ASSOCIATION OF CANADIAN MAP LIBRARIES AND ARCHIVES
BULLETIN

Publishing historical air photos in Alma Digital: A case study featuring the University of Ottawa Library's new DAMS

GIS Trends

Section Editor: Martin Chandler, Cape Breton University

Author : René Duplain
Research Librarian (GIS), University of Ottawa

Keywords: Aerial imagery, air photos, Alma Digital, DAMS, digital repository, Omni, special collections

Abstract

Air photos have been used to support GIS-related research projects at the University of Ottawa, particularly in the field of climate science. The University of Ottawa Library houses a large collection of historical paper air photos and have recently increased efforts to further digitize this collection. Traditionally, the photographs have been searchable through a custom ArcGIS Online Web App, but this standalone portal has been limited in the accessibility and discoverability of these resources. In 2021, the University of Ottawa Library implemented Alma Digital as its institutional DAMS, which allowed its digital assets to be searchable directly within the library catalog, Omni. Following the implementation of this DAMS, close to 1,000 of the Library's digital air photo collection were added to this platform. This has provided a new discovery portal for these digital air photos. Work to improve the discoverability, organization, and description of these resources, as well as numerous digitization projects, is still ongoing.

Alma Digital

University libraries, including the University of Ottawa Library, are constantly striving to improve how to manage their collections of digital assets. As Kaplan (2009) describes, “Whether you are affiliated with a university, a school, an archives, a museum, or an independent organization, you are most likely currently dealing with the difficulties of digital preservation.” Implementing a Digital Asset Management System (DAMS) presents one potential solution to this issue as an option to store, describe, and disseminate digital resources. In describing DAMS, Xing (2021) argues that implementing such a system “increases the efficiency of managing contents and helps maximize the value of content.”

In 2020, the uOttawa Library’s Systems Librarian for Digital Repositories, Carolyn Sullivan, and partners began investigating the use of a DAMS to help address two specific goals from the uOttawa Library’s Strategic plan (Strategic plan 2025, n.d.):

- *Make collections easier to discover, access, and use*
- *Expand, preserve and promote our unique and special collections*

It was recognized that the uOttawa Library’s digital collections had limited accessibility and were being stored on unstable media. This applied to resources from Archives and Special Collections as well as items from other special collections, such as digitized historical air photos. As part of their investigation, Carolyn and partners conducted a thorough research and consultation project, which included a survey of DAMS used by other CARL (Canadian Association of Research Libraries) institutions, ultimately leading them to three candidates for a new DAMS: Islandora, Hyrax, and Alma Digital. It was determined that the latter was the best fit for the uOttawa Library given available resources and staff time.

Alma Digital is built-in to Alma, the Ex Libris product selected back in 2018 as the library services platform used by all OCUL (Ontario Council of University Libraries) institutions, including uOttawa (OCUL, 2018). Although not an open-source product and not included in the OCUL Alma subscription, the clear connection to Alma made integrating the Library’s digital assets within Alma Digital relatively straightforward, while also allowing items within the DAMS to be searchable (e.g., by keyword) within the front-end library catalog, Omni. Since its launch in June 2021, the uOttawa Library has used Alma Digital to improve access to digitized rare books, replace its existing video hosting platform, and promote the digital air photo collection via the new “Collection Discovery” tab where assets can be grouped by collections/sub-collections.

