

Carto Norge

42 Survey Engineer Regiment's Norwegian Mapping Tasks 1968 - 1982

Overview

'*Carto Norge*' was the exercise name for annual deployments to Norway between 1968 and 1976. 47 Cartographic Squadron mounted them from 1968 to 1972, then 42 Survey Engineer Regiment reorganised and 47 Squadron was disbanded and its two troops, Air Survey and Cartographic, together with the Reproduction Troop formed 22 Map Production Squadron. This new unit then mounted the 1973 exercise. 1974 saw the start of a three year programme to produce a block of twelve sheets for series M 711 and the fieldwork phases were led by 19 Topographic Squadron supported by personnel from elsewhere in the Regiment. The first of these deployments was called *Abanilla*, but the name reverted to *Carto Norge* for the 1975 and 1976 deployments. Because 47 Squadron was so small their exercises tended to be full squadron affairs including the headquarters elements of the OC, SSM and SQMS but thereafter the deployments were based around an enhanced Troop.

All the exercises involved field work to support the production of mapping produced on return to the Regiment's base at Barton Stacey.

Mapping of Norway

NATO Geographic Policy stated that nations were responsible for mapping their own territory at a scale of 1:50,000 but must make the mapping available to other member nations. Norway's national mapping at that scale was produced on regular sheet lines covering the entire country and was made available for NATO designated as series M 711. The UK's equivalent was the Ordnance Survey's Landranger series which was produced as a military version designated series M 726.

Norway had another 1:50,000 series entitled M 714. This series comprised 16 sheets on irregular sheet lines as each one covered a garrison or training area and was produced for solely military use.

Series M 816 was a series of over 50 sheets produced at a scale of 1:25,000 each covering an area of specific military interest such as a training area or garrison.

The First *Carto Norge*: 1968 Mjölfjell

From the 13th to the 31st of July 1968 47 Cartographic Squadron deployed to Mjölfjell near Voss on the first *Exercise Carto Norge* to carry out field survey work necessary for the subsequent plotting at 1:25,000 of a map of the artillery range in the mountains to the north of the village.

The main party under the OC, Major Tom Linley, flew to Bergen whilst the road party under Captain Patrick Fagan drove to Tynemouth and sailed by ferry to join them.

The squadron then left Bergen in convoy comprising Land Rovers and a 3-ton truck with all the stores and some of the men in the back. A local had advised going via Dale instead of the longer route through Granvin however, this road proved unsuitable for the truck which later slipped over onto its side but luckily nobody was injured. The vehicle was unloaded and using much muscle power it was

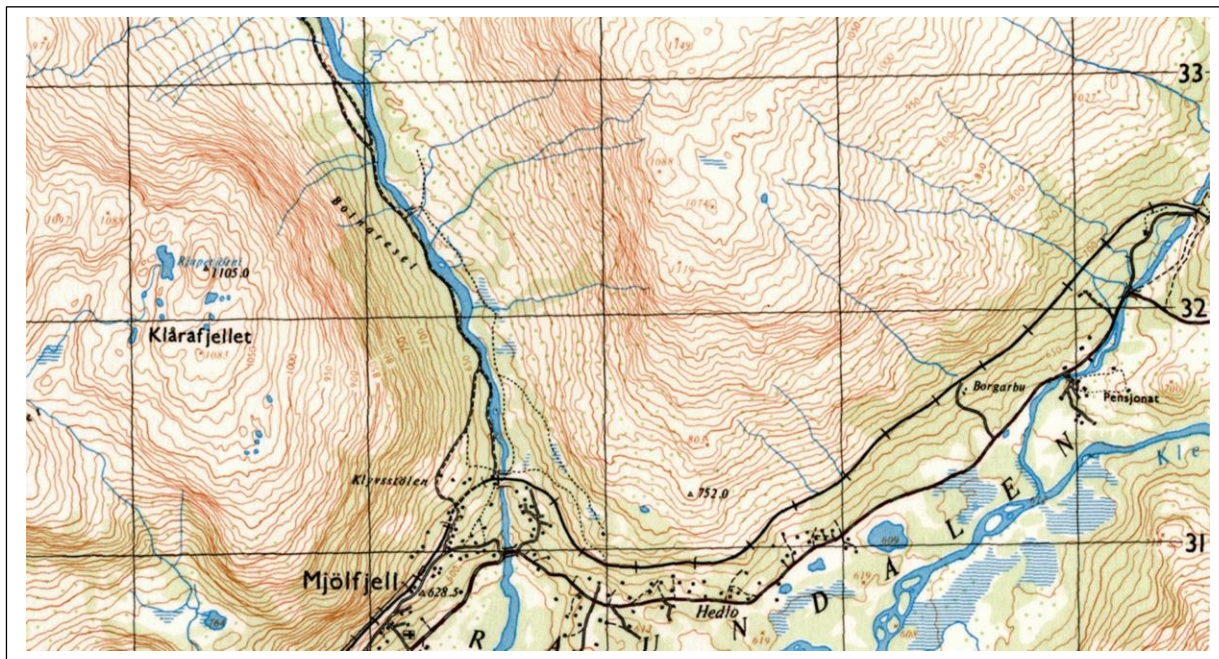


Sergeant Colin Price working on the production of a PIR at a typical Norwegian trig marker.

finally righted and the journey continued to the wooden huts on the outskirts of the village that was to be the unit's base.

