Founded in 1920 by Sherman Fairchild, the company Fairchild Aerial Camera Corporation had developed high quality aerial cameras, such as the Fairchild F-8, and even entire aerial photographic platforms, such as the Fairchild FC-1 aircraft. In addition to well-publicised oblique shots of Manhattan and other high-profile locales, Fairchild pioneered the field of aerial photogrammetry. World War II dramatically increased the demand for high-end aerial cameras for photoreconnaissance and mapping. By the end of World War II, Fairchild Camera & Instrument Corporation (Ithaca, N.Y.) had made a name for itself as the United States’ preeminent manufacturer of aerial cameras. Drawing on that expertise and reputation, Fairchild decided to diversify. The Fairchild camera transit F-227 is one of these products.

A camera transit, or photo theodolite, is a surveyor’s tool for terrestrial photogrammetry. It is in essence a transit or theodolite, where the sightline can be recorded on film. This allows for photogrammetric interpretation of the images and results in more detail being recorded in a shorter period of time. If these images are replicated as offsets on a baseline, stereoscopic interpretation is also possible.

The Fairchild camera transit was developed by Fairchild reputedly “in co-operation with J.E. King of the U.S. Forestry Service, to meet specifications of the U.S. Navy Hydrographic Office.”

DESCRIPTION

The Fairchild camera transit is comprised of a “conventional thirty second reading Keuffel & Esser transit” (type 5078-E), which had been modified to “carry a specially designed and built camera.” The telescope and standards of the transit were removed to provide enough space for the camera unit, and a wide aluminium base fitted around the compass box. The telescope was then mounted atop the camera unit (Figure 1). The shutter unit is enclosed in a casing, with cut-outs for speed and aperture settings (Figure 1). The unit has a plate for mounting on a tripod and four levelling screws.

In order to avoid any magnetic deflection, the camera housing and all parts were made from magnesium, aluminium and brass. The cast magnesium body shows the following casting numbers: D593-1 on the plate film door; and R-539-12 on the bottom of the camera housing.

LENS AND ACCURACY

The camera is equipped with an 8½" Goerz Aerotar lens with an f/6.8 aperture, set in a Wollensak Betax nº4 shutter with settings B, T, 1/2 to 1/50 second. The lens had a fixed focus on infinity. The Goerz Aerotar, a derive of the Goerz Dagor, is a symmetrical cemented triplet type lens which was highly corrected for distortion and specifically designed for applications in mapping and aerial photography. Indeed as Revere G. Sanders, Assistant Vice President of Fairchild Camera, pointed out, Fairchild chose the lens, because it gave ‘exceptionally sharp photographic resolution and is free from lens distortion which could be a source of error.' To further reduce the error, the camera was specifically designed for use with glass plates, as it was feared that normal film might shrink or expand with age and temperature variations. These plates were pressed against the fiducial marks on the focal plane, which were “adjusted by the U.S. Bureau of Standards to locate the principal point of the photograph within the specified accuracy.”
Moreover, a level bubble mounted inside the camera was also included in each photograph as a control to ensure that the transit had indeed been levelled correctly and that the photo had thus been taken horizontally. Each of the twelve images per set was also registered with an automatic counter mark (Figure 5).xvi

Clearly, accuracy was of paramount significance. While the camera looks asymmetrical, the focal point of the lens is exactly at the horizontal pivot point, i.e. the centre of the compass and plumb bob line. Also, the exact focal length of the camera is given as 209.98mm (see Figure 5). One of the Fairchild Camera Transits was field tested by the ‘Subcommittee on Terrestrial Photogrammetry of the Society of Photogrammetric
Engineering and was found to be have inaccuracy of 0.63mm (or 0.30%).

**WHAT’S IN THE BOX?**
The complete camera transit was comprised of a wooden carrying case with the camera transit, three filters (red, yellow, minus blue), plate holder box with seven glass plate holders, a sunshade for the telescope sight, a cable release, plumb bob, and a spare shutter.

**USAGE**
Once points suitable for ground control had been identified in the area to be surveyed, the camera was set up horizontally, so that as much of the horizon was shown in the top of picture as possible. A total of twelve images was taken at 30º intervals throughout a full circle (360º). A cable release was required to trip the shutter (and reduce the potential for camera shake).

**PUBLIC RECEPTION**
The camera transit was officially released to the press in October 1946. Fairchild played the media card well, and had their piece of equipment, replete with a company-provided stock photo, well-covered by professional publications in the surveying and photographic disciplines. It was also featured in *Popular Science*, a general-interest magazine with nation-wide distribution among the interested public (Figure 7).

Revere G. Sanders, Assistant Vice President of the Fairchild Camera & Instrument Corporation, even managed to have a five-column piece published in the magazine *Public Works* of December 1946. The article, which extols the cost-benefits of the instrument (reduced field work and office costs, mapping larger areas at greater speed; eliminate field helpers; improve workflow), is replete with the same three stock photos.
Figure 6. Visual walk-around of the Fairchild camera transit F-227 (sn Exp 5)
We are, at the time of writing, uninformed about the list price of the unit in 1946. It was reported to be about four to six times the cost of a simple transit, and thus not readily adopted by the commercial small-scale surveying firms.

It would appear that some of the units were bought by the U.S. Navy “to survey rugged coast lines.”

