

**HISTORY  
OF THE  
FOURTH FIELD SURVEY BATTALION  
R.E.**

**BY  
LIEUT. COL. M.N. MACLEOD D.S.O. M.C. R.E.  
COMMANDING OFFICER**

4th Field Survey Battalion  
( Rubber stamp on original )

Lt. Col. E.M. Jack C.M.G. D.S.O. R.E.

I despatch herewith a history of this Battalion from its formation up to the beginning of 1919 the date of its arrival in Germany.

I have given statistics of the work done as far as it has been possible to compile them from the records which have been kept.

Unfortunately owing to their bulk it was necessary to destroy many of the records of the work, particularly of the Observation Section and the periods selected for statistics are always the most characteristic.

Much of the history has had to be written from memory and there may be a few mistakes in details. This I fear is unavoidable.

Yours sincerely,

26th June 1919

Lieut - Colonel, R.E.  
Cmdg. 4th Field Survey Battalion, R.E.

A HISTORY OF THE FOURTH FIELD SURVEY BATTALION, R.E.

in five parts

Forward and Index.

- Part I. HEADQUARTERS SECTION.
- Part II. TRIG. and TOPO SECTION.
- Part III. MAPPING and PRINTING SECTION.
- Part IV. MAP ISSUE SECTION.
- Part V. OBSERVATION SECTION - under which is included :
- (a) Observation Groups and Calibration,
  - (b) Sound Ranging Sections, and
  - (c) Compilation of results obtained.

HISTORY

of the

FOURTH FIELD SURVEY BATTALION, R.E.

FORWARD AND INDEX.

HISTORY

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## FOURTH FIELD SURVEY BATTALION, R.E.

### Introduction

In the following account the formation and activities of the 4th Field Survey Battalion, its history and working are described under the following headings :-

#### Part I Headquarters Section

Dealing with formation, organization, personnel and administration.

#### Part II Trig and Topo Section.

Dealing with outdoor survey work, battery fixation, artillery boards, and cognate work.

#### Part III Mapping and Printing Section.

Dealing with compilation, drawing, and printing of maps.

#### Part IV Map Issue Section.

Dealing with the issue and distribution of maps.

#### Part V Observation Section.

This is sub-divided into three sections, A, B, and C.

A. Dealing with the work of the Observation Groups and the Calibration Section.

B. Dealing with the Sound Ranging Sections.

C. Dealing with the compilation of results obtained by Groups and Sections.

Each of these descriptions has been written as a narrative as nearly complete in itself as possible. The Sections, however, necessarily overlapped to some extent and there is a certain amount of repetition taking the history as a whole.

The work of the Battalion is further classified into the following periods, each of which indicates a definite change of front or policy:

Period February 1916 - March 1917. The SOMME Battle.

Period March 1917 - July 1917. The German retreat to, and occupation of, the "Hindenburg Line".

Period July 1917 - November 1917. Operations on the Coast.

Period November 1917 - April 1918. Winter on the YPRES Salient.

Period April 1918 - August 1918. German offensive in Flanders.

Period August 1918 - November 1918. German retreat and British offensive in Flanders.

Various orders and instructions issued from time to time to the Units in the Battalion which may be of interest are attached as Annexes.

## PART I

HEADQUARTERS SECTION.

HEADQUARTERS SECTION.

Fourth Field Survey Battalion R.E.

Period February 1916 - November 1917.

The 4th Field Survey Company was formed under the Command of Captain M.N. MacLeod R.E. as part of the Fourth Army H.Q. This officer joined the Fourth Army H.Q. then assembling at TILQUES, on February 18th. The actual formation of the Company did not commence until the Army H.Q. moved to QUERRIEU on February 26th. The Company was formed from a nucleus consisting of a Topo and Printing Section intended originally for service in Salonica and sent to France under the Command of Captain B.F.E. Keeling, R.E. ( at the beginning of 1916 )

This Topo and Printing Section may be said to have represented the final effort on the part of the Ordnance Survey in finding personnel, and as no further reinforcements could be obtained through Maps G.H.Q., it was necessary to find all other personnel required in the Army.

The most important of these were :-

- (1) Adjutant & Quartermaster.
- (2) Q.M.S. & Pay Sergeant.
- (3) Clerks.
- (4) Computers.
- (5) Draughtsmen.
- (6) Storemen Packers.
- (7) Cooks.

