

The History of the Japanese Optical Industry and Relationship to World Events

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Introduction

The history of camera and optics companies worldwide has been storied, with a rich history of innovation, competition, and fandom. Each company is associated with a certain quality and niche of photography and has a distinct following. Schneider is known for its large-format lenses, Mamiya for cheap but quality medium-format, Leica for high-quality and expensive rangefinders, and Hasselblad for expensive medium format digital systems. Today, two of the largest optics and camera companies for professional-level Single-Lens Reflex (SLR) photography equipment are Canon and Nikon, both Japanese companies founded in Tokyo between WWI and WWII (1937 and 1917, respectively [1, 2]). The debate among photographers between these two companies is as timeless as vim vs emacs for programmers, Mac vs PC, or Yankees vs Redsox. However, in the US market, these companies only really rose to prominence after WWII. Prior to WWII, companies like Kodak (an American company) and Leica (a German company) dominated the US market. As we will see, Canon and Nikon gained their foothold in the late early 20th century, between the wars, making optics for the Japanese military, and came to prominence in the late 1950's and early 1960's during the US occupation and Japanese economic recovery phase.

Camera and optics companies comprise a wide range of fields; on one end, there are purely camera companies, which do not design their own optics or produce their own lenses, and on the other end are optics companies that may not be involved in consumer photography at all, focusing on optics like microscopes or wafer steppers. In the middle lie companies like Canon and Nikon, and these combined camera and optics companies have been heavily involved and affected by world affairs – many produced reconnaissance optics or sights during war, and changing geopolitical relations also led to opening and closing of different markets. Natural disasters have affected manufacturing plants in Southeast Asia, and specialty lenses and cameras have been produced for world sporting events and scientific applications such as cameras designed for use in space and on the moon. This paper will focus on two sections: the effect of WWII and subsequent events, such as the Cold War and Korean War, on Japanese camera companies, and finally cover the relevance of large optics companies in the 21st century. Both of these analyses will focus on Nikon in particular.

Nikon Early History

From the very start, Nikon was heavily influenced by the military. Nikon was founded in 1917 as *Nippon Kōgaku Kōgyō Kabushikigaisha* or Nippon Kōgaku in Tokyo by the merger of Iwaki Glass Seisaku-sho, Fujii Lens Seizo-sho, and Tokyo Keiki Seisaku-sho, a move prompted by the Imperial Japanese Navy (IJN) in order to produce optical equipment such as prisms for binoculars, telescopes, microscopes, and similar. Most of Nikon's early designs were based on German optical formulas, and the original primary lens designers were a set of eight German technicians, invited to the company in 1919. Nikon's production and design therefore closely resembled German optics firms Leitz (later Leica) and Zeiss.

Unfortunately for Nikon, the Washington Naval Conference of 1921, which limited Japanese ship construction, also limited the demand for Nikon's glass. Furthermore, in 1923, the Great Kanto Earthquake halted Nikon production operations. However, realizing the company's importance towards supply of optical munitions (such as the aforementioned binoculars, sights, telescopes, etc), the Japanese Navy Ministry arranged for the reconstruction of the manufacturing plant in Tokyo. Little more than a month after the earthquake, Nikon was able to resume research and manufacture of optical glass. This reconstruction and restructuring actually had a net benefit to Nikon, funneling projects and talented engineers from elsewhere in the IJN into the company.

A subsequent agreement in 1930, the London Naval Treaty, placed further limits on Japan's naval presence in the Pacific. The Navy Minister, Navy Chief of Staff, and Supreme War Council strongly objected Japan's signing of the treaty, and argued successfully for the central Japanese government to increase research funding. Increasing research funding would allow Japanese ships to be more technologically advanced than their American and British counterparts, even though the London Naval Treaty limited the total ship tonnage Japan was permitted to construct. This increased spending, especially on experimental technological pursuits, was a great boon to Nikon's business throughout the 1930's. Nikon further diversified their offerings, beginning production of standard photographic lenses and debuting telephoto lenses. During this period, Nikon was the primary optics manufacturer in Japan, and supplied lenses and optics to other Japanese optical firms in order to produce cameras.

As an example of the type of projects Nikon was given following the London Naval Treaty and increased IJN reliance was the development of aerial reconnaissance photographic equipment.

The IJN was reliant on French-manufactured aerial reconnaissance equipment until Nikon developed their own 700-1200mm photographic equipment for aerial reconnaissance.

Following their success in aerial cameras and photographic equipment, Nikon began producing artillery cameras for land use. By Nikon's own admission "...it was primarily in response to the demands of the navy that [Nikon] took up camera research" [3].

WWII and Occupation

Throughout the late 1930's, Nikon and other optics and camera companies began supplying cameras and optics to the general public, reaching a peak in 1940 at 218,659 units sold.