The field work consisted of identifying and producing Point Identification Reports (PIR) of existing trig points and artillery survey points for the plan control, establishing additional height control by altimetry and carrying out field annotation of the air photography. The unit split into two parties to carry out the work, one staying at the Mjölfjell base and a smaller group that moved to a timber hut about five km into the map area from where pairs of surveyors moved further north sleeping in two-man tents. The work progressed without problems and was completed on time.

The map sheet to be produced was designated Series M 816, Sheet Mjölfjell, Edition 1-GSGS and produced to a specification provided by the Norwegian Mapping Authority. The air photography was provided by Wideroe, a Norwegian company, and was of an excellent quality taken with a Wild RC 8 camera in 1968.



An extract from M 816 Mjölfjell, Edition 1-GSGS

The task was significant in that it was the first production task for the Regiment's newly installed Wild B8 stereo plotting machine and the resultant map sheet was to be assessed by the Norwegian mapping authority. The ground control was sufficient and positioned such that aerial triangulation was not necessary. To ensure a uniform standard of plotting and cartographic work all the air survey work was done by one person, Corporal Alan Gordon who had recently attended a Wild B8 course at the Swiss School of Photogrammetry, and the compilation and the subsequent scribing of detail and contours was carried out by one cartographic draughtsman, Lance Corporal Pat Paterson. The sheet was printed by 22 Lithographic Squadron in July 1969.

A version of this map with a field firing overlay was published as GSGS Misc 2334 in 1971 however this was an incorrect title and it was replaced by a reprint published as GSGS 5153 in 1972.

An extension to the western edge of the sheet was carried out in 1970 and field checked as part of exercise *Carto Norge 70* and published by FKT, the Norwegian mapping authority, in 1972 as a second edition with marginal information stating that it was produced by 47 Carto Sqn in 1968 and 1970 with the print note TRYKT 1 NGO 11-72.

Carto Norge 69: Kampen

In 1969, the task was to produce a map at 1:50,000 of the Kampen Training Area which is located to the North West of Bardu and a 1:25 000 map of part of that area called Heggelia. On Monday 14th July a party of 25 left Barton Stacey on the four-day journey by sea, rail, ferry and bus organised by the travel agency Hogg, Robinson and Gardener Mountain, to the Norwegian Army Barracks on the Southern edge of Bardu at latitude 69° North. All involved considered the complicated journey an amazing experience. Key personnel were OC Major Tom Linley with WO2 Frank Lyons as SSM, Staff Sergeants Mick Callow and 'Bunny' Burrell controlled the technical activities supported by Sergeant Jim Jefferies responsible for the Trig Scheme and cartographer Sergeant Dave Draycott.



Theodolite observations at Orrefjell by Sappers Stones and Johnson.

The work was again producing PIRs of existing trig points and air photo annotation but this time the task was rather more difficult as the cover was RAF photography taken in 1969 with an F49 camera and the prints were all underexposed. There was also a trig scheme to put in more control which involved visiting each existing and proposed station, some at almost 1,500 metres above sea level and quite remote involving very long walks, and erecting an RA beacon and then revisiting to carry out the observations. Again the task went according to plan and the unit left for the four day return trip arriving back at Barton Stacey on the 9th of August.

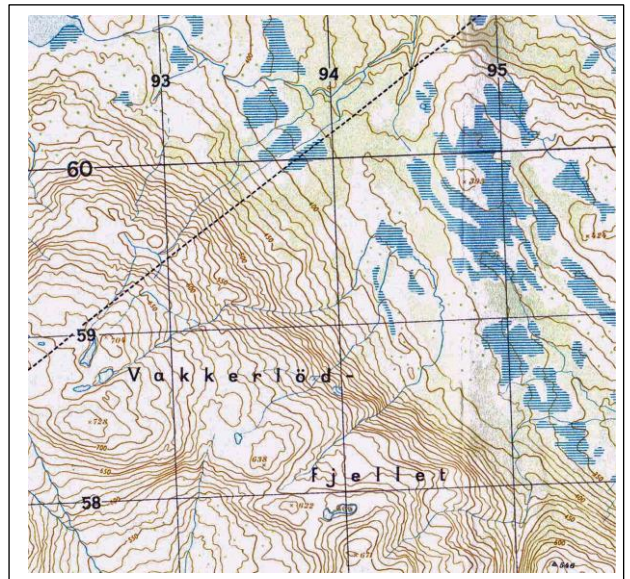
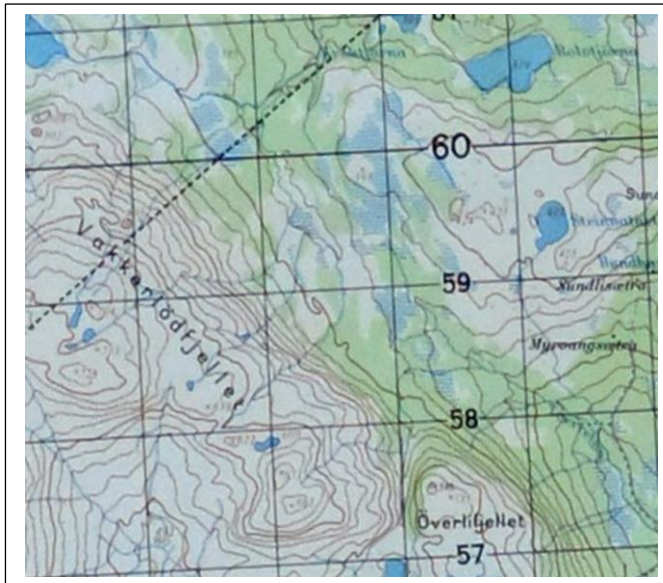


The Kampen sheet was the first task that used Air Survey Troop's Hilger and Watts Stereocomparator in Block 101. Its automatic recording capability and paper tape output were innovative at the time.