C.Q.M.S. Cackett from the 145th Army Troops Company was applied for from 1st Army as C.Q.M.S. and a circular letter was sent to Divisions in the Army asking them to submit names of Officers and men considered suitable for the other duties.

From the names sent in a number of men were selected and directed to report at QUERRIEU for examination.

The candidates were then examined by the O.C. in Drawing, Computing, or Clerks duties according to their qualifications and a selection made on the results of this examination.

The clerks, one computer and about eight or nine draughtsmen were obtained in this way and retained with the Company.

None of these men had any knowledge of the special duties which they were called upon to perform, and all required considerable further training and instruction before they became efficient. In the Clerk's office particularly, the lack of anyone familiar with military office routine and procedure was greatly felt.

Eventually a man was found in the Observation Section handed over by the 3rd Field Survey Company who had experience of clerks' work in a Brigade office, and he was brought into H.Q. as chief clerk, which position he has filled ever since.

Several officers were interviewed for the post of Adjutant but none of the first applications was considered suitable. 2/Lieut Evill, 2nd Manchesters was eventually selected and joined the Company on 22nd March 1916.

At the end of March 1916, officers of the 4th Field Survey Company were :-

O.C.	Capt M.N. MacLeod, R.E.
O.C. Topo Section	Capt B.F.E. Keeling, R.E. with Lieut. & Q.M. T. Johnson.
Adjutant	Lieut. G. Evill.
O.C. Printing Section	2/Lieut. R. Quigly, R.E.
Compiling Section	2/Lieut. J. Coburn, R.E.

The accommodation at first available at QUERRIEU for the Company offices was totally inadequate. A small house was found in the village for the Printing Section, and the O.C's office and Map Store placed in a hut on the outskirts of the village. No other buildings being available it was necessary to build huts for the offices. This work was put in hand by the C.E. at once, two corrugated iron huts, 142

x 18 feet and 60 x 18 feet being built in the Chateau grounds. These were complete by about the 15th of March, when the Company offices were moved into them.

Up to this time, the Topo Section had been working in the field under the 3rd Field Survey Company. As soon as the offices were ready, this section was brought to QUERRIEU.

Indents for stores and transport for the Company had been put in at the end of February and these were completed during March, the formation of the Company being complete by the end of that month. During the formation of the Company its duties were carried out by the 3rd Field Survey Company and the work was gradually taken over from it as the necessary men and stores were collected.

The Observation Section was taken over from the 3rd Field Survey Company on the 13th March; with it, three officers, Lieuts. C.Q.L. Penrose, R.G.A. and H.H. Cowan, R.F.A. and 2nd Lieut. Coburn, R.G.A., and about 30 other ranks.

Two Sound Ranging Sections "S" and "R" joined the Company about the end of March:

"S" Section      Lieut A.H. Atkins, R.G.A.  
                          Lieut E.T. Paris, R.G.A.  
                          2/Lt R.B. Peters, R.G.A.

arriving first, and:

"R" Section      Lieut T.G. Hodgkinson.  
                          Lieut R. Gillanders,  
                          Lieut J.A. Lynch,

shortly afterwards.

Two more officers for observation work were found in the Army and the Observation Section was reorganised into two groups, each with two officers as follows :-

No. 1 Group      Lieut C.Q.L. Penrose, R.G.A.  
                          Lieut F.R. James, R.F.A.

No. 2 Group      Lieut H.H. Cowan, R.F.A.  
                          2/Lt E.A. Tarrant, R.G.A.

A further two officers joined the Company later; Lieut W.A. Bell, R.F.A. and 2/Lieut. E. Walford.

No fixed establishment of Observation Groups and Sound Ranging Sections was laid down in War Establishments and the General Staff of the Army were empowered to decide how many were required on the Army front.

In March 1916, a War Establishment for a Field Survey Company was published laying down establishments for :-

H.Q. Section	3 Officers	& 15 Other Ranks
Topo Section	1 Officer	& 16 Other Ranks
Printing & Map Section	1 Officer	& 16 Other Ranks
Observation Group H.Q.	1 Officer	& 2 Other Ranks
Survey Post Squad		8 Other Ranks
Sound Ranging Section	3 Officers	& 18 other Ranks

All the above included A.S.C. drivers (H.T. & M.T. ). A copy of this War Establishment is attached.

