PEER-REVIEWED ARTICLE

NEW TOOLS FOR MILITARY HISTORIANS: HOW GIS CAN HELP UNDERSTAND CANADA'S NORTH-WEST EUROPE CAMPAIGN

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The use of geographical information systems (GIS) has exploded both in the private and public sectors. Not surprisingly, librarians and archivists have staked out a large role with GIS in the public sector through their efforts to preserve and maintain geospatial data collections. Their efforts have had cross-disciplinary ramifications which include the use of geospatial data collections in military history. In the Canadian context, military histories have in the past been heavily reliant on traditional sources such as interviews, diaries, and official transcripts of events without any real thought given to geographical information beyond the odd topographical map. This oversight is not due to lack of historical geographic data, but more so because of its perceived lack of importance.[1] This paper intends to highlight how GIS can significantly add to the study of military history and the potential value of GIS projects to the discipline.

For many post- Second World War Canadian historians, Canada's North-West Europe front has tended to highlight the failure of an ill equipped and poorly led Canadian army against a battle-hardened and ferocious German military. In the years immediately after the war, Canadian historians were quite critical of the army's performance. Even Canada's official war historian, Colonel C. P. Stacey, confirmed the Canadian's failure against the German army stating that the initial invasion of Normandy in France was a classic example of their performance, writing that "man for man and unit for unit, it cannot be said that it was by tactical superiority that we won the Battle of Normandy."[2]

In fact, Stacey believed that it was simply a matter of overwhelming numbers that led the Allies (Americans, British and Canadians) to victory over the *Wehrmacht* in Normandy – a common theme persistent until the end of the war.[3]

Stacey's first impression of Canadians' battlefield abilities in his 1960 official history *The Victory Campaign* has persevered among others. Historians

[1]When the Official History of the Canadian Army in the Second World War was released in 1960 the main focus for sources used were war diaries, operational reports and personal officer notes. This "top-down" type history that many other later histories would also come to use was not uncommon for its time but it overlooks a variety of sources such as geographic data. An excellent indicator of this is the use of actual topographical maps in the official histories themselves. For the *Official history of the Canadian Army in the Second World War, Vol II The Canadians in Italy, 1943-1945* only 25 topographical maps are used in a book of over 700 pages in length. In the *Official History of the Canadian Army in the Second World War, Vol III The Victory Campaign: The Operations in Northwest Europe, 1944-45*, which is again over 700 pages, only 14 maps are used. Of the maps that are examined, they are more so focused on formation movement than terrain analysis. The lack of overall use of geographical data in Canada's official histories is indicative to the perceived role of perspective geographic tools were to early military historians.

[2]Colonel C. P. Stacey, Official History of the Canadian Army in the Second World War, Volume III, The Victory Campaign: The Opera*tions in North-West Europe, 1944-1945* (Ottawa: Queen's Printer, 1960), p. 274.

[3]*Wehrmacht* is the German word for the united armed forces of Nazi Germany – this included both regular army units and the Waffen SS both of which faced off against the Canadians in Normandy and beyond. Stacey's belief in the "overwhelming the enemy theory" comes across repeatedly in his works and other scholars have taken note. See Terry Copp's, *Cinderella Army: The Canadians in Northwest Europe, 1944-1945* (Toronto: University of Toronto Press, 2007), p. 83 for a detailed account of Stacey's beliefs.

Figure 1. Canadian soldiers fire into a battered house during the battle for Caen, France, June 10, 1994.

