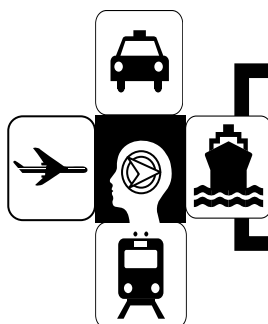


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Tech Brief

The Development of an Airport Obstruction Identification System (Low Altitude Mapping System)

FHWA-NJ-2007-017

June 2007

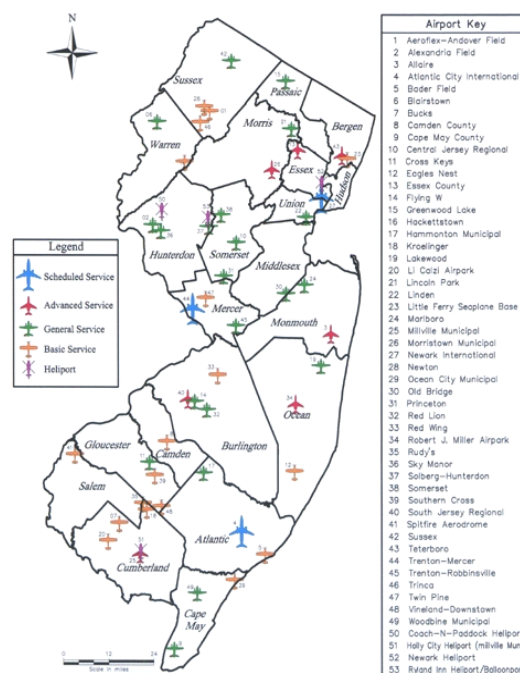
HERE IS THE PROBLEM

The State of New Jersey is extremely populated and rather small geographically. In order to ensure safety at all of the airports in New Jersey, an airport obstruction identification system must be developed. The New Jersey Department of Transportation (NJDOT) Division of Aeronautics is statutorily obligated to identify all obstructions to the approaches at the State's public use airports and heliports; and to have these obstructions removed. The objective of this research was to develop a prototype system to easily acquire data, either at fixed intervals or over time, and generate a tree removal or trimming plan for discretized trees or tree areas.

AND, HERE IS THE SOLUTION...

There are many different technologies that could be used for raw data collection at the airfields. For this project, five such technologies were examined.

These five included LIDAR, ground based tools, cranes/lifts, normal aircrafts, and radio-controlled aircrafts. The fifth technology, the use of a radio-controlled (R/C) aircraft was finally selected for use on this project. It was subsequently determined that a radio-controlled helicopter, rather than a blimp, balloon, or airplane, would be the most appropriate medium for the needs of this project.



IMPLEMENTATION; HERE WE COME...

After reviewing many different possibilities for the purchase of radio controlled helicopter systems, the process was narrowed down to two different options. These were a semi-commercial system and a custom built system. Following careful review of each system, it was determined that the custom built system would be a better fit and was far less expensive than the semi-commercial system. The custom built system included an R/C helicopter and the use of a consultant to integrate the system for the final use. Another advantage of building the system was that it could be customized to the exact needs of the project, thus avoiding “generic” equipment that could have potentially low accuracy.

THESE ARE OBJECTIVES OF THE STUDY...

The objective of this research is the development of a prototype system that will easily acquire data either at fixed intervals or over time, and generate a tree removal or trimming plan for discretized trees or tree areas.

The question may be asked if the U.S military has used this type of technology (unmanned aerial surveying aircraft) for years, why is DOT spending time trying to develop a new system? The answer is simple, we are looking to develop a **low cost** and easily implemented mapping system. In the past, other types of low altitude mapping technologies were not very precise, or were cost prohibitive. With advances in GPS and Digital Camera technologies, it was the research team’s intent to develop a system that could be driven to the field and used to collect data in a matter of minutes by a DOT employee. Usage of full scale aircraft, consultants, full ground survey crew or other methods proves time consuming and costly. This project was initiated for less than the cost of one full manual ground based survey.

HERE IS WHAT WE DID...

From a proof of concept perspective, the project was a success. The system was integrated and used to acquire sample data. The data was then analyzed and compared against “truth” data. There was a high degree of correlation between the manually collected data and the computer generated analyzed data. The project then moved toward full scale implementation and automation.