These numbers had evidently been fixed before any great experience of Field Survey Company work had been gained and must be regarded as tentative only. In view of later experience they seem ludicrously inadequate, and it was not long before their inadequacy made itself apparent.

After the formation of the Company, the increase of work in all departments was immediate and rapid, moreover, since preparations for the SOMME offensive of 1916 were commencing, the work had to be carried out without delay. To provide the personnel necessary to handle this increasing work, the



expedient was adopted of forming a number of extra Group H.Qs. and Survey Post Squads. The men for these were found in the Army and employed in all branches of the Company. The transport and equipment for these units however, was not drawn unless they were actually employed in the line on the specific duties for which they were theoretically intended.

The strength of the Company on various dates, as a result of these transactions is shown below ( taken from A.F.B. 213).

Strength on	Officers	Other Ranks
March 25th 1916	11	118 ( the first A.F.B. 213 rendered)
April 1st	11	157
May 6th	16	232
June 3rd	17	241
July 1st	20	261
August 5th	12	183
September 2nd	13	198
October 7th	12	198
November 4th	12	225

During April, a third Observation Group of three posts ( it should be noted that as the War Establishment only allowed one officer per group, each group in the line having two officers was shown on paper as two groups ) was put into the line officered by 2/Lieuts. Tarrant and Bell and an additional Group was formed at Company H.Q. to “regularize” the position of 2nd. Lieut. Gardiner, an officer employed on the General Staff at Army H.Q. and borne on the strength of the Field Survey Company.

In July 1916, the “Reserve Army” was formed and Captain Keeling, R.E. left the Company to Command the 5th Field Survey Company, his place being taken by Captain H.J.S. Gaine, R.E. On July 18th, the Reserve Army came into the line, and two complete Observation Groups and one Sound Ranging Section were handed over “ in situ” to the 5th Field Survey Company; with them went the following officers :-

Lieut. Cowan )	No. 2 Group.
Lieut. Walford )	
2/Lt. Tarrant )	No. 3 Group.
2/Lt. Bell )	
Lieut. Hodgkinson)	“R” Sound Ranging Section.
Lieut. Gillanders )	
Lieut. Lynch )	

The remaining Observation Group was split up into two groups under the command of Lieuts. Penrose and James, and two more officers, 2nd Lieut. B.W. Edwards, R. Dub. Fus. and 2nd Lieut. C. Bishop, R.F.A., were obtained for duty with them.

Early in the Summer of 1916, it had been realized that the establishment allowed for a Field Survey Company was inadequate and discussion had been going on throughout the Summer on the subject of a revised establishment. This revised establishment was approved and issued on the 18th November 1916 and allowed the personnel shown in the tables below, which shows the numbers allowed by the new establishment as compared with the old one:-

	Old Establishment		New Establishment	
	Officers	O.R.	Officers	O.R.
H.Q. Section	3)	15)	)	
Topo Section	1) 5	16) 47	) 6	78
Printing & Map Section	1)	16)	)	
Observation Group H.Q.	1	2	2	14

Survey Post Squad	-	8	-	12
Sound Ranging Section	3	18	3	33

As will be seen the new establishment gave substantial increase in all branches, so rapid however was the increase of work that this establishment also proved quite inadequate, as had the last, and was out of date within a month of its publication. The reason of this undoubtedly was that it was based on discussions of experience derived primarily from the operations of June, July and August, the early stages and preparations for the SOMME battle, before the necessity of producing maps at Army H.Q. had been fully established and before sufficient experience of the work of Observation Groups and Sound Ranging Sections in active operations had been gained.

By December, the battle of the Somme was over and the Fourth Army commenced to extend its front by taking over the front held by the French Armies on its right. This necessitated the formation of additional Observation Groups and Sound Ranging Sections.

A third group under Lieut. Coburn was formed in December and two more in February, one of the existing groups, however, being handed over to the 5th Field Survey Company.