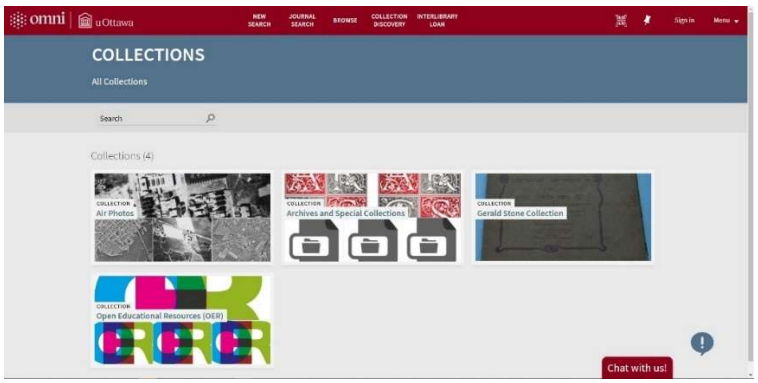

Figure 1: Collections discovery tab in Omni

Air photos

uOttawa Library Collection

Air photos, also commonly referred to as aerial photographs or aerial imagery, began early in Canada in the early 1920s. These resources, catalogued and disseminated by the National Air Photo Library (NAPL), include a complete coverage of all of Canada, over 90% of which are in black and white and a much smaller portion in colour and/or in infrared imagery (The Collection at National Air Photo Library, 2022). Traditionally, air photos were taken "for mapping, charting of the sea coasts, building of highways, town planning and any ground activity, including disasters, where a measure of size or change had to be made" (Carbonetto, 1983). While these are still relevant applications of air photos in more modern times, recent advancement in GIS and remote sensing have also allowed these digital images to be used in projects involving landscape validation, feature identification and characterization, terrain classification, and more (Carvalho & Reef, 2022; Gomez et al., 2015; Knuth et al., 2023).

The uOttawa Library's air photo collection is comprised of approximately 300,000 air photos ranging from the 1920s to the early 2000s spanning much of Canada. Of this collection, roughly 190,000 have been described (i.e., have some metadata) and approximately 5,000 have been digitized. For the past several years, these paper and digital resources were shared via a custom ArcGIS Online Web Application, where users could explore the collection using an interactive map with each photo being represented by its centre point (centroid). Using this Web App, users could browse through the collection, find basic metadata by photo (e.g., flightline and photo number), request paper photos for consultation, and download digital photos—stored on internal servers—for their projects. This standalone application was made available to users via a research guide entitled "Cartographic Resources." However, it was also recognized that this Web App had many limitations, with no easy way to filter photographs by flightline, by year, and/or by region. The digital photos had also not been inventoried in the library catalog, meaning that users would need to know to look in the Web App to find photos.

In response to these challenges in the accessibility of these digital resources, the decision was made to begin integrating the digital air photo collection into the new library DAMS. It was believed that the DAMS would improve the management of this collection in the following ways:

1) Accessibility: Adding these air photos to the library catalog would allow users to be able to discover these assets directly within Omni. Users could search for photos, classified in Omni as "Images" Resource Type, by flightline, National Topographic System (NTS) number, or other relevant metadata.
2) Preservation: Although the DAMS does not necessarily represent a long-term preservation solution, following the LOCKSS principle (Lots of Copies Keeps Stuff Safe), keeping three or more copies in two or more locations would be ideal for short-term storage and preservation purposes.
3) Organization: A DAMS would allow us to organize digital collections by "special collection" more easily than it might be in another platform, including the current Web App. This would be particularly helpful for sub-collections that do not necessarily have a clear geographic link (e.g., sharing features).
4) Shareability: Given that all OCUL institutions already use Alma and Omni, air photos within Alma Digital, or at least their records and metadata, could be more easily shared with OCUL partners. Likewise, other OCUL institutions that might also utilize Alma Digital for

their digital air photo collections could, in turn, share these with uOttawa. Overall, such an approach would make shared air photo collections easier to discover, foster collaboration between OCUL institutions for future digitization projects, and reduce duplication of effort.

Figure 2: Left- Air photos collection within Omni, Right- Viewer/downloader of a random air photo (flightline: A7193, photo number: 33) within Omni

Given that these images can take up a lot of storage, particularly higher resolution (1,200 dots per inch) photos in TIF format, it was determined that a lower resolution (300 dots per inch) version of these resources in JPG format would be more appropriate for the DAMS, with the higher resolution continuing to be stored on internal servers. This approach also offered multiple versions of these resources that could serve different purposes for users.