Source: LCMSDS Photo Archive – LMH-P09878

have tended to focus, as Stacey had, on the recollections of both senior, and to a lesser extent, junior officers in the Canadian army and their British counterparts. Thus, history has not been kind to the Canadian soldiers who fought in Europe during the Second World War. This began to change in the early 1990s.[4] Historians began to reassess individual narratives of soldiers and take account of terrain and geography. Historian Terry Copp was perhaps the most inclined to take the latter into account in his seminal book Fields of Fire: The Canadian's in Normandy. His biggest contribution was taking into account what a small gradient in slope could have in a battle in his aptly titled book: *Fields of Fire* - which highlights how inclines can affect fire ratios of artillery and small arms, potentially giving an entrenched defender a massive tactical advantage. Copp stated that "it would be difficult to write about this or any other military campaign without a detailed knowledge of the ground."[5]

It is from Terry Copp's appreciation of terrain and geographical features, including craters, that historians, particularly military historians, can build on their understanding of the past by integrating GIS into basic historical work. As stated above, historians tend to focus on more traditional sources such as paper and oral testimony. Military historians have been particularly these sources when explaining military campaigns.[6] Although extreme geographic changes (and in Copp's case terrain analysis) are acknowledged, GIS has yet to be implemented as a scholarly source. Although using basic sources are proven to be beneficial and is a step in the right direction, military historians should move on from geo-referenced maps and terrain analysis. By its very nature, GIS collects a variety of intangible data such as air photos and defence overprints that, by themselves, do not offer much, but combined, they can expand our understandings immensely. This complex data goes far beyond any simple geographic exploration because the collected intangibles are invaluable to military historians looking to examine an engagement where a shell, mortar crater, or shifted trench line could prove decisive in understanding the outcome. This can only be done with the accuracy of GIS.

As of 2015, the Laurier Centre for Military Strategic and Disarmament Studies (LCMSDS) at Wilfrid Laurier University began a partnership with the University of Waterloo's geospatial centre in hopes of creating a geographic information system that explores the First Canadian Army's

[4]John A. English published a monograph on the Normandy campaign that questions Stacey's argument. He is arguably one of the first to take a different tone on the abilities of the Canadian soldiers fighting in Europe, however, his work solely focused on the soldier's point of view with very little terrain analysis or other geographic exploration. See John A. English's *The Canadian Army and the Normandy Campaign* (Westport: Greenwood Publishing Group, 1991). For a complete historiography on those who have written on Canada in the Second World War see Tim Cook, *Clio's Warriors: Canadian historians and the Writing of the World Wars* (Vancouver: University of British Columbia Press, 2006).

[5]Terry Copp, *Fields of Fire: The Canadian in Normandy* (Toronto: University of Toronto Press, 2003), p. XIV.

[6]Military historians usually prefer to stay on the operational or strategic level of analysis. This history typically sticks to what the commanders and the overall higher chain of command decided and carried out. Unfortunately, historians of this trade have been accused by social historians of overlooking more important content from the tactical level where the lower rank soldiers were, this includes tactical level maps and geography. See John Keegan's *The Face of Battle: A Study of Agincourt, Waterloo and the Somme* (New York: Viking Books., 1976). Keegan was arguably one of the first military historians to argue for the need to move beyond great men and examine other sources of interest.