However, in 1942, government regulations forced all camera and optics manufacture to be for military purposes, and commercial sales did not resume until after the war. During the war, most of the products supplied to the military were supplied to the army or navy for aerial usage. Much of this supply was dedicated to aerial reconnaissance – with the improving capabilities of aircraft to fly longer, higher, and faster, photographic technology had to keep up to continue producing valuable reconnaissance photos, and general aerial optical equipment such as binoculars and telescopes. One general was quoted as saying that "80 percent of vital wartime intelligence came from aerial photos" [4].

One interesting piece of technological note was the disproportionate importance of photographic technology to Axis powers, since Allied powers developed radar to supplement their photographic technology. This push was a contributing factor towards Japanese optics and camera manufacturer's post-war optics superiority to many other optics companies.

In 1948-1951, US policy shifted from allowing Japanese economic recovery to promoting full economic recovery, as part of an overarching goal to rival the USSR and deprive it of potential allies, as well as demonstrate the superiority of capitalism to communism. Related events include Mao's victory in China in 1949 and the Korean War in 1950, during which Japan became a strategic outpost for American foreign influence in East Asia. This was brought to a head in 1951 in the Treaty of San Francisco, which ended Japan's position as an imperial power and ended Allied post-war occupation of Japan. US involvement in Japan boosted the Japanese economy significantly, since soldiers had ready access to products in the Japanese market.

Matching the shift in US policy towards Japan was an internal shift in Japanese policy, the Outline of Japanese Economic Stabilization Plan, laid out in 1948 to put Japan's economy back on track following the war and occupation, and to quickly eliminate dependence on US aid. Part of this policy included a ninefold increase in exports, which included cameras and optics export to the US. Involved in this was the official exchange rate set by Joseph Dodge in 1949, which set an exchange rate which slightly undervalued the Yen, allowing for extremely favorable trading terms. These economic shifts led to a drastic restructuring of the photography market for Japanese optics and camera manufacturers, with 86% of production exported to foreign markets in 1949, and a general growth in the industry of nearly nine percent yearly from 1949 to 1960, both in terms of total value and value of exports.

Overall and most important to the Japanese camera manufacturer's rapid growth and success following WWII was the Allied General Headquarters (GHQ)'s policy towards export. Between 1945 and 1949, GHQ forced a 100% export policy, forbidding any domestic camera and optics market (this was subsequently changed to 80% export, due to the rising domestic black

market). Due to the demands for high-quality exports of commercial camera equipment, Japanese camera and optics companies were forced to retool commercial camera factories from the 1930's. In order to promote this, GHQ secured funds from the US to import precision Swiss machine tools to retool the factories. This was granted to four companies – Nikon, Canon, Minolta, and Seiko, a watch and shutter corporation. Nikon, Canon, and Minolta concentrated on developing cameras for the popular 35mm photographic film that was the standard at the time. Nikon and Canon accomplished this by copying and innovating upon German camera designs from Leica and Zeiss, while Minolta generally had more unique designs.

Korean War

In 1950, the Korean War broke out. At the time, the US was still heavily invested in Japan as a strategic outpost in East Asia, and Japan served as the de facto base for US operations in the region. Due to the US's involvement in the Korean War, Japan was called upon to provide military supplies, including military-related optics to the US during this period. US military expenditure exceeded even US aid during this time period, peaking in 1952 at \$824 million.

While Nikon and Canon retained many of their factories from the mid-1940's, Minolta had always been a smaller company, and thus had more limited production capabilities. Luckily, Minolta was able to capitalize on a large number of skilled laborers in the Nagano Prefecture. These laborers were unemployed textile workers, who had lost their jobs due to changing economic conditions. However, their experience with textiles translated well towards camera assembly. Minolta wasn't the only camera company on the block setting up or expanding manufacturing capabilities though. With Nikon and Canon targeted squarely at the high-end

and export market, other companies came in to fill in the lower-end and domestic market, such as Ricoh, Olympus, Yashica, Petri, Mamiya, and Bronica. Asahi, which was formerly a powerhouse optics company, also introduced consumer photographic equipment in 1952 and rebranded themselves as Pentax.

These new companies contributed significantly to the popularization of photography in Japan, as well as leading to a number of innovations. Asahi's first SLR, the Pentax, was famous for introducing the rapid-wind film advance lever as well as a film rewind crank. These were significant ergonomic improvements that were copied on almost every 35mm SLR made from then on. Olympus's Pen camera was extremely popular throughout Japan due to its low price and cost-cutting measures. The Olympus Pen's unique feature was its half-frame images, which used only half the film area of a standard 35mm frame, allowing twice as many pictures to be fit onto a single roll of film. Film was very expensive in Japan at the time due to the limits on imported film, so doubling the number of images per roll was very helpful for the budget-conscious Japanese family.

At the peak of demand during the Korean War, there totaled over 100 camera manufacturers in Japan, most of which just assembled cheap components from the bigger optics manufacturers. However, following the end of the Korean War, demand for cameras slumped, and by 1954 the number of camera companies had fallen to about 65 firms.