Aerial triangulation was carried out on the recently installed Hilger Watts stereocomparator and computed at Feltham where the adjusted control along with the map sheet corners and other geographical intersections and the map grid were plotted using the Zuse digital plotter, the first time this had been done.

The detail was plotted at a scale of 1:25,000 on the squadron's sole Wild B8 by Corporals Brian Garvey and Graham Longley operating on shifts. At this time operating the Wild B8 was the sole preserve of experienced corporals. The map was published in 1971 as Series M 714, Sheet Kampen, Edition 1-GSGS with the print note 'Printed by 42 Survey Engineer Regiment 12/71/1889/OA'.

The air survey plots were then used to produce Series M 816, Sheet Heggelia, Edition 1-NOR which was published by FKT in 1973.



Extracts from M 714 Kampen at 1:50,000 (left) and M 816 Heggelia (right) at 1:25,000; both map sheets were produced from the same air survey plots.

Carto Norge 70: Blåtind

The detachment again comprised 25 personnel but this time under the command of Major Hugh Woodrow with WO2 Don Kirk now the SSM and Staff Sergeant Mick Callow, Sergeants Bev Hill and Jim Jefferies as the SNCOs.

The exercise commenced on the 11th of July with a BEA flight to Oslo then the main party flew on to Bardufoss and Sergeant Jim Jefferies and two sappers flew to Bergen and then moved to a Norwegian Army camp at Bomøen a few kilometres to the East of the Voss. From here they spent a week field checking an extension to the Mjölfjell sheet using plane table methods before flying north to join the main previously mentioned party. This was possibly the last time that plane table methods were used on a 'live' task.

The base this year was a tented camp at Akkasaeter, a remote farmstead about 3km from a metalled road.

Technical work again consisted of photo identification of trig points and interpretation of detail on the 1969 RAF air photography and altimetry heighting. Several altimetry traverses were carried out and one was a two day affair using pairs of Land Rovers but as the terrain became steeper and more rugged they were reduced to arduous walking over the rough terrain and an overnight bivouac.



Sapper Jimmy Hamilton plane tabling at Mjölfjell.



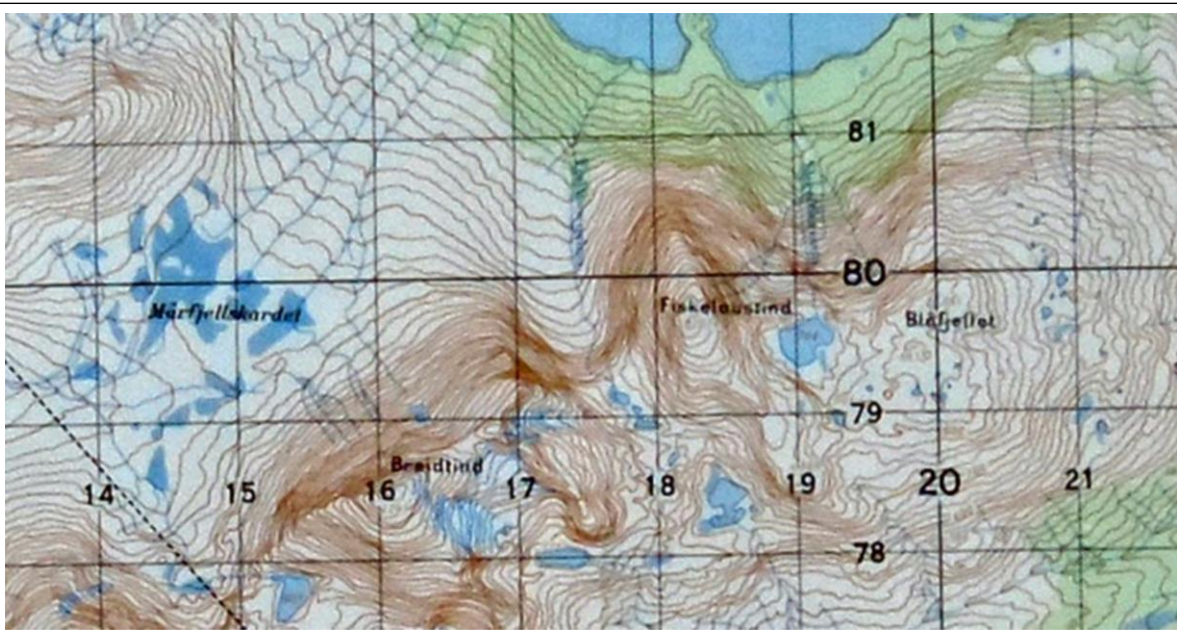
Sergeant Jim Jefferies admires the view at Vourak trig point whilst waiting for the Negretti and Zambra altimeter to settle.

Communications with the Regiment were difficult with every scheduled call interrupted by Russian interference. Quick selection of an alternative frequency was swiftly followed by more interference. The Cold War was real in those days!

With the task successfully completed the camp was struck on the 30th of July and the detachment returned by air to Barton Stacey arriving on the 1st of August.

The aerial triangulation and adjustment was carried out as the previous year and the Geodetic Office at Feltham again produced Zuse graphics for the plotting, which was again on the Wild B8, followed by the cartographic stage. The map was field checked in 1971, printed by 22

Lithographic Squadron and finally published as Series M 714, Sheet Blåtind, Edition 1-GSGS in 1972. Once again the air survey plots were used to produce a 1:25,000 sheet of part of the area which was published as Series M 816, Sheet Akkasaeter.