Six more officers joined the Battalion on the dates shown :-

Lieut. C.C. Goodwyn	(Ox. & Bucks. L.I.)	17-11-16
Lieut. R.A. Colvin	(A. & S. Highlanders)	19-12-16
Lieut. K.S. Broad	(Leinster Regt.)	21-1-17
2nd Lieut. C.J. Strachan	(Royal Sussex Regt.)	8-3-17
2nd Lieut. L. Leyson	(S. Lancs. Regt.)	16-1-17
2nd Lieut. S. Cursiter	(Scottish Rifles)	19-3-17

the last named taking charge of the Printing Section in place of 2nd. Lieut. Quigly who had left the Company on 12-12-16.

Another Sound Ranging Section ( "H" Section ) under the command of Lieut. H.E. Golding, M.C., was formed early in February and transferred to the 5th Field Survey Company on the 15th, while two more Sound Ranging sections, "G" and "K", formed at G.H.Q. joined the Company on the following dates:-

"K" Section	17-12-1916
"G" Section	21- 3-1917

A large proportion of the personnel for these Groups and Sections had to be found in the Army and trained in the Company and their formation was not complete till the end of March, at which time the Staff and organization of the Company was as follows :-

H.Q. Section.

O.C.	Major M.N. MacLeod.
Adjutant	Captain G.Evill.
O.C. Topo Section	Captain H.J.S. Gaine.
Assistant (for Mapping)	Lieut. K.S. Broad.
O.C. Printing Section.	Lieut. S. Cursiter.
Compiling Officer	Lieut. C.C. Goodwyn.

Observation Groups

No. 1 Group. Lieut. C.Q.L. Penrose.  
Lieut. Chapman

No. 2 Group Lieut. F.R. James.  
Lieut. Leyson.

Sound Ranging Sections

"S" Section. Capt. A.H. Atkins.  
Lieut. E.T. Paris.  
Lieut. E. Lott

"K" Section Lieut. W.R. Darwin.  
Lieut. J.J. Welch.

Lieut. T.M. Harbottle.

No. 3 Group Lieut. J. Coburn  
2/Lt. C.J. Strachan

“G” Section

Lieut. G. Marsden.  
2/Lt. F. Hare.  
2/Lt. G.H. Welch.No. 4 Group. Lieut B.W. Edwards.  
Lieut. Gibbs.Corps Topo Sections.

III Corps	2nd Lieut. W. Anderson.
IV Corps	Lieut. Champion.
XV Corps	Captain A. Godwin-Austen.

The formation of the Corps Topo Sections had been commenced in December and was complete by the end of February. During this time, further discussion had been going on regarding the personnel and organization of a Field Survey Company which resulted in a modified War Establishment being issued in April 1917. This Establishment is shown in the comparative table below :-

	<u>1st W.E.</u>		<u>2nd W.E.</u>		<u>3rd W.E.</u>	
	Officers	O.Rs.	Officers	Ors.	Officers	ORs.
H.Q. Section	5	47	6	78	6	80
Observation Group H.Q.	1	2	2	14	2	14
Survey Post Squad	-	8	-	12	-	12
Sound Ranging Section	3	18	3	33	3	33
Corps Topo Section	-	-	-	-	1	10

This establishment effected little change in the total numbers but allowed of promotion for a proportion of the officers commanding Observation Groups and Sound Ranging Sections to the acting rank of Captain, added an establishment for the Corps Topo Sections, and legislated for the transfer of all Field Survey Company personnel to the R.E.

It did not, however, allow of any extra personnel to work the new printing and photographic machinery which commenced to arrive about this time though it is understood that arrangements were made with the D.A.G. Base to allow of such men as were required for this being carried on the Establishment as supernumeraries. This arrangement was exceedingly unsatisfactory as it was not possible to give such men adequate promotion and transfer them to the R.E., and it became evident that another reorganization and change in the Establishment was inevitable.

The mobile operations during the German retreat to the Hindenburg Line had shown up clearly the difficulty of commanding groups and sections from Army H.Q. in such circumstances, and in June 1917 proposals were put up to Maps G.H.Q. both demi-officially and through the Army, recommending the decentralization of the Command and the reorganization of the Army Field Survey Company into a number of Corps Companies.

