

# Natural Resources Management

## CASE STUDY

### State implements automated digital photogrammetric workstations to manage natural resources

**Customer:** Washington State Department of Natural Resources(WADNR)

**Industry:** Natural Resources and Land Use Management

#### Background

WADNR manages more than 5.3 million acres of state-owned land for the people of Washington. Of these, more than 3 million acres of trust lands were received from the federal government at the time of statehood on November 11, 1889. WADNR's main goal is to provide leadership in creating a sustainable future for the trusts and citizens of the state, and to oversee development of state lands, with respect for natural resources and the surrounding environment.

#### The challenge

Unlike many states, Washington has retained most of its trust lands to provide a continuous flow of income to build public schools, universities, community colleges, prisons, and state institutions such as mental hospitals and the Capitol building. With these trust lands came the responsibility of managing them in perpetuity. As a result, WADNR is always looking for better tools to help with its resource management tasks.

#### The evaluation

Since the early 1970s, WADNR has been producing topographic maps, line maps, and orthophotos to record land changes and manage the State's natural resources more effectively. From 1973 to 1980, WADNR used contract services for flying, ground control and orthophoto negative production, with remaining work done in-house. In 1981, working with the USGS on a cooperative ortho project, WADNR acquired its first aerial triangulation equipment and software. From 1981 to 1991, WADNR's aerial triangulation process included: manual searches for established ground control using old Coast and Geodetic Survey data, log book descriptions and other State and county control when available; and the use of analog point marking methods, measurement on comparators and analytical plotters, and digital analytical block adjustment—all of which took approximately two hours per photo to complete.

In 1991, the manual search for ground control was supplemented with expensive survey grade (centimeter accuracy) GPS equipment. Then in 1994 new, less expensive, hand-held, resource grade (sub-meter) GPS units were acquired to establish coordinates on well defined, photo identifiable features. Therefore, it was no longer necessary to search through old USCGS data for photo control points. GPS yielded a solid, well distributed, resource grade control net in the same amount of time or less.

Meanwhile, WADNR wanted to increase both productivity and accuracy, and at the same time was moving to the use of airborne GPS and, more recently, airborne IMUs. It was natural, therefore, to exploit the benefits of digital photogrammetry, such as automatic point measurement, instant resetting of models to make additional measurements, and digital orthophoto generation. With the introduction of these methods, full digital processing soon



*“During an in-depth analysis of stereo technologies integrated with geodatabases, we evaluated products that would enable WADNR to exploit stereo imagery directly in the geodatabase. We found SOCET for ArcGIS® to be the most productive tool for the job.”*

Dick Petermann, CP  
WADNR Photogrammetrist

became the norm for most image processing and resource data collection. Consequently, by 1995, WADNR had acquired its first digital photogrammetric workstation, running SOCET SET®

Before implementing digital photogrammetric workstations, WADNR processed only 500 to 600 high-altitude black-and-white images per year to generate hardcopy orthophotos. Now, using SOCET SET, with its full digital image processing capabilities, WADNR has the capacity to process more than 2500 color images into digital color orthophotos annually, with approximately four times better geometric accuracy. One of the benefits is that the higher productivity enabled WADNR in 2000 to change from 1:63,360 to 1:32,000 photo scale to achieve better precision. To ensure that its specifications are always met, WADNR prefers to use minimal ground control to drift correct aerial triangulation block adjustments rather than airborne GPS/IMU on its own. Typical triangulation rates per image with SOCET SET are around 10 times faster than the analog/analytical approach of the early 1990s.

WADNR was the first U.S. customer to use the SOCET for ArcGIS module of SOCET SET, introduced in January 2005. WADNR technicians use SOCET for ArcGIS to update the information in legacy shapefiles annually. SOCET for ArcGIS is a SOCET SET module that adds a stereo digitizing capability to all levels of ArcGIS, allowing 3D information to be captured into 3D shapefiles as well as personal and enterprise geodatabases.

Using SOCET for ArcGIS, foresters in the WADNR photogrammetry group can complete additional tasks, such as forest inventory and typing, allowing users with little or no photogrammetry experience to maintain the extensive geodatabase more efficiently, with increased accuracy and productivity.

### Conclusion

For the past 10 years, WADNR has relied on SOCET SET to map the state's resources. Using software and equipment that costs one fourth of traditional stereo plotters, WADNR has improved triangulation times per image tenfold and geometric accuracy, fourfold. WADNR's photogrammetrists value SOCET SET's advanced processes and functionality for generating digital orthophotos. The flexibility of using digital images with SOCET for ArcGIS software also has increased the use of aerial photography for GIS applications, forest resource inventories, kelp beds and riparian monitoring, offering useful new capabilities for WADNR to collect and update features in the ESRI @environment.

Moreover, resource managers who have never used true photogrammetric tools before find that they can use this new technology to manage the state's resources more effectively.



*“We have become significantly more efficient in our land use management practices because of advances in digital triangulation processes offered by state-of-the-art software such as SOCET SET. With 10 years of experience using digital triangulation, our technicians utilize airborne GPS together with minimal ground control along with larger photo scales to satisfy specifications. Triangulation times per image are vastly improved. The results are used in our flowline to generate digital orthophotos.”*

Dick Petermann, CP  
WADNR Photogrammetrist