An extract from M 714 Sheet Blåtind showing the rugged nature of the countryside and the importance of accurate contouring by the B8 operators.

Carto Norge 71: Bjerkvik

On the 6th of July Major Hugh Woodrow and 31 soldiers together with the stores and Land Rovers travelled by air to Bardufoss and then by road to the campsite outside

Bjerkvik. Sergeants Bev Hill, Dave Mead and Mick Ward led three field parties tasked with photo annotation for a 1:50,000 M 714 sheet north of Bjerkvik. It is believed that this was a pilot sheet for further M 714 work.

There was no requirement this year for PIR work as the Norwegians had reliable coverage in that area. Work was completed and the detachment returned to the UK on the 31st of July.



Sergeants Bev Hill, Taff Hemming (SQMS) and Dave Mead in the SNCO living accommodation which was also used for technical work during Carto Norge 71.

47 Squadron now had three Wild B8s and these were now the standard plotting instrument operated by all air surveyors. The sheet was compiled and submitted to the Norwegian Mapping Authority who subsequently rejected it. There was a great deal of marshy land with small ponds and lakes and it was the generalisation of these water features and those up in the areas above the treeline that caused the Norwegians to reject the sheet because that was the detail the Norwegians used for navigation on the ground in conjunction with contours. The Norwegians sent an annotated stereo overlap indicating the detail required, the intricacy of which was extremely surprising.

The rejected sheet was not re-worked or published as a GSGS edition and no further M 714 work was carried out by 42 Regiment. However, the air survey plots were used to produce a 1:25,000 scale sheet of part of the area which was published as Series M 816, Sheet Elvegardmoen.

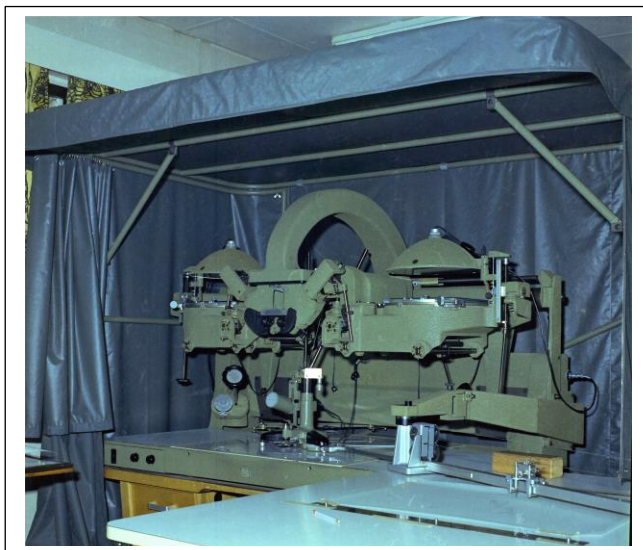
Carto Norge 72: Mosjøen

Captain Peter Savage and 29 soldiers deployed by air into Bodo on the 28th of June and travelled by road to Mosjøen. The group divided into two with a party of six under Staff Sergeant Bev Hill going north to field check the 1:50,000 map sheet of Bjerkvik produced from the previous year's work. After two weeks they returned to Mosjøen to join the main group in carrying out photo annotation in the Drevja area which is just to the north of the town. The task was completed on time and the detachment returned to the UK on the 24th of July.

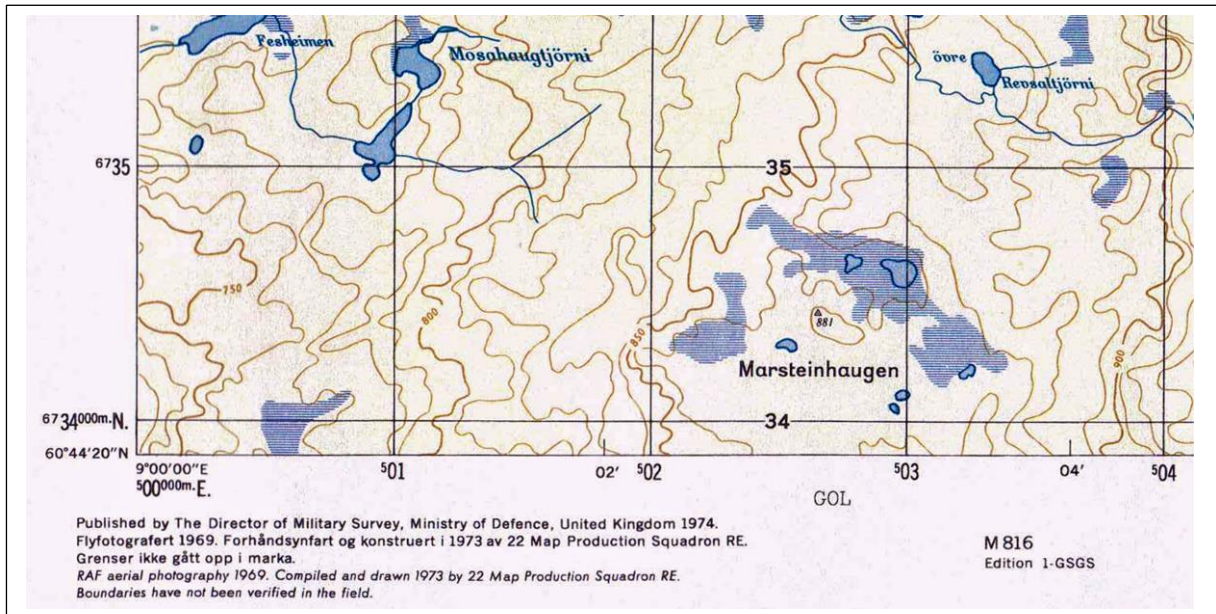
Over the winter period a 1:25,000 map sheet Series M 816, Sheet Drevja was produced and accepted by the Norwegian authority mapping.