These proposals provoked acute controversy and severe criticism and the diversity of opinion was such that the much needed reorganization did not take place till June 1918. The strength of the Company month by month at this period was as follows :-

		Officers	Other Ranks
December	1916	14	233
6th January	1917	17	320
3rd February	1917	26	388
3rd March	1917	24	424
8th April	1917	30	474
6th May	1917	29	503
3rd June	1917	29	513

In March, the Germans commenced their retreat to the Hindenburg Line and early in April, the Fourth Army H.Q. moved up from QUERRIEU to VILLERS CARBONNEL. No buildings existed at this place and the Army H.Q. was accommodated in huts. Company H.Q. remained at QUERRIEU for six weeks after the rest of the Army H.Q. moved forward while huts for it were being put up. The accommodation built consisted of :-

1. Special hut for O.C., Adjutant & Clerks offices about 60 x 18 feet.
2. Special hut for Printing machine and hand presses about 60 x 18 feet.
3. Nissen hut with roof light for letter-press printers.
4. Nissen hut for photographers.
5. Hospital Nissen for Litho-draftsmen, paper store and Printing Officer.
6. Hospital Nissen for Mapping Section & Topo Section.
7. Nissen hut for Compiling Section.
8. Hospital Nissen for Map Store.
9. Nissen hut and marquee for Q.M. Store.
10. Three Nissen huts for Officer Mess and Quarters.
11. Four Marquees and eight bell tents for N.C.Os. and mens quarters and messes.

Pending the construction of these, an office was started in PERONNE which was used as a Map Depot and Advanced Topo Office, and this was maintained after the Company moved up.

The Company H.Q. moved to VILLERS CARBONNEL by road on 6th May, the personnel and equipment, exclusive of the printing machines, required about 45 lorry loads. The move was carried out in three journeys, ten lorries being provided by Army H.Q. the remaining loads were carried forward in the Company's own vehicles.

At the end of May 1917, preparations commenced for moving the Army to the coast and the XV Corps was withdrawn from the line to proceed there. A special Field Survey Company to work with the Corps was formed by G.H.Q. under the command of Major Keeling, R.E. Captain Gaine and Lieut. Goodwyn left to join this Company on 16th June. Preparations were also made to relieve "S" Section with a view to moving it to the coast, and "P" Section under Lieut. Peache, R.E. joined the Company to relieve it. In July the 4th Field Survey Company moved to DUNKERQUE by train and took up its H.Q. in a school in ROSENDAEL, a suburb of that town, taking over from the Field Survey Company XV Corps, one group and one Sound Ranging Section then in line. This S.R. Section was relieved by "S" Section shortly afterwards and left for Egypt. The remaining Groups and Sections of the 4th Field Survey Company were handed over "in situ" to the Third Army.

It was found necessary shortly afterwards to raise a second Group for this front, and this was done by Captain J. Coburn with a nucleus of 15 N.C.Os. and men from his old Group (No. 3)

In addition to the above, a Sound Ranging section formed for "Calibration" and lent to XV Corps was brought on to the Company Strength. This was afterwards re-mustered as an Observation Group. In accordance with the General re-numbering which took place at this time, these three groups became Nos. 5, 6 and 22.

The strength of the Company remained substantially unaltered for the next three months and was as follows :-

	Officers.	Other ranks.
July 7th	7	302
August 5th	20	384
September 2nd	20	383
October 7th	21	383
November 4th	22	401

In November, orders were received for the Army to proceed to the SOMME front and the O.C. with Lieut. Broad and a small staff of draughtsmen proceeded by road to DURIE ( just S. of AMIENS) to commence the mapping of this area. No accommodation was available in this village and an office was

found in AMIENS where the work was commenced. A few days later, however, these orders were cancelled and the Army was ordered to the YPRES front. This detachment therefore, handed over its work to G.H.Q. and returned to ROSENDAEL.

Period November 1917 - April 1918.

In November, the Company was called upon to furnish a number of men for service in ITALY. At the end of this month, the Company moved to CASSEL, the Fourth Army taking over the front held by the Second and Fifth Armies.

The move was accomplished by lorry, the equipment etc. requiring some 60 lorry loads.

Five Groups and five S.R. Sections in line on the Army front were taken over "in situ" and brought on to the strength of the Battalion. The Groups and Sections on the Coast remained there with the XV Corps Heavy Artillery, for about another month, when No. 5 Group was transferred to the Fifth Army and No. 6, 22 Groups and "S" Section rejoined the 4th Field Survey Company.

