

Digital data capture is the key to what we do. We turn reality into virtual reality so it can be processed into something it currently is not; like mapping a 100 acre farm, and seeing it three years later as a community, or mapping an existing two lane road and driving it later as a major city artery. Our world is all about collecting information in 3D and using it to create something different. That's where the 3D LiDAR scanners come into the picture.

Our firm operates four 3D LiDAR scanners, which collect data anywhere from 15 cm to 1500 m from the scanner and at an accuracy of .000015 m to .010 m. The initial thought was that digital data is digital data, and clients need digital data to perform their projects so we can provide it to them from whatever source we can. Our first LiDAR scanner enabled us to collect 2000 points per second covering anywhere from 3 m to 1500 m. We completed numerous topographic mapping projects for municipalities and land developers, many volume calcula-

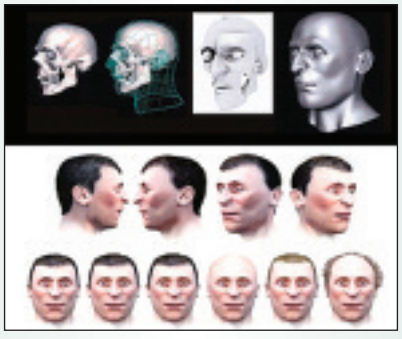
tion projects for surveyors and aggregate operators, architectural projects, and then started into forensics.

In December of 2006, Northway-Photomap Inc. was called upon by the Toronto Police Services to complete the scanning of a skull. The skull, along with the rest of the bones, was found in the Eglinton Flats area of Toronto after a year of decay. Currently, this person is known only as a case number, with no name or family. Using a short-range, high precision scanner, the skull was scanned from many angles allowing for the complete geometry to be captured. Once the scans were processed, and assembled into one data set, the point cloud was processed into a solid model by means of triangulation of the data points. This process forms many little triangles describing the geometry of the skull. The final product is a digital version of the skull. We completed the task once again, of converting reality to virtual reality.

Northway-Photomap Inc. used their laser scanner to capture the geometry of the skull.

This was not the end of the process. Using specialized software at Northway-Photomap, a potential face for the skull was created; however, in conjunction with the Toronto Police Services we realized that the software did not create a face based upon generally acceptable methodologies. The skull data was then transformed by Toronto Police Services and other resources into what the person may have looked like prior to the tragedy. Today, the images below have been issued by the TPS and we wait for someone to recognize this person.

In another situation, we documented the inside of a murderer's apartment for use in the courtroom to describe the exact conditions that existed prior to any changes that may have occurred during the investigation. We believe that our system worked really well since the murderer pleaded guilty to the crime within hours of being arrested.



Toronto Police Services and other resources give the geometry a potential face.

On June 13th 2008, the feature film "The Incredible Hulk" was released by MVL Incredible Productions Canada Inc. Yes, an Ontario Land Surveyor was on set, capturing the data using our LiDAR system. When creating a feature film or television production that utilizes animation, the background geometry is needed to quickly allow for the generation of the animated characters. Northway-Photomap Inc. has developed this expertise and was able to supply all the required LiDAR scans for this production. If you haven't seen it, please do and watch for parts of the GTA in the movie. It was filmed mostly here in this area.

Author Paul Francis on the set of "The Incredible Hulk"

Surveyors DO WHAT?? I guess the answer to this question is changing as fast as technology. Surveyors of all disciplines have the unique ability to professionally capture data and factually present the data for use in many ways. The roots of our disciplines provide us with many opportunities. We just have to look outside the box and find them.

Paul Francis is the President of Northway-Photomap Inc., a privately owned corporation, which provides professional land surveying services in aerial photography, surveying, photogrammetry, and laser scanning. Paul can be contacted by email at: **pfrancis@photomapltd.com.**