Carto Norge 73: Tisleia

On the 29th of June Captain Viv Darby and 29 soldiers sailed from Newcastle to Bergen and moved on to a Norwegian Army camp. They carried out photo annotation in the Tisleia area and returned to the UK on the 30th of July. No further details of this deployment are known but a 1:25,000 map sheet was produced and published in 1974 as Series M 816 Sheet Tisleia.



Air Survey Troop's original Wild B8 stereo plotting machine



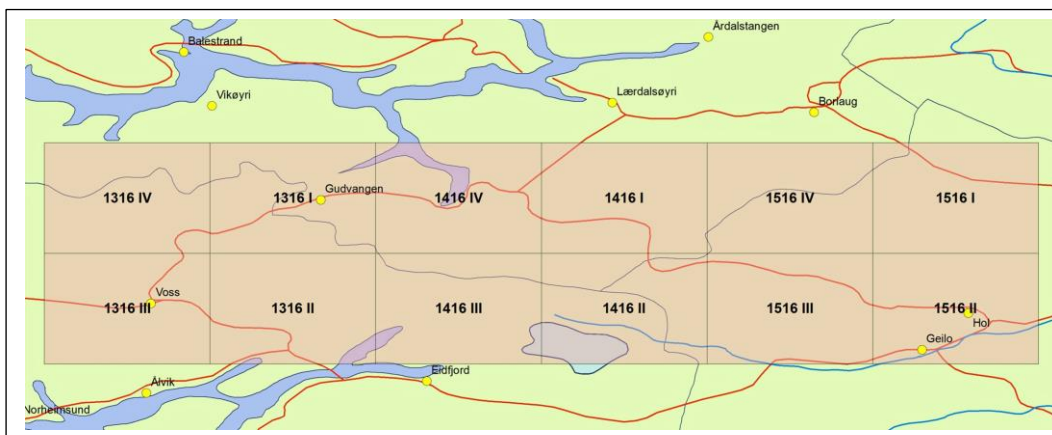
Extract from M 816 Sheet Tisleia showing very different terrain from the earlier mountainous sheets and the attribution to the short-lived 22 Map Production Squadron RE.

The M 711 Project: Norwegian National Mapping

The Task

During 1973 negotiations were conducted between D Survey 2 and the Norwegian Mapping Authorities regarding the proposal that 42 Survey Engineer Regiment should produce a block of twelve sheets of the 1:50,000 series M 711, the Norwegian national mapping series. It is of note that previous work by the Regiment on Norwegian 1:50,000 mapping was for series M 714 which was a specifically military series. Producing sheets for series M 711 was of a different order in that it was the equivalent of a foreign army being tasked to produce a block of maps for the Ordnance Survey Landranger series of Great Britain.

The block comprised the four quadrants, identified as I to IV, of sheets 1316, 1416 and 1516 stretching eastwards across Norway from Voss to Geilo.



Extract from the Carto Norge cover diagram produced by the Defence Geographic Centre JFIG in 2015 showing the twelve M 711 sheets tasked to 42 Survey Engineer Regiment.

This was a very serious undertaking as regards both the scope of the task and the exacting standards to which the air surveyors and cartographers were to work. There was initially concern at the Directorate that a large proportion of the Regiment's air survey and cartographic capacity would be committed for five years possibly to the detriment of operational tasking.

The Plan

The RAF was tasked to fly the photography during the summer of 1973. Flight lines were to be east-west with four tie strips and the photo scale was to be 1:50,000.

Initially the plan was for field detachments in 1974 and 1975 however, it was later decided to spread the field work over three years and to obtain helicopter support from the Army Air Corps.

The planned work production cycle was for the field work on sheet 1316 to be completed by the end of July 1974, air survey work then to run until the end of April 1975 followed by the Norwegians field checking and office editing through to the end of March 1976 when the reproduction stages would be carried out, including a further edit of the proofs by the Norwegians, with the four sheets printed in June 1977. This cycle was to be repeated with sheet 1416 started in 1975 and printed in 1978 and 1516 started in 1976 and finished in 1979; a five year commitment.

Exercise Abanilla 1974

For some reason the Norway deployment of 1974 was called *Exercise Abanilla* although those taking part referred to it as *Carto Norge 74*. Air Survey Troop from 22 Map Production Squadron under command of Captain John Cobbing RCE and supported by three Sioux helicopters together with their air and ground crews from 2 Flight Army Air Corps deployed to Tvildemoen Camp, a Norwegian Army base near Voss which lies between Hardanger and Sogn fjords and alongside Vangsvatnet Lake for two months during the summer of 1974. This was a considerably bigger task than the previous single map sheet exercises hence the need for helicopter support.

The field work entailed identifying ground control and producing PIRs and carrying out field annotation in preparation for the production of the four quadrant sheets of sheet 1316. Control points were pre-marked and spotting photography was taken with a Vinten F95 camera attached to the Sioux helicopters and processed in the camp by Sergeant Roy Stevens, a photographic technician.