Figure 2. C. P. Stacey
Source: Library and Archives Canada – PA-501025

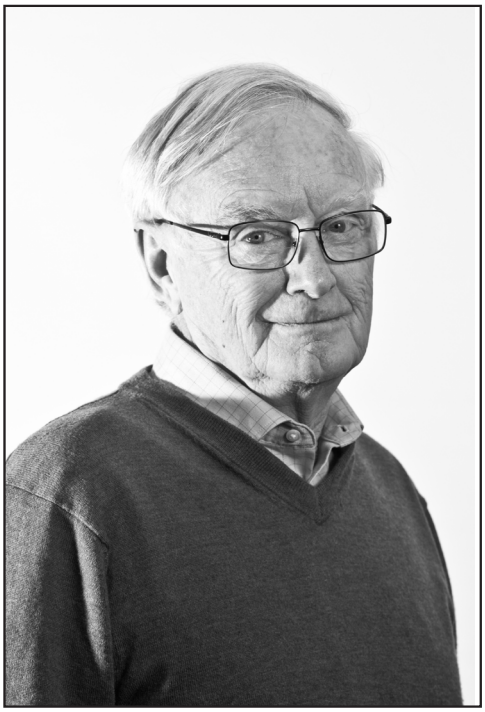

Figure 3. Terry Copp
Source: LCMSDS Photo Archive – LMH-P05142

advance through North-West Europe during the Second World War. The project members include Eva Dodsworth, Dr. Geoffrey Hayes, and Trevor Ford. Dodsworth, who heads the Geospatial Centre at the University of Waterloo, has been instrumental in starting the project and supplied the services of her centre to this project. Dr. Hayes, also at the University of Waterloo, has been the visionary for what uses can be gleamed out of the project while Trevor Ford, a PhD Candidate and Archival Manager at LCMSDS, has provided the archival materials (maps and air photos).

From the beginning, the goals of the project were simple. Using source maps and photos from LCMSDS' collection and along with the Geospatial Centre's expertise of Google Earth and georeferencing, a GIS platform is being built to catalogue Canadian battles. In using GIS for each military engagement and reassessing traditional historical records, a spatial data infrastructure is being created. It is the team's hope that this data arrangement will be made available to both academics and the public alike; therefore, creating a system with few restrictive boundaries, while also providing a layered map system that can be manipulated by individuals to better understand the campaign.

What makes this GIS project original are the sources used to create the layered map. Over the course of the past thirty years, LCMSDS has been collecting thousands of maps, which include hundreds of defence overprints.[7] These overprints are 1:25,000 scale topographical maps that have had known enemy positions printed onto the map itself.[8]

These positions came from aerial observation flights conducted from 1944-1945 by the Royal Canadian Air Force and other allied air forces.[9] These overprints were vital for the soldiers on the ground during the war, as they typically planned their operations around these maps.[10]

[7]Currently LCMSDS has over 3,000 maps of which approximately 213 are defence overprints.
[8]There are some scaled to 1:50,000 but they focus solely on the Italian Front.
[9]Edgar F. Raines Jr., *Eyes of Artillery: The Origins of Modern U.S. Army Aviation in World War II* (Washington D.C.: Center of Military History United States Army, 2000), p. 11.
[10]Interestingly enough these Defence Overprints have been largely overlooked by military historians because they focus too heavily on the tactical level – which as stated above tend to be of little interest to those who prefer to stay on the operational or strategic level.