Research and GIS

Digital historical air photos have been found to be useful resources for supporting GIS research in Canada (Roberti et al., 2021; Millard et al., 2013). At uOttawa, air photos have most frequently been used in climate science, as demonstrated by research at the Laboratory for Cryospheric Research led by Dr. Luke Copland (Laboratory for Cryospheric Research, n.d.). In 2020, the uOttawa Library collaborated with Prof. Copland and Parks Canada for a joint purchase of around 800 air photos in the Yukon in the 1940s and ‘50s from the National Air Photo Library (NAPL). Professor Copland has used such aerial imagery in his work to model the loss in glacier ice, stating “The purchase and scanning of historical air photos by the University of Ottawa Library […] has provided invaluable information as to how glaciers are changing across Kluane National Park in the Yukon and elsewhere.” This work has been vital to recognizing the impact of climate change in the Canadian Arctic, because, as Professor Copland points out, “These glaciers have been retreating increasingly rapidly over the past few decades, with ice losses in this region at currently some of the highest rates in the world.” Just a few digital air photos can be used to support such research projects and publications (Schaffer et al., 2017; Kochtitzky et al., 2019; Kochtitzky et al., 2020). The ongoing work at the Laboratory for Cryospheric Research represents a success story for the use of air photos as assets supporting research at uOttawa, but these resources are underutilised in many other disciplines and could support a much wider variety of research projects.

Future trends and projects

Air photos, particularly in digital format, are useful resources that can help drive research within at outside uOttawa. As such, it is imperative to prioritize making these resources easier for users to discover, access, and download, to help meet their research needs across disciplines. Utilizing

the Library DAMS as a new mechanism to integrate digital air photos into the library catalog offers a new discovery portal for these assets and is a step in the right direction.

With the assistance of the uOttawa Library's Specialist (Digital Humanities), Roxanne Lafleur, and her co-op students, in collaboration with the Specialist (GIS), Pierre Leblanc, who has considerable institutional knowledge of these resources, new air photo digitization projects have been undertaken in recent months. These projects have been focused on special collections that have been determined to be (a) useful to users, (b) able to be completed within a reasonable period (i.e., within a semester) given limited resources, and (c) feasible to upload to the DAMS (i.e., with complete metadata). A recent example of such a project includes the Bostock special collection which contains just over 800 photos. This collection, which includes photos from across Canada highlighting various geomorphological features, was recently digitized and will soon be added to the DAMS.

Such projects take time, funding, staffing, and expertise. This applies for scanning the photos (e.g., determining what parameters to select), organizing and describing them (e.g., gathering metadata by flightline and creating a detailed inventory by photo), and uploading them to Alma Digital (e.g., by mapping the metadata schema to fit with Alma Digital's Dublin Core fields). Now that a portion of the digital air photo collection has been added to the DAMS, these challenges are better known, and procedures are being established to make this process more efficient. In parallel to these efforts, work is ongoing to update the ArcGIS Online Web App to improve the interface, link with the photos uploaded to the DAMS, and ultimately better meet the needs of users.

Acknowledgements

I would like to acknowledge the following individuals who have significantly contributed to the digitization, description, and/or integration of our air photo collection to our Library's DAMS for this project: Carolyn Sullivan, Systems Librarian for Digital Repositories, University of Ottawa; Pierre Leblanc, Specialist (GIS), University of Ottawa; Roxanne Lafleur, Specialist (Digital Humanities), University of Ottawa; Dr. Luke Copland, Professor & University Research Chair in Glaciology, University of Ottawa; and Bailey Burkard, Co-op student, University of Ottawa.

