THE HISTORY OF TECNOLOGICAL INNOVATIONS ON AERIAL PHOTOGRAPHY FROM THE FIRST PHOTOGRAPH TO NOWADAYS AND THEIR USAGE PURPOSES OVER THE PAST YEARS

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Abstract— Technological innovations were incredibly effective in previous times and importance of innovations stands at the same level in today's world. From the first attempt of taking black and white photograph to nowadays, time passed and technology developed gradually. Minds, thinking, tactics and purposes inevitably changed like technology. In this study I started from the "Invention of photography" and this invention, of course, had made new surveys and researches available. After that, studies had been made mostly based on "air" branch. At the period of World War I and World War II, interpretation techniques and ways developed from simple using handheld cameras to sophisticated complex analyses of images. Both human sources and technological innovations worked together just like a body. Afterwards new terms appeared in battlefields that started with "Aerial" or "air". It is clear that World War I and II formed the structure for aerial reconnaissance and photo interpretation. We can easily conclude that developments which are related to air power and control are still as important as before, thus many countries that understood the importance of aerial interpretation studied on reforms for their good during the war. Furthermore these runnings will continue as time passes, indeed. As a conclusion, this article provides data to illuminate the technological and organizational innovations that changed the outcome of the war, photo reconnaissance in photography sector, especially related to aerial photography.

Keywords— Aerial photography, Photointerpretation, Remote sensing, Technological innovations.

I. HISTORY OF AERIAL PHOTOGRAPHY

If we make the definition of photography first, the term "photography" is derived by two Greek words meaning "light" and "writing. Photography means the art, hobby, or profession of taking photographs, and developing and printing the film or photographs or processing the digitized array image. In another word, photography is production of permanent images.
First photographs were taken in 1839. And very close to that date, the French photographer and balloonist Gaspard-Félix Tournachon, known as "Nadar", took photographs from the "air" in 1858 over Paris, France. Taking photographs from air created the term of "Aerial Photography".
Aerial Photography means photography from the air. However, the photographs that Nadar produced no longer existed. And therefore James Wallace Black and Samuel Archer King took the earliest surviving aerial photograph on October 13, 1860 and it was titled 'Boston, as the Eagle and the Wild Goose See It.'. It depicts Boston from a height of 630 m.

This type of photograph, by means of the use of aerial photography, rapidly increased during the World War I, as reconnaissance aircraft were equipped with cameras to record enemy movements and defenses. At the beginning of the conflict, the usefulness of aerial photography was not fully appreciated by sides. But after the importance of air mapping and aerial reconnaissance were understood, new improvements which were happening at the first time in history gradually took place in the war.

And it is very obvious that World War II was also a war of air conflicts, photointerpretation, air mapping and aerial photographs. The code of the war was "The one who has air control was the one who wins the war".
After the wars, importance of air reconnaissance increased by technological developments and innovations. Finally country governments were aware of the importance of innovations on "air".

II. ADVANTAGES OF REMOTE SENSING

"Remote sensing", as a term, began with aerial photography and reconnaissance. Photo reconnaissance created a new vintage point for remote controlling and sensing. There are many advantages of remote sensing that most of the countries already knew and made developments to have dominant power for their country.

First of all remote sensing can be "very general". It means that the one who are more capable of collecting information about its opponent are likely to have general information about them. By overseeing opposite side's area, we can conclude their settlement, their militarization and their war style. No doubt for that it is extremely important in combat conditions.
It is the only practical way to obtain data from inaccessible regions in difficult and inevitable

positions. Further, remote sensing are the group of acts which are very specific, relatively cheap and rapid method of acquiring up-to-date information over a large geographical area. Even with the cost of ground truthing this is very economical.

III. TYPES OF AERIAL PHOTOGRAPHY

There are two main branches of aerial photography: "oblique aerial photography" and "vertical aerial photography.

Oblique aerial photographs are taken from kinds of aircraft whether this is a fixed wing airplane, helicopter or "lighter than air" craft, balloon. The subject is seen at an angle and therefore the photographs are perceived by the human eye as having depth and definition.

As the name suggests, vertical aerial photographs are taken from directly overhead looking down vertically and they therefore produce a mostly flat image almost like a map. It is clear that, when we look at the history, both methods were largely developed for military purposes.

Oblique aerial photography is commonly used for aerial construction progress reports, archaeology, advertising and promotion work, in the sale of commercial and residential property and land, in legal disputes or just to produce a stunning aerial photograph for display.

Vertical aerial photographs are most commonly used for mapping projects, for land use or geomatics surveys, farm evaluation, flood risk assessment and scientific studies. And if you know focal length of camera and height of aircraft above the ground you can calculate the scale of the photograph.

3.1 General Observations

Although early aircraft offered poor visibility, some of them were suited in order to take effective photographs. Their experiments clearly demonstrated the effectiveness of photoreconnaissance most, but also that the usual and old cameras would be unsatisfactory for use in open aircraft cockpits.

Remote sensing, Visual Reconnaissance and Aerial Photography were the first activities regarded as military aviation's primary missions. Aerial observers were trained to show and indicate the enemy zone and to report against a detailed checklist of possible enemy activities.

These news were mostly including new weapons emplacements, presence of smoke, speed and style of militarization, fresh tracks in open fields, massing of personnel, quantity of personals, vehicle traffic, and many others.

It shows us that early usual aerial cameras were hand-held but as important as weapon for both sides. They required manual operations by observer pilots.