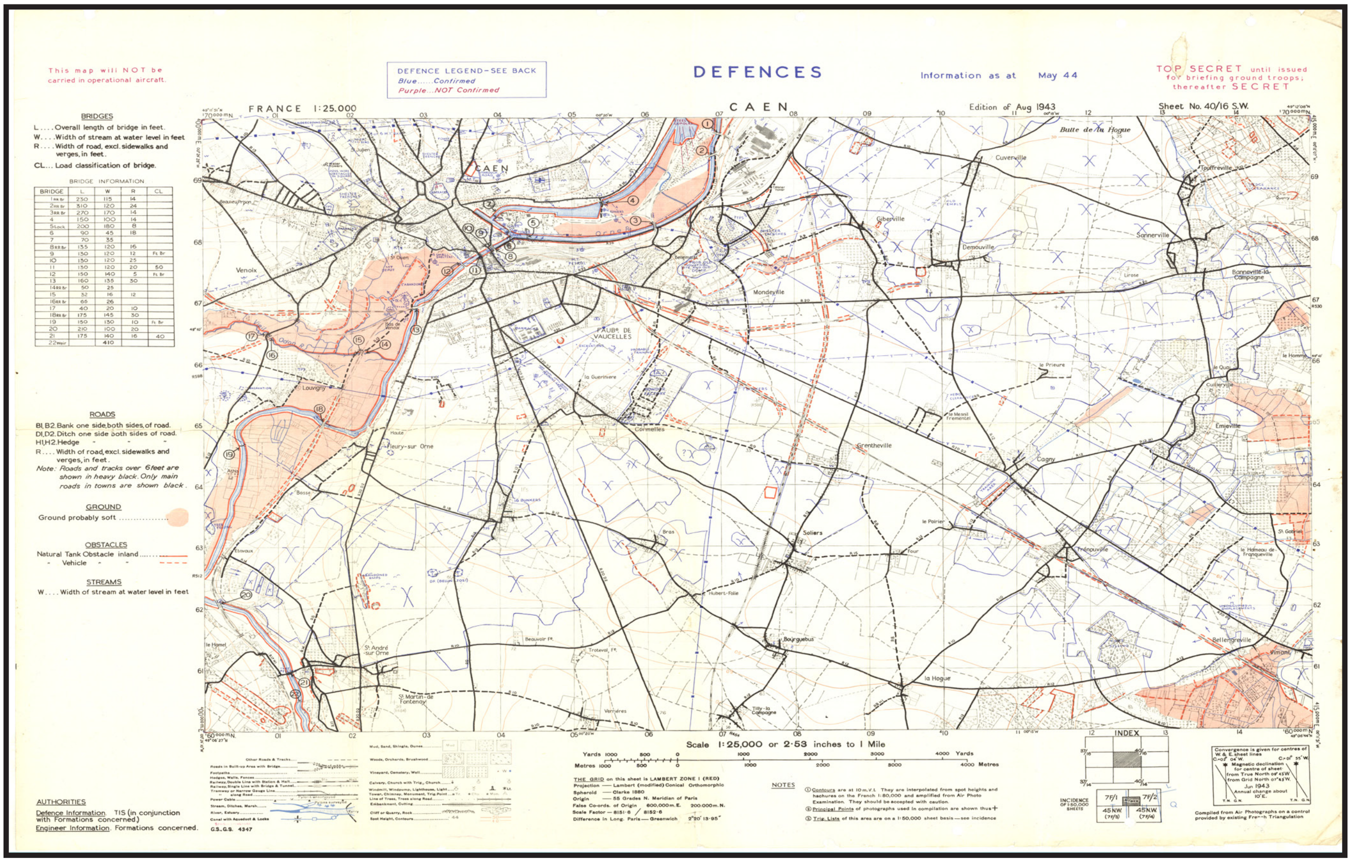

Figure 4. Defence Overprint: Caen Defences, 1944; *Source: LCMSDS Map Archive – LMH-M00343*