**Production and Quantities Built**

Despite the well-coordinated media campaign, the market did not take to the transit camera. In part, this was because the camera transit was principally suited to a very specific task: large-scale terrestrial mapping. Yet the very aerial cameras that Fairchild had been developing for the US armed forces in World War II had supplanted the need for terrestrial systems such as the Fairchild camera transit. While the pre-war aerial cameras, such as the Fairchild F-8, were hand held operations that could be set up for vertical photography, war-time demand led to standardised high-end developments, such as the Tri-Metrogon set up, which provided accurate capture of aerial imagery suitable for stereoscopic interpretation and resulting mapping. Aerial photogrammetry had none of the limitations encountered with a camera transit, which was found to be “best suited to regions not too thickly wooded, yet with enough scattered trees, structures, and characteristic contours shapes to give plenty of identifiable points....a definite drawback...its lack of usefulness in country bare of prominent details, or so thickly wooded as to interfere with clear photography.”

At the other end of the surveyor’s spectrum, small-scale terrestrial mapping at the property or sub-property level, stock-standard transits/theodolites were more versatile tools and moreover much cheaper to operate.

While the Fairchild camera transit constitutes the apex of development for that kind of equipment, it is also a great example of technological extinction. It is, in fact, the equivalent of the Spruce Goose among the camera transits.

The total number of Fairchild Camera Transits built is unclear at the time of writing. The unit described here has the body serial number “EXP 5”, suggesting that it is an experimental model. The unit carries a Goerz Aerotar with serial number 7615447. The stock photo of the photo transit, depicted in a number of publications, shows a Goerz Aerotar with the serial number 7615444.

Detailed searches of the world-wide web, online-accessible catalogues of museum holdings, and auction catalogues so far failed to locate even a second example of the theodolite. Thus the total number of units built remains unclear, but overall seems to be extremely low.

**Endnotes**

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1. Length is measured from front of lens to back of film door.
2. Listed as F=8 ¼ inch (=209.55mm).
3. Observation of the actual example shows a minimum aperture of f/22, while several items in the contemporary literature claim f/32.
4. Photoheodolite (or photogrammeter) was the European term.
1946, p. 57.—Phototheodolite. *Science Illustrated* vol. 4, 1949, p. 67, p. 6—The camera was reported in *The International Hydrographic Review* (Anon., ’The Fairchild Camera Transit.’ vol. 25 n° 2, 1948, pp. 59–62), which was extracted in other hydrographical journals (e.g. *Deutsche Hydrographische Zeitschrift* vol. 2, n° 6, 1949, p. 304).

11. The Keuffel & Esser Co. (Hoboken, New Jersey) engineer’s transit’ (type 5078) was manufactured from 1913 until the late 1940s.


14. As early as 1921 Keuffel & Esser (New York) had offered their own version of a photo-theodolite comprised of a plate camera housing below the transit (but seemingly set up at exactly 90º angles).

15. The 8 ¼” inch are equivalent of 210mm in the metric system.— Bailey, ’A New camera transit…’ *op cit* notes that the aperture is f/6.9, while other literature on the Goerz Aerotar notes f/6.8 (e.g. Kingslake, R. 1942. Lenses for Aerial Photography. *Journal of the Optical Society of America* vol. 32 n° 3, pp. 129-133).


17. Sanders, ’How the Camera Transit is used in Survey Work…’ *op cit*.

18. Bailey, ’A New camera transit…’ *op cit*.


22. ’Camera transit, for use in surveying land.’ *Science News Letter* vol. 49, 1946, p. 256.— Bailey, ’A New camera transit…’ *op cit.— Anon., ’The Fairchild Camera Transit…’ *op cit.* (some text in this publication has been taken verbatim from Bailey (’A New camera transit…’ *op cit*) including the mistaken aperture (f/6.9 instead of f/6.8), while the sections on functionality and the bibliography are identical to text in Sanders (’How the Camera Transit is used in Survey Work…’ *op cit*). The images in that publication are also Fairchild stock photos.


25. Sanders, ’How the Camera Transit is used in Survey Work…’ *op cit*.

26. Sanders, ’How the Camera Transit is used in Survey Work…’ *op cit*.


28. The Tri-Metrogon set up was a coupling of three Fairchild K-17B aerial cameras fitted with Metrogon lenses, whereby the center camera was set at vertical flanked by two units set at 45º oblique positions, thus providing for a horizon-to-horizon image capture (cf. Spennemann, Dirk HR [2012] Interpreting WWII intelligence data for cultural heritage studies. *Journal of Conflict Archaeology* vol. 7 n° 2.).

29. Sanders, ’How the Camera Transit is used in Survey Work…’ *op cit*., p. 33.

30. It was acknowledged that ’[f]or the average individual land surveyor the camera transit represents a rather considerable investment (Sanders, ’How the Camera Transit is used in Survey Work…’ *op cit*).


32. The camera was acquired on eBay (#300528792362 February 2011) from a seller based in Florida. Enquiries regarding its provenance revealed that the unit had been part of an acquisition surplus from educations institutions, and that it was not possible to track down the detailed provenance.

33. Matching numbers on front and rear cells.

34. Such as ’The Fairchild Camera Transit.’ *The International Hydrographic Review* vol. 25 n° 2, 1948, pp. 59–62

35. Sanders, ’How the Camera Transit is used in Survey Work…’ *op cit* noted that “the demand at this time [December 1946] involves such small quantities as to make it necessary to build up the instruments by hand to fill the individual orders that are received.” (p. 33).