Carto Norge 75

The following year saw *Exercise Carto Norge 75* depart from Newcastle on the 28th of June to continue the field work for the 12 sheets. The detachment was under command of Major Mike Nolan, Officer Commanding 19 Topographic Squadron, and comprised two officers and 35 soldiers from and supported by 14 personnel from 7 Regiment Army Air Corps. Again the surveyors stayed at Tvildemoen Camp near Voss in four wooden barrack blocks. The air survey SNCOs were Staff Sergeant Neil Gilhespy and Sergeant Ted Davies. The aim of the exercise was to provide up to date information on the reliability of the lake levels and the bench marks on the existing maps. To find, pre-mark and fly spotting photography of the 61 control points selected by the air surveyors for the task and also establish, pre-mark and fly spotting photography of five new control points on the Hardangerjokulen Glacier. The spotting photography was taken with a F95 camera on a mount fixed to the Allouette helicopters and trials were also carried out using a Hasselblad camera. Again, the spotting photography was processed in the field by Sergeant Stevens using a Jobo processor.

A Wild Pug 4 point transfer device was used to transfer the point position from the F95 prints to the F49 survey cover. This was possibly the first time this instrument was taken into the field. Field annotation was also carried out over a wide area.

One other item of interest on this deployment was that one of the helicopters was used to evacuate an injured Norwegian climber from a glacier and take him to hospital. The detachment returned to Barton Stacey on the 25th of August.

Carto Norge 76

Carto Norge 76 took place between the 1st of July and the 5th of September and comprised two officers and 35 soldiers plus 14 attached personnel from the Army Air Corps with two Gazelle helicopters all under command of Captain Geoff Parkes with Staff Sergeants 'Lofty' Branson, Jock Stockley and Geoff Tolley as the lead SNCOs. The detachment was based at Torpo to the east of the mapping block and this time accommodation was under canvas. Rows of 180 lb tents occupied the village camp site, a meadow sloping down to a river, and the camp's log cabin was taken over as the bar. The work carried was similar to previous years; point identification and production of PIRs including using F95 spotting photography processed in the camp by Sergeant Jim Dale, photo annotation and provision of some additional control points.



After being helicoptered to a summit Corporal Jimmy Hamilton sets out a pre-mark ready for the spotting photography.



Hearts and minds: Corporal Ian MacDiarmid briefing a teacher during the local school's visit.

The extended stay this year allowed for personnel to enjoy some adventurous training and also to get involved in a number of projects with the local community.

The Hallingdal valley is known as a particularly insular farming community who would never have had contact with British forces before and indeed were generally unwelcoming to strangers. The detachment made huge efforts to win the 'hearts and minds' of this relatively closed community through a variety of means and were extremely successful to the point that they were invited to join in the Geilo carnival and were the subject of a praiseworthy article in the local paper.

Based on these efforts 19 Squadron achieved joint runner up in the Engineer-in-Chief's Award for 1976.

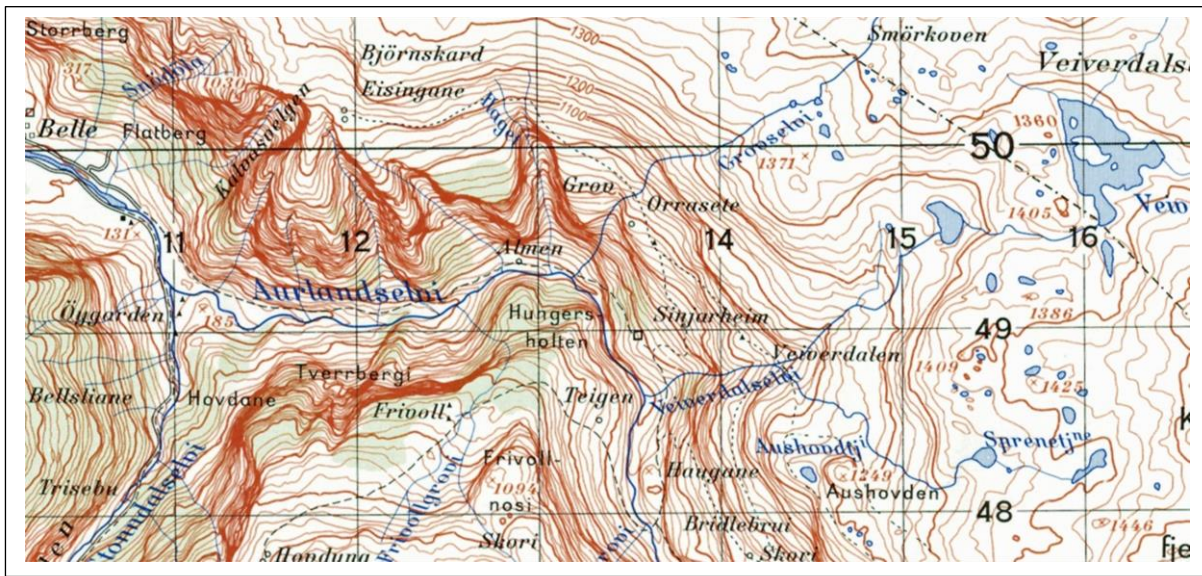
M 711 Map Production Work

Production of the block of 12 sheets was the Regiment's major air survey and cartographic task from 1974 until almost the end of the decade. The 1973 photography was flown and processed by the RAF when the majority of 6 ASLS were on detachment. Unfortunately the planning had not taken into account the large height differences, the steepness of the fjords and the sun angles which resulted in short overlaps and deep shadows which together created enormous problems during the aerial triangulation and plotting stages.