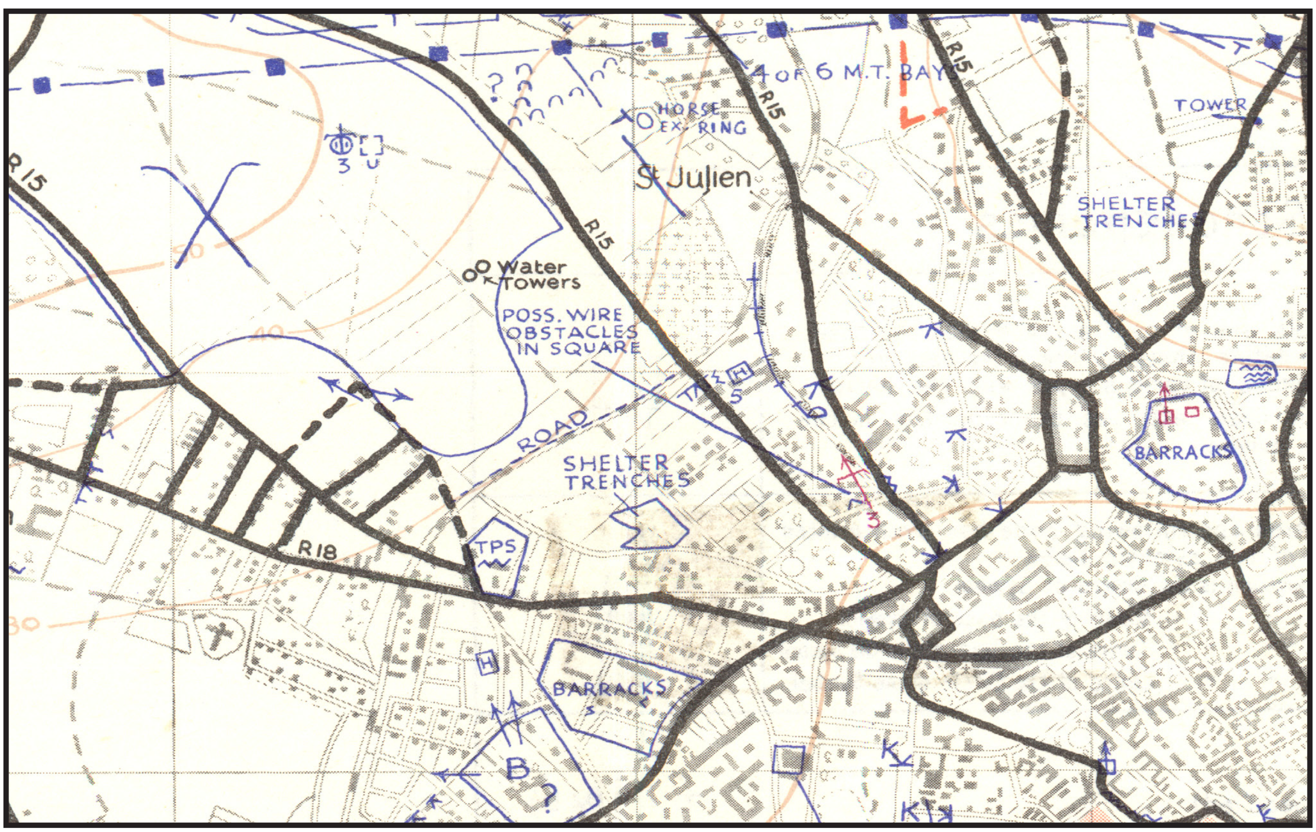

Figure 5. Section of 'Defence Overprint: Caen Defences, 1944' that details gun positions, machine gun nests, and artillery pits; *Source: LCMSDS Map Archive – LMH-M00343*

The idea of defence overprints was not new in Second World War. During the First World War, observation balloons marked enemy trenches and artillery positions on a map. These maps, which military historians now call trench maps, were used in both small operational plans and large strategic aims. As the war continued, the air war brought forth fighter pilots on both sides in an attempt to control the skies so the observers could mark out targets.[11] Because entire operations were decided on the accuracy of the trench maps, military commanders came to view air observation as key to any successful campaign. This lesson was taken in by many during the Second World War. The Allies used a more refined version of the trench map – the Defence Overprint.

After the war, most of the maps were sent back to Ottawa and given to the Historical Section under Colonel Stacey. Eventually, after years of gathering dust, they were discarded and LCMSDS accepted them into their collection in the early 1990s. Since then, they have proved invaluable in assessing the obstacles that advancing units faced albeit enemy positions or geographical hurdles. What further makes these overprints practical for historians is that they match up exactly with air photos taken during the war.

LCMSDS has the largest collection of Second World War air photos in Canada. These photos, as with the defence overprints, follow the First Canadian Army from 1944-1945. Reconnaissance flights would fly steadily at a certain height snapping photos of the Earth at small time intervals. The idea was that entrenched enemy units and geological deformities such as flooding of the land, something the Germans did regularly to impede the Canadian's advance, would be noted and relayed to the ground forces. The photos taken were handled by the Air Photo Interpretation Section of the First Canadian Army in order to plot out advance routes and enemy positions for the mapping section. After the war, the photographs were sent to the air photo interpretation school at Rivers, Manitoba. When the Canadian Forces closed the base in 1971, the collection was sent to the Canadian War Museum in Ottawa. Unable to find adequate storage for the photos (as they number over 130,000), the War Museum allowed LCMSDS to acquire them.[12] All 130,000 have since been digitized and cataloged by flight number, location and date.[13]

With these two excellent sources, LCMSDS and the Geospatial Centre at University of Waterloo have been constructing an online geospatial map visualization tool. After considering a number of online GIS products, it was quickly realized that ease of access to the platform was of the utmost importance. Two of the most popular online mapping tools include Google Maps and Google Earth - both of which offer free online access to the programs and support organizing and hosting the map images and metadata. Google Maps will act as a repository for the metadata, while highlighting troop paths, and offering KML map files for download. The KML files can then be viewed in Google Earth. Once the project is complete, it will be listed within the Google Maps Gallery section.