By 1918, aerial observation had become a key component of military operations, as is indicated by the systematic and detailed form of observation orders. In addition, observations were also done with non-winged aircrafts, balloons.

3.2 Balloon Observations

Balloons were used for observations in the earliest form of military aerial observations to provide the vantage point to view troop movements. In Italy, the French photographer Nadar, as it is mentioned before, is credited with offering and serving to the French Army in 1859 in support of its aerial operations.

Although it is not known if his offer was accepted, his proposal plausibly marks the earliest recognition of the military potential of aerial photography. Later, balloon observations were employed, largely experimentally, in the U.S. Civil War (1861 to 1865) and the Franco-Prussian War (1870 to 1871).

Once, balloons were very important tools to monitor the battle zone, militarization of other side and collect critical data for main base. This type of Aerial Photography was the pioneer of air surveillance and it played very important roles in wars as well.

3.3 Photointerpretation

Photo interpretation is a huge part of photogrammetry and remote sensing. If we make the definition of "photo interpretation", we can describe as the act of examining photographic images for the purpose of identifying objects and judging their significance. Aerial Photo Interpretation, in some disciplines, is the primary reason for aerial photos. National security and military applications are where photo interpretation is the most demanding. The importance of photo interpretation is, also had been, always same level and as the time passes this situation will be like that.

Clearly, World War I and II formed a critical period in the history of photointerpretation; within a few years of intense innovation, the camera and the airplane were integrated to form, arguably, the most effective intelligence resource of the conflict I.

Many applications of image interpretation are like land use/land cover mapping, geologic mapping, soil mapping, agriculture, rangeland management, water resources, urban/regional planning, wetland mapping, wildlife ecology, archaeology, environmental assessment, etc.

3.4 Military Air Reconnaissance and Surveillance

Military photointerpretation and aerial photography grew from previous reconnaissance and surveillance

activities, and today largely extinct. When we look at World War I, we can easily conclude that the use of aerial photography rapidly grew during the war, as reconnaissance aircraft were equipped with cameras to record enemy movements and defenses. World War I, at that point, is exactly a key war for both militarization on aerial activities and gathering information by photointerpretation with aircrafts and observer pilots.

World War I

At the beginning of World War I, the military on both sides of the conflict saw the importance and value of using the airplane for air reconnaissance and surveillance work but did not fully understand the potential of aerial photography.

Initially, aerial observers did aerial reconnaissance by making sketch maps and verbally conveying conditions on the ground. They monitored them and reported on enemy positions, supplies, and movements; however, some observers tended to exaggerate or misinterpret conditions.

In some cases, their observations' data were based on looking at the wrong army. It was mainly because of that from above identifying one soldier from another was not easy for observer pilots.

Some observers started using cameras to record enemy positions and found aerial photography easier and more accurate than sketching and observing. Soon all of the nations involved in the conflict were using aerial photography.

The war brought major improvements in the quality of cameras. Photographs which were taken at 15,000 feet (4,572 meters) could show footprints in the mud. World War One was a major impetus to development of aerial photography.

World War II and Afterwards

World War II brought tremendous growth and recognition to the field of aerial photography that continues to nowadays. In 1938, the chief of the German General Staff, General Werner von Fritsch, stated "The nation with the best photoreconnaissance will win the war." It can mainly be concluded from German General's statement that air superiority would be available with aerial surveillance, indeed.

By 1940, Germany led the world in photoreconnaissance. However, after von Fritsch's death, the quality of German photo intelligence declined gradually. When the United States entered the War in 1941, it basically had no experience in military photointerpretation. They didn't have any need to use or upgrade their aircrafts for taking aerial photography at that time. By the end of the War, it had the best photointerpretation capacity of any nation in the world.

In 1945, Admiral J. F. Turner, Commander of American Amphibious Forces in the Pacific, started that, "Photographic reconnaissance has been our main source of intelligence in the Pacific. Its importance cannot be overemphasized."During the 1950's, aerial photography continued to evolve from work started during World War II and the Korean War.

IV. WHY IS AERIAL PHOTOGRAPHY SO IMPORTANT?

Joseph Nicephoce Niepee, the first photographer and inventor of photography, took the first black and white photograph. Nadar used this invention, a kind of opportunity for him, and worked on photography in a way of aviational. And the term of "aerial photography" appeared. Some kinds of technics, kites balloons pigeons and aircrafts with camera, used for this purposes.

Remote sensing which involves collecting information about the Earth from a distance using electromagnetic sensors evolved from aerial photography. Afterwards World War I and II formed the structure for aerial reconnaissance and photo interpretation. These were important issues for sides in wars.

Aerial Photographs were useful tools in studying changes on the surface of the earth over time. They were a record of what was on the land at the time the photograph was taken, can be used for many types of studies. They are particularly valuable in land use and land cover analyses, and comparing older data sets with new information.

Maps can be generated from aerial photographs. Interpretation of photos creates maps and at that point aerial photographs play essential works on it. Many applications of image interpretation are like land use/land cover mapping, geologic mapping, soil mapping, agriculture, forestry, management, water resources, urban/regional planning, wetland mapping, wildlife ecology, archaeology, environmental assessment and etc.

As a conclusion, as a term of Aerial Photography plays critical role in today's world. It has branches of photointerpretation, remote sensing and observations. The more we study and understand the situation happened in history, like air intelligence, conflicts and technological improvisation, the better we can conclude surveys and make improvements for the future.

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