NASA Partnership

Throughout the 1960's, NASA underwent extreme development for its manned space program. It initially used 70mm film, but realized there was a need for smaller, more portable cameras.

Nikon had at this point developed a reputation for reliable, quality camera products, so NASA approached them to supply modified cameras for spaceflight. These modifications were extensive, generally bringing the camera up to NASA specs, which involved weight reductions, soldering and adhesives modifications, and some ergonomic modifications to enable glove-wearing astronauts to use the cameras. In 1971, a modified Nikon F flew with Apollo 15, and in 1973 another modified F, this time with a motor drive, flew and were used in Skylab.

Following the success of these modified Nikon F's in space, NASA requested more cameras, which Nikon eventually supplied in the form of modified F3's. One version of the modification allowed for use with very long spools of film, much longer than the standard 36-exposure rolls the cameras were normally designed for. This allowed for extended use without replacing the film, but at the cost of an extremely bulky camera. Another version of the modification featured just a motor drive, and was similar in size to the normal F3. Following these two cameras, Nikon's next camera supplied to NASA was an F4, which only needed minimal modifications to prepare it for spaceflight.

Throughout this early partnership, Nikon was able to learn a tremendous amount about improving the reliability and durability of their cameras, as evidenced by the improved quality of consumer-level cameras, to the point of only small and minor modifications needing to be made for spaceflight applications. [5]

After the film F4, Nikon's offerings to NASA began swinging to digital – this had obvious benefits from a spaceflight perspective, because harsh chemicals didn't have to be carried on board in order to see quick results. An F4 was therefore modified with a monochrome CCD back. Nikon

has continued supplying NASA with cameras, and to this day, almost all cameras aboard the ISS are Nikon, and most of them are plain consumer cameras and lenses with almost no customization. The ISS has a nearly-complete set of focal ranges, from fisheye to “several” of their recently-acquired 800mm f/5.6, a relatively new release by Nikon. These lenses are now mounted on the latest professional Nikon cameras, the D5’s, with some older D4 variants and D3 variants still used. [6, 7]

Conclusion: Large Optics Companies in the 21st Century

The 21st century has been a very exciting time for photography as a whole, and especially for Japanese manufacturers. Canon and Nikon have squarely won the professional photography market, with Sony, another Japanese camera company, rising to fill many amateur and semi-professional video needs. German optics and camera companies have been relegated to a few small high-end niche roles within photography, and American optics and camera companies are essentially nonexistent.

The success of Japanese camera and optics companies in the 21st century is a direct result of their importance in the late 1950’s and early 1960’s economic recovery policies. During this period, Japan focused economic efforts and exports on high-quality, high-profit goods such as cameras, watches, and eventually, electronics. This allowed Nikon and other companies to gain access to key US markets, which boosted sales tremendously. One key point is that during this economic recovery, US aid and cheap labor, along with experience gained during WWII, allowed Japanese cameras to be produced for significantly cheaper than their German equivalents. This allowed Nikon sales in the US and exports in general to skyrocket. Today, Nikon’s sales overseas

are almost seven times higher than domestic sales, and US sales are just shy of double domestic sales, and represent the largest single region for Nikon. [8]

Nikon has kept up with the trends, successfully transitioning to digital in 1999 with the D1. Since then, digital cameras have exploded in popularity and quality, since digital technology has made the marginal cost of a photo zero. No longer do you have to pay for film and development, and digital photography further allows for instant gratification. Due to the significantly decreased barrier to entry, the popularity of photography is at an all-time high.

One interesting class of cameras that rose to popularity in the digital age is the mirrorless interchangeable-lens compact (MILC) type camera. These cameras feature interchangeable lenses and relatively large sensors, but no mirror, which allows them to be much smaller than SLR's. This compactness, coupled with the high quality due to the relatively large sensor, and the ability to mount many different lenses on them has been the key to their popularity. At this point, all major camera manufacturers have produced a line of MILC cameras, and Nikon is no exception. Nikon released the 1 series of cameras in 2011 to fill this niche. This represents another aspect of Nikon – they adapt to producing the products which are desired at the time, from reconnaissance optics before and during WWII, to rangefinders to compete with Leica in the 1950's, to film SLR's from the 1960's to early 2000's, digital SLR's starting in 1999, and even MILC's starting in 2011. This wide variety of products throughout the years show Nikon's flexibility and expertise in many areas of optics and camera manufacture.

Nikon was the original and, in the author's opinion, the best Japanese camera and optics company. Sponsored in the early 20th century by the Navy and with a strong presence in the

photography market today, Nikon has long been among the premiere Japanese camera and optics companies. As the digital age reigns, photography has reached an all-time high, and Nikon technology has risen with it, producing top-notch cameras and lenses to keep up with modern demand.

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