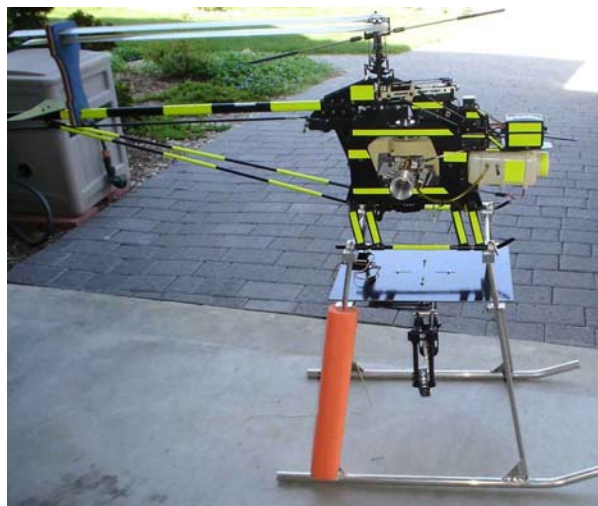


Figure 2: R/C Helicopter with vibration damping undercarriage.

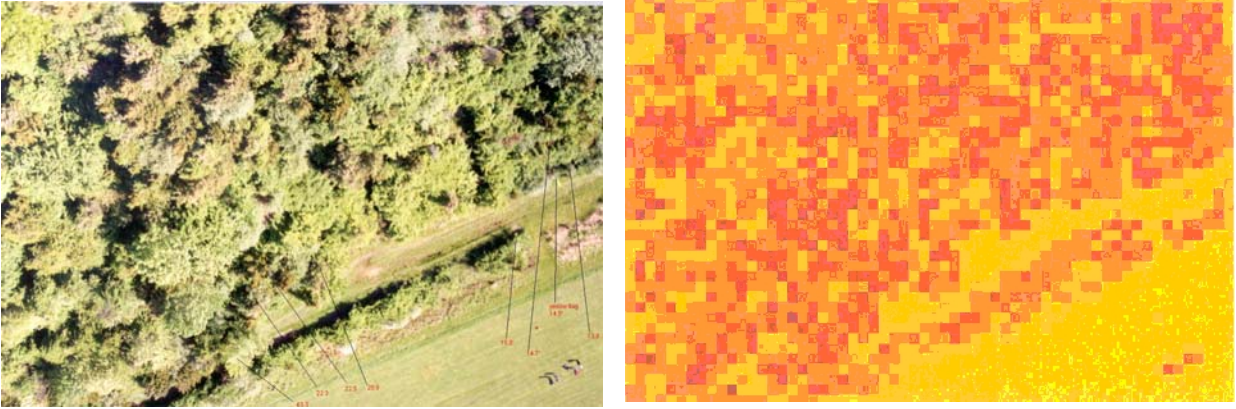


Figure 3: side by side comparison of field image and computer analyzed tree height model. (Note the accuracy: the system could detect the height of people standing in the bottom right corner of the image).

WHAT IS THE NEXT STEP?

The R/C helicopter was not as easy to fly as originally anticipated. The research team underwent extensive training to learn the basics of flying R/C units. Many of the individuals trained became quite proficient by the end of the project.

The one significant problem that seems to be universal in similar research project around the world is the system vibration. Use of an R/C helicopter for mobile mapping is a reality. However, the vibration of the system during flight still creates numerous obstacles. The cause of the vibration is the engine (a standard combustion engine similar to what one might find on a weed wacker). Blurry images, loss of GPS satellite tracking, and line of sight while flying the unit are all very real problems that need to be addressed in future work. Use of vibration dampers and “auto-pilot” automatic stabilization units helped but did not completely eliminate the errors.



Figure 4: NJDOT employees conducting hands on training.

CONCLUSION...

The development of an airport obstruction identification system utilizing low altitude mapping technologies is an extremely promising technology. Once fully developed, it can enable NJDOT to accurately identify, map, and remove trees that are currently posing a danger to arriving and departing aircraft at various airports within New Jersey. It will also enable the DOT to remove the suspect vegetation from property the first time, without missing any obstructions. The technology used within this project has the potential for use in many different future applications. Other uses for this technology include the possibility of use with DOT's search and rescue operations and accident investigations.

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A final report is available online at

<http://www.state.nj.us/transportation/research/research.html>

If you would like a copy of the full report, please FAX the NJDOT, Division of Research and Technology, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for: **Development of an Airport obstruction Identification System**

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