Sources

Carbonetto, K. (1983). The National Air Photo Library. *Urban History Review / Revue d'histoire urbaine, 12*(1), 67–72. https://doi.org/10.7202/1018997ar

Carvalho, R. C., & Reef, R. (2022). Quantification of Coastal Change and Preliminary Sediment Budget Calculation Using SfM Photogrammetry and Archival Aerial Imagery. *Geosciences (Basel), 12*(10), 357-. https://doi.org/10.3390/geosciences12100357

The Collection at National Air Photo Library. (2022, April 25). Government of Canada. Retrieved March 21, 2024, from https://natural-resources.canada.ca/maps-tools-and-publications/satellite-imagery-and-air-photos/air-photos/national-air-photo-library/collection-national-air-photo-library/9693

Gomez, C., Hayakawa, Y., & Obanawa, H. (2015). A Study of Japanese Landscapes Using Structure From Motion Derived DSMs and DEMs Based on Historical Aerial Photographs: New Opportunities for Vegetation Monitoring and Diachronic Geomorphology. *Geomorphology (Amsterdam, Netherlands)*, 242, 11–20. https://doi.org/10.1016/j.geomorph.2015.02.021

Kaplan, D. (2009). Choosing a Digital Asset Management System That's Right for You. *Journal of Archival Organization, 7*(1–2), 33–40. https://doi.org/10.1080/15332740902897360

Knuth, F., Shean, D., Bhushan, S., Schwat, E., Alexandrov, O., McNeil, C., Dehecq, A., Florentine, C., & O'Neel, S. (2023). Historical Structure From Motion (HSfM): Automated Processing of Historical Aerial Photographs for Long-Term Topographic Change Analysis. *Remote Sensing of Environment, 285*, 113379-. https://doi.org/10.1016/j.rse.2022.113379

Kochtitzky, W., Jiskoot, H., Copland, L., Enderlin, E., McNabb, R., Kreutz, K. and Main, B. (2019). Terminus Advance, Kinematics, and Mass Redistribution During Eight Surges of Donjek Glacier, St. Elias Range, Canada, 1935 to 2016**.** *Journal of Glaciology*, *65*(252), 565-579. https://doi.org/10.1017/jog.2019.34

Kochtitzky, W., Copland, L., Painter, M. and Dow, C. (2020). Draining and Filling of Ice Dammed Lakes at the Terminus of Surge-Type Dań Zhùr (Donjek) Glacier, Yukon, Canada**.** *Canadian Journal of Earth Sciences, 57*, 1337-1348. https://doi.org/10.1139/cjes-2019-0233

Laboratory for Cryospheric Research (n.d.). Dept of Geography, Environment & Geomatics, University of Ottawa. Retrieved March 6, 2024 from https://cryospheric.org/

Millard, K., Redden, A. M., Webster, T., & Stewart, H. (2013). Use of GIS and High Resolution LiDAR in Salt Marsh Restoration Site Suitability Assessments in the Upper Bay of Fundy, Canada. *Wetlands Ecology and Management, 21*(4), 243–262. https://doi.org/10.1007/s11273-013-9303-9

Roberti, G., Ward, B. C., van Wyk deVries, B., Perotti, L., Giardino, M., Friele, P. A., Clague, J. J., Menounos, B., Anderson, L. S., & Freschi, S. (2021). Structure From Motion Used to Revive Archived Aerial Photographs for Geomorphological Analysis; An Example From Mount Meager Volcano, British Columbia, Canada. *Canadian Journal of Earth Sciences, 58*(12), 1253–1267. https://doi.org/10.1139/cjes-2020-0140

Schaffer, N., Copland, L. and Zdanowicz, C. (2017). Ice Velocity Changes on Penny Ice Cap, Baffin Island, Since the 1950s. *Journal of Glaciology, 63*(240), 716-730. doi: 10.1017/jog.2017.40

Strategic plan 2025 (n.d.). uOttawa Library. Retrieved March 4, 2024, from https://www.uottawa.ca/library/strategic-plan