Work on the western sheet, 1316, started soon after the deployment returned to UK with the aerial triangulation observations on the Hilger Watts Stereocomparator which were then computed at MCE in Feltham. The acknowledged relative inexperience of the observers together with the poor photography led to residuals exceeding the tolerance and thus the need to re-observe many points. An acceptable

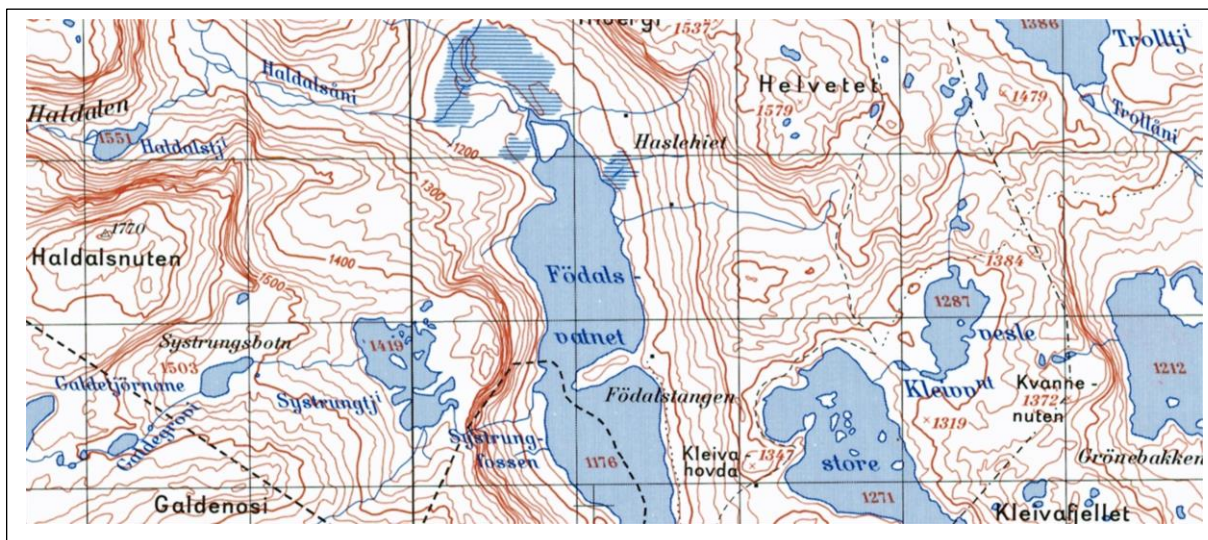
solution was finally achieved and the four sheets were then plotted using the unit's three Wild B8s. Proofs were sent to Norway for field checking and editing followed by amendments and then final cartographic work and then through the reproduction processes with all four sheets printed and published during October and November 1977.

However, the production of the centre block, the four 1416 sheets, did not go so well and they were rejected by the Norwegians following their field check and edit. The Regiment was not made aware of the failure of the sheets until January 1978. Problems had been noted during the aerial triangulation stage to such an extent that the RAF re-flew the task in October 1976 using flight plans that took into account the extreme terrain and sun angle.



Extract from M 711 Sheet 1316 I showing the steepness of the terrain that was not taken into account when flight planning; one factor in the subsequent rejection of the four sheets in 1978.

Meanwhile, whilst the Norwegians were checking 1416 the production work on the final sheets, 1516, was started but behind schedule waiting for the new photography.



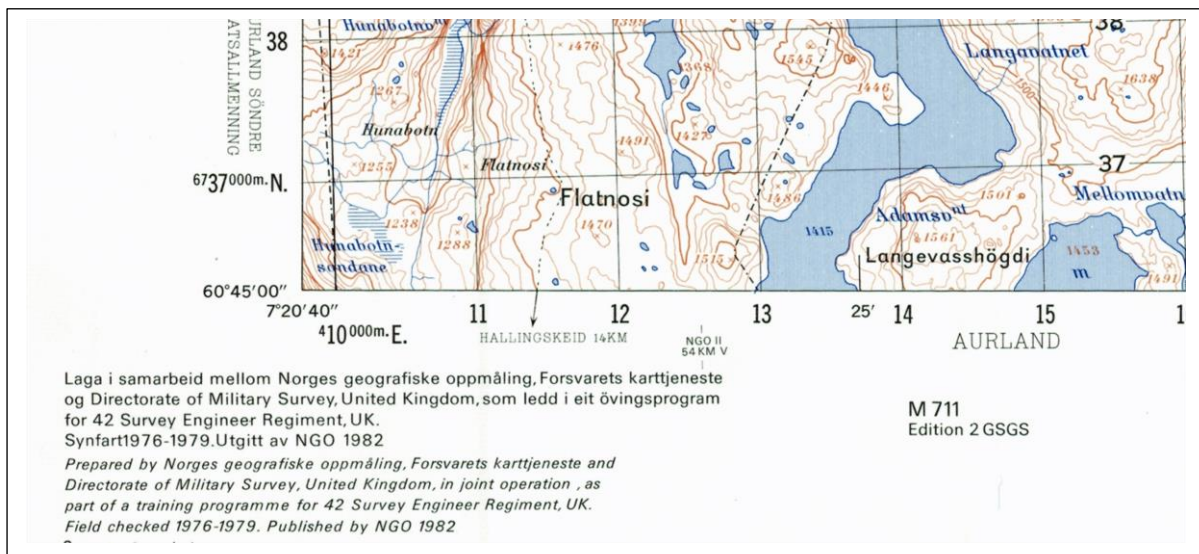
Extract from M 711 Sheet 1516 IV: working opposite shifts on this sheet was the first plotting task for Sappers Chris Teeling and Glen Wilkinson immediately after completing their primary air survey technician training in 1977 – an example of how inexperienced technicians still managed to produce excellent work.

