

**FEDERAL AID
FINAL PERFORMANCE REPORT**

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

**Alaska Department of Fish and Game
Wildlife Restoration Grant**

Grant Number: W-35-Q-1 **Segment Number: 1**

Project Number: 3.53

Project Title: Digital Aerial Photography Census Equipment Grant

Project Duration: 1 January 2014 to 30 June 2018

Report Period: 1 January 2014 to 30 June 2018

Report Due Date: 1 August 2018

PRINCIPAL INVESTIGATOR: Nathan Pamperin

Cooperator:

WORK LOCATION: Fairbanks

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

A major goal for wildlife research and management staff at ADF&G is to obtain reliable estimates of abundance for species of interest. A majority of techniques used to estimate the abundance of wildlife rely on sampling to come up with overall population estimates. Estimates of abundance are paramount in being able to manage game populations and determine appropriate harvest limits. There are approximately 20,000 caribou harvested annually within the state of Alaska.

The unique biology of caribou allow researchers the opportunity to census entire herds if certain weather conditions are present. In the period of time following calving, caribou can form large aggregations while they seek relief from insects. Insect harassment intensifies under warm, calm weather conditions and caribou groups tend to form in places where cooler temperatures or more wind may exist such as along the coast or at higher elevations. When these large aggregations form it allows the photocensus technique to be employed while the entire herd may be contained in relatively few densely packed groups. If a caribou herd is sufficiently grouped, the photocensus plane will fly over each group and take pictures ensuring that the entire group is photographed, including shooting the photography so that there is overlap among each photograph. These individual photographs (9 inch by 9-inch prints) are hand counted by staff to obtain a total count of caribou in the herd. The management of Alaska's largest caribou herds is completely dependent on the Department's ability to aerially photograph caribou aggregations when they occur.

The existing aerial photo film equipment that ADF&G uses for its annual caribou surveys are between 40–70 years old. There are increasing concerns over ability to get camera

parts, film, and the ability to develop the film. Additionally, counting animals on prints can be inaccurate and time consuming if photo quality is poor. Recent tests of digital systems have indicated that several improvements over the current system are likely. The ability to automatically mosaic digital images saves considerable staff time over manual layout of prints, flying fewer transects (larger digital footprint) will improve accuracy, and improved photographic flexibility results in an increased ability to conduct surveys in more normal Alaska weather conditions, resulting in more potential survey days per year.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

The transition to using digital technology goes back to the mid-2000s when the photocensus group started looking into the possibility of using consumer grade DSLRs. That course ended in the late 2000s with the realization that consumer grade cameras could not efficiently replace the imagery/coverage we were getting with film and that we needed to look into more advanced aerial camera systems. After some initial investigation into camera systems that included testing a 60mp medium format system in 2012, DWC attempted to secure a funding to purchase more advanced medium format systems. Although many commercial “off the shelf” systems were available for standard aerial photography none of them met the unique needs of the photocensus surveys and we decided to pursue a customized system.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

Objective 1:

We plan on purchasing two digital camera systems to outfit our two survey aircraft (one Cessna 206 and one DeHavilland Beaver). A digital system will cost less to operate, and will increase the possible survey days and increase our accuracy (increases our weather window). A digital camera system allows for real time checking of camera shots to make sure time and money are not wasted by shooting images which come out poorly.

We started our investigation into customized aerial camera systems by contracting with Dr. Thomas Millette of Mount Holyoke College to help us research systems and specify the technical requirements in the RFP. After thoroughly investigating different technologies, we wrote and released an RFP for the two camera systems. SoftNav Systems of Quebec, Canada was awarded the contract in June of 2016. SoftNav delivered two systems that were composed of three medium format, 100 megapixel cameras with two of the cameras slightly oblique and one at nadir. Each system employed a survey grade GNSS system, inertial measurement unit (IMU), and gyrostabilized mount. Additionally, SoftNav customized their flight management software to suit our specific needs.

IV. MANAGEMENT IMPLICATIONS

Acquiring digital aerial camera systems to replace film systems used for caribou photocensus surveys has greatly improved our accuracy and efficiency in estimating caribou abundance. In our first season using the digital systems we were able to photograph caribou under conditions (lighting and amount of photos necessary) that would have been problematic or impossible with the film systems. On an image to image comparison, the digital system produces higher quality images that allow us to count some higher proportion of caribou that would likely have been

missed in film. Photography of caribou groups is improved due to the wider swath coverage which enabled use to capture the majority of caribou aggregations in a single transect. The layout process with digital imagery, GPS, and inertial data is automated with photogrammetry software and is far more accurate than the manual methods used with film. Finally, since we can produce orthomosaics from the digital system, we are able to count the images in GIS software which has many advantages over the manual counts done previously with film (Fig. 1).



Figure 1. Example image from digital system annotated with points (green=calf, red=adult) within GIS software.

V. SUMMARY OF WORK COMPLETED ON JOBS

Federal Aid funds were used to accomplish the entire project. The end result was two digital aerial camera systems specifically tailored to our needs for caribou photocensus surveys.

FROM PROJECT STATEMENT:

Objectives:

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Accomplishments:

We purchased two complete camera systems and associated software to process imagery. The first system was delivered and tested in October of 2016 and the second system was delivered and tested in May/June 2017. We successfully used the new cameras to census five caribou herds during the June and July of 2017.

VI. PUBLICATIONS

None

**I. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE
THAT WAS ACCOMPLISHED ON THIS PROJECT**

None

PREPARED BY: NATHAN PAMPERIN

DATE: MARCH 5, 2018