Figure 5. Sample Air Photo 3079, Sept 11, 1944 – Netherlands

Source: LCMSDS Air Photo Archive – LMH-A111-3079

[11]Lee Kennett, *The First Air War: 1914-1918*, (New York: Free Press, 1999), p. 42.
[12]Terry Copp was then Director of LCMSDS at the time and gladly took them on for preservation. This was an added bonus too as they significantly furthered his research with *Fields of Fire.*
[13]Beginning in 2011 LCMSDS with the support of a number of private donors began a systematic process of cataloging and digitizing the photographs. A team of dedicated student employees and volunteers at LCMSDS have not only scanned all of the photos but also created a preliminary inventory and a basic finding aid. This preservation phase of the project was completed in August of 2013 with minor work continuing to present.

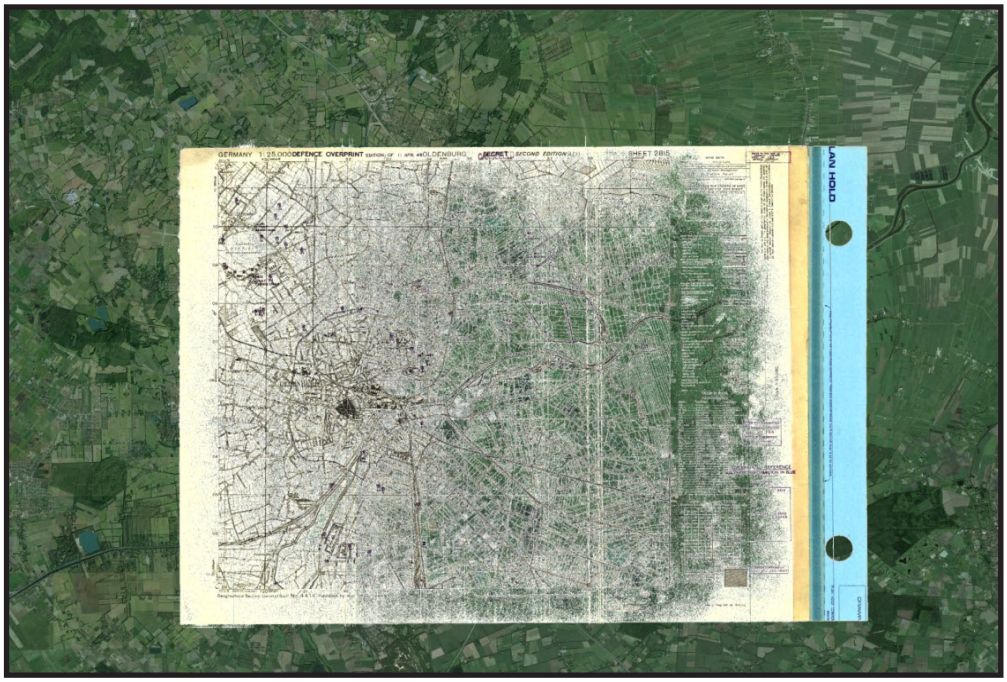

Figure 7. Sample Defence Overprint georeferenced and layered onto Google Earth
Source: University of Waterloo Geospatial Centre; Google Earth

In order to enable viewing of the maps in Google Earth, each defence overprint map and corresponding aerial photograph was scanned and georeferenced. ArcGIS was used to georeference each image and Google Earth was used to create the image KML outputs. Shapefiles were created to indicate map coverage, which were then also converted into KML format and uploaded into Google Maps. Each coverage polygon has a map associated with it, and once users click on the polygon, a link to download the map in KML format becomes available.

Each image includes a description, and with the troop paths drawn out, a working platform was created to allow for manipulation by the user to garner a greater understanding of the Canadian war effort in North-West Europe by allowing historians the ability to reassess with a new tool. In many ways, historical reassessments are critical to our understanding of the past. More importantly, this project should be seen as a first attempt to use GIS with military history as future project from other campaigns and wars could greatly benefit from the application of GIS.

Although this project is in its early stages, Google mapping products are being used to demonstrate the potential of these visualization tools. The most time consuming component of this project was the georeferencing of the maps; which took just over three months to do. Developing the final map project lasted only several weeks. Moving forward, however, the team would like to incorporate these maps into a more sophisticated GIS program where searching for maps and viewing the maps can be done together. Creating a mapping interface, similar to the Scholars GeoPortal would be ideal and is something the Geospatial Centre is currently considering. Furthermore, this project has the potential to expand itself from simply the Canadian North-West Campaign. For Canadian military history an examination on other conflicts based on the GIS system we are proposing could expand pre-existing historiography. Good examples of this could include the First World War, the Second World's Italian Campaign and even Canada's involvement in Afghanistan.

Another avenue this project has potentiality with is with modern-day bomb disposal. Over the past two years, LCMSDS has had relations with bomb disposal groups in the Netherlands and Germany, which use both its archival maps and air photos

to help identify possible unexploded ordinance. Unfortunately, only individual air photos and defence overprints are used. A manipulated GIS platform would only help further this effort, as the database would focus on certain tell-tale signs of live explosives from both air photos and maps along the Canadian campaign route. If this project was made available to the bomb hunters, having both air photos and overprints layered in a Geographic Information System, the end result would be invaluable. Other HGIS research could also be carried out using this project's approach. Both University of Toronto Mississauga and McGill University Libraries have extensive air photo collections.[14] These air photos, which cover most of Ontario and Quebec, could be combined with like area topographical maps to create a GIS system similar to the project highlighted in this paper.

Ultimately, it is the hope of this project's team that the creation of a comprehensive geographic information system, matched by easy access and manipulation, will allow the public and scholars to better understand Canadian's actions in the Second World War. Battles throughout Canada's North-West Europe Campaign should be re-assessed to highlight changes in terrain and elevations. This is not to say that previous scholarship of the Canadian campaign done with GIS is faulty. Instead, a database like this should be seen simply as an additional tool, albeit a vital one, in the historian's arsenal to better understand an already misunderstood campaign.

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Trevor Ford *is a third year PhD Candidate at Wilfrid Laurier University. Having started his doctorate at Memorial University of Newfoundland in 2013 under the supervision of Dr. Mark Humphries, Trevor was offered the chance to come to WLU with Mark in order to continue his studies and join the Laurier Centre for Military Strategic Disarmament Studies in 2014 as Archival Manager. Since his arrival, Trevor has completely reorganized and catalogued LCMSDS' holdings, including a year-long scanning project that digitized all of the Centre's maps. He has just finished setting up LCMSDS' new website waterlooatwar.ca, which chronicles the Waterloo County based 118th Battalion during the First World War. Trevor is currently working on several different projects, including one that is a joint venture with the University of Waterloo's Geospatial Centre, where LCMSDS' maps are being geo-referenced and added to Google Maps.*

With help from the Social Sciences and Humanities Research Council of Canada (SSHRC) Joseph-Bombardier Research Scholarship and under the supervision of Dr. Humphries, Trevor's doctoral research covers the role of the Canadian military's intelligence units and their domestic activities during the First World War. Trevor specifically examines the Military Intelligence Branch and their conduct against real and perceived enemies during and immediately after the war. This subject is not only unexplored but is also highly relevant to today's national security apparatus and the wider concept of state security in Canada. Trevor has published three articles on this subject and is currently working on a book of collected letters.

[14] Dodsworth, Eva H, and Andrew Nicholson, *Using Google Earth in Libraries: A Practical Guide for Librarians* (New York: Rowman & Littlefield Inc., 2015), p. 26.