All air survey work was completed in the autumn of 1977 immediately prior to all technical work in the Regiment ceasing when the unit was deployed across Hampshire on *Operation Burberry*, the Fireman's Strike, to man Green Goddess fire engines. The strike continued until the 19th of January 1978. Field checking had to be done in the summer time so the Norwegians checked 1516 in the summer of 1978 instead of the planned year earlier which led to the sheets being successfully published in 1981.

The Regiment learnt that 1416 had been rejected by the Norwegians a week before the end of the Firemen's Strike. The Commanding Officer, Lieutenant Colonel Peter Andrews who was new in post, called Staff Sergeant Alan Gordon, who had only re-joined the unit at the start of the strike and hence had no involvement in the task, to a meeting and tasked him to investigate the causes of the failure and recommend changes to procedures to ensure that the re-worked sheets would pass Norwegian scrutiny.

The conclusions were that the sheets failed for mainly two reasons; the first being the poor quality photography and the second was a lack of continuity in the plotting staff due to the task not being given sufficient priority when considered against the routine of military life e.g. regimental duties, military training, postings and other disturbances.

The Commanding Officer gave the re-plotting a high priority, all air surveyors were stereo tested using the latest system used by the School of Military Survey and those with the best results formed the plot section and more rigorous checking procedures were put into place. The re-plotting of the four 1416 sheets using the 1976 photography started in the spring of 1978 with Sergeants Steve Bridge and Ted Davies overseeing the plot section until the air survey stage was completed in early 1979 ready for Norwegian field checking that summer. The four sheets were accepted and published in 1982 bringing to a close the *Carto Norge* tasking that had started fourteen years previously.



Extract from M 711 Sheet 1416 II with text confirming the extended field checking due to the rejection of the initial work.

Summary

The *Carto Norge* exercises and the subsequent map production tasks led to the production and publication of fourteen 1:50,000 scales map sheets and seven at a scale of 1:25,000. This was a considerable undertaking for the Regiment at a time when it was also committed to operational work in support of *Operation Banner* in Northern Ireland and other sundry tasks.

Sheet Number	Name	Edition	Date Published	Date Printed
1316 I	Gudvangen	2-GSGS	1977	Oct 1977
1316 II	Ulvik	2-GSGS	1978	Oct 1977
1316 III	Voss	3-GSGS	1978	Nov 1977
1316 IV	Myrkdalen	2-GSGS	1978	Oct 1977
1416 I	Aurlandsdalen	2-GSGS	1982	Oct 1982
1416 II	Hardangerjokulen	2-GSGS	1982	Oct 1982
1416 III	Myrdal	2-GSGS	1982	Oct 1982
1416 IV	Aurland	2-GSGS	1982	Oct 1982
1516 I	Gyrinosvatnet	2-GSGS	1981	Aug 1981
1516 II	Geilo	2-GSGS	1981	Sep 1981
1516 III	Hallingskarvet	2-GSGS	1981	Jul 1981
1516 IV	Djup	2-GSGS	1981	Apr 1981

Publication details of the block of twelve M 711 sheets.

The field exercises grew from a modest 18 day deployment to support the production of a relatively small 1:25,000 scale map sheet into two-month long exercises that included helicopter support for the field work for four 1:50,000 sheets produced to national mapping standards.



Electronic distance measurement with the tellurometer operated by field surveyor Lance Corporal George Dixon with cartographer Corporal Steve Clarke booking, an example of how these exercises gave the generally office-based air surveyors and cartographers an insight into the field survey work that preceded their involvement in the map production process.

These exercises provided valuable training over nearly a decade in that they gave air survey and cartographic technicians the opportunity to visit and see first-hand the terrain that they would subsequently view through a Wild B8 or scribe onto plastic. It showed how difficult it is for a field surveyor to positively identify a control point marked by a stone cairn on a stone covered mountain top on an air photograph of dubious quality.

However, producing air survey work to stringent national mapping standards raised other issues. Mainly that the flight planning needs to be done correctly, the photography must be of the highest standard commensurate with the camera used for the task and, if given the right priority so that there is continuity to the work force, then soldier technicians are able to work to very high standards.

Compiled in 2017 by Alan Gordon from 42 Survey Engineer Regiment Annual Historical Record Reports and various maps and documents provided from DGC records by Brian Garvan particularly the final draft agreement between the Directorate of Military Survey UK and Forsvarets Karttjeneste Norway for the production of twelve sheets of series M 711 and the minutes of photogrammetric task meeting post Exercise Abanilla held on 10 Feb 1975.

Of equal importance were the personal memories of Garry Asbery, Mick Clowes, Ted Davis, Tony Harder, Pete Hesketh, Bev Hill, Jim Jefferies, Dave Mead, Mike Nolan, Colin Price, Roy Stevens, Chris Teeling and the author - all former members of a squadron involved in these exercises and the subsequent map production.

The author is gratefully to Mandy Warrington-Brown and Colin Wright from the Defence Geographic Centre for their help in arranging for permission to reproduce the map extracts included in this article.

All maps reproduced with the authority of the Defence Geographic Centre, Ministry of Defence, United Kingdom, 2017.