Just before this move took place, orders were received from Maps G.H.Q. to send a Sound Ranging Officer and an Observation detachment to the Artillery School at Salisbury Plain. Captains Atkins and Coburn were selected for these posts and left with a small detachment of selected N.C.Os. and men before the end of November.

On completion of these moves and changes the Battalion was organized and officered as follows :-

H.Q. Section

O.C.	Major M.N. MacLeod, R.E.	
Captain H.J.S. Gaine, R.E.		(Topo)
Lieut. K.S. Broad, R.E.		(Asst. Topo)
Captain G. Evill		(Adjutant)
Lieut. S. Cursiter		(Printing)
Lieut. C.C. Goodwyn, R.E.		(Compiling)

Observation Groups

No. 1 Group.

Captain D.F. Ingleton  
Lieut. J.A. Slater

No. 2 Group.

Captain R.S. Webb  
Lieut. L.S. Palmer

No. 3 Group

Captain W.A. Bell  
Lieut. G.E. Dunnage

No. 4 Group

Captain J.S. Coates  
2/Lieut. J.M. Peakman

No. 6 Group

Lieut. P.F. Yarwood (acting)  
2/Lieut J.G. Panrucker

Sound Ranging Sections

"S" Section.

Captain T.M. Harbottle  
Lieut. E. Leach  
2/Lieut. E.W. Hughes

"B" Section.

Captain D.L. Drew  
2 Lieut. W.O. Clarke  
2/Lieut. G.H. Stevens

"Q" Section.

Captain J.H.L. Johnston  
Lieut. C.W. Bayliss  
2/Lieut. L.S. Beaufoy

"I" Section.

Captain J. Beech  
2/Lieut. G.A. Bryant  
Lieut. L.S. Beaufoy

"W" Section.

Captain T.W. Dickson  
Lieut. P.M. Sparling  
Lieut. H. Townsend  
2/Lieut. A.W. Cable

No. 12 Group

Captain W.H. Stephenson  
2/Lieut. K.O. Lefeaux

"M" Section

Captain I.H. Clarke  
Lieut. R.H. Fergusson  
Lieut. J.D. Grogan

No. 22 Group

Captain R.H. Chapman  
Lieut. M. Mackenzie

"A" Section

Captain R.F.S. Mitchell  
Lieut. W. Hope Jones  
Lieut. W.H. Smith  
2/Lieut. H.F. Gosling

Corps Topo Sections

II	Corps	Lieut. R.B. Beilby
VIII	Corps	Lieut. J.E. Brittenden
IX	Corps	Lieut. I. Lang
X	Corps	Lieut. B. le M. Andrew
XIX	Corps	2/Lieut. E. Blackwood
II ANZAC	(afterwards XXII Corps)	Vacant

Shortly after the completion of these moves, orders were received from Maps G.H.Q. to form three more Sound Ranging Sections, two of which were to relieve sections already in the line, three of which were required for service elsewhere.

"BB" Section was formed by 2/Lieut. E.W. Hughes ( of "S" Section )

"FF" Section was formed by Lieut. L.S. Beaufoy ( of "I" Section )

relieving "Q", "A" and "B" Sections.

"GG" Section was formed by Lieut. E.C. Rippisley shortly afterwards and was employed as a "Wind Section". At the same time, approval was given by the Army for the formation of a new Observation Group, numbered 23.

The move to the YPRES front involved also some modification in the organization of the Company. The outdoor Topo and Artillery work was entirely separated from the Mapping work and the Officer in Charge moved forward to RENINGHELST and later to BOESCHEPE, while the Compiling Section was also moved forward to the old Second Army Observation Centre at LOCRE.

These changes were required owing to the very large size of the Army area and the shortage of M.T. transport.

With the equipment taken over from the 2nd Field Survey Company was a second printing machine, and this coupled with the very great increase in the front held by the Army necessitated an immediate increase of staff at H.Q.

During the Winter of 1917, discussions had still been going on with regard to a new Establishment for the Company and a provisional new Establishment was got out. Owing to the differences of opinion among F.S.C. Commanders as to the nature of the organization, ( whether it should be an Army Battalion or Corps Company organization) there was considerable delay in obtaining final approval. Meantime however, the work was increasing and the need for obtaining additional personnel was pressing.

Reinforcements of Technical personnel were not however available at G.H.Q. and in these circumstances it was decided to try to find them in the Army. Divisions were accordingly asked to submit names of men who were Lithographic Draughtsmen and Printers, Architectural or Surveyors Draughtsmen, Wet Plate Photographers, and so on in civil life.

As a result of this request, a large number of names were sent in. These men were then sent to Company H.Q. at CASSEL and there tested in their trades, the most efficient workmen up to the numbers required, being retained. This resulted in a large excess over the authorised establishment which soon provoked comment from the D.A.G., and as the power of forming additional Observation Groups had been withdrawn from the Army, the position of these men could not be regularised. Permission was obtained to retain them temporarily as supernumeraries to their units, which became more and more peremptory.

A similar situation was arising in the case of Sound Ranging Sections. The Establishment of linesmen in these had proved insufficient for the work required and all sections had gradually collected a number of supernumeraries.

The Battles of March and April 1918 brought the manpower question into great prominence and the D.A.G. finally ordered the immediate return of all supernumeraries to the Depot.

The strength of the Company during this period was as follows :-

		<b>Officers</b>	<b>Other ranks</b>
December	1917	58	1023
January	1918	48	1002
February	1918	48	985
March	1918	47	1007
April	1918	54	1054
May	1918	64	1111

In June, the new Establishment was finally approved and published. It is shown in the following comparative tables :-

	<b>1st W.E.</b>		<b>2nd W.E.</b>		<b>3rd W.E.</b>		<b>4th W.E.</b>	
H.Q. Section	5	47	6	78	6	80	13	162
Observation Group H.Q.	1	2	2	14	2	14	3	14
Survey Post Squad	-	8	-	12	-	12	-	12
Sound Ranging Section	3	18	3	33	3	33	4	39
Corps Topo Section	-	-	-	-	1	10	1	10

This Establishment, as will be seen, largely increased the personnel at H.Q. but hardly touched the question of Sound Ranging sections, so that it by no means solved the whole of the personnel difficulties.

Two other changes introduced by this organization were the addition of two officers at H.Q. known as O.C. "Artillery Sections" and the grant of acting ranks to officers holding various appointments in the unit which was now styled Field Survey Battalion.

This Establishment, as stated above, was not introduced till June 1918. The main outlines of the organization, such as the formation of Artillery sections and the number of men at H.Q. were known sometime previously.

The command of so many Groups and Sections was from the first ( that is from the date the 4th Field Survey Company took over from the Second and Fifth Armies ) found to be very difficult and it was decided therefore to appoint O.C. Artillery Sections at once without awaiting the final approval of the Establishment. Captain Atkins, on his return from Salisbury Plain on 15-3-1918, was accordingly placed in charge of all Groups and Sections and took up his H.Q. at LOCRE. The need for an assistant Adjutant also became urgent and Lieut. Panrucker was brought in from No. 6 Group to H.Q. to perform these duties.

This left the Observation Section very short of officers and no reinforcements being available at the Depot, it was necessary to commission two N.C.Os. (Sergeants Platt and Eyre) from the Groups in the Company.

Captain Coburn returned from Salisbury Plain at the end of March and resumed command of No. 6 Group relieving Lieut. Yarwood, who then took command of No. 23. The organization at the end of March was as follows :-

H.Q. Section

O.C.	Lt Col M.N. Macleod, R.E.
Topo Section	Captain H.J.S. Gaine, R.E. 2/ Lieut. A.H. Bogle, N.Z.E.
Artillery Section	Captain A.H. Atkins, R.G.A.
Mapping Section	Lieut K.S. Broad, R.E.
Printing Section	Lieut. S. Cursiter, R.E.
Compiling Section	Lieut. C.C. Goodwyn, R.E.
Adjutant	Captain G. Evill.
Asst. Adjutant	Lieut J.G. Panrucker, 2nd Worcesters.

	<u>Groups</u>		<u>Sections</u>
No. 1 Group	Capt. D.F. Ingleton	“S” Section	Capt. T.M. Harbottle
No. 2 Group	Capt. A.S. Webb	“BB” Section	Capt. E.W. Hughes
No. 3 Group	Capt W.A. Bell	“I” Section	Capt. I. Beech
No. 4 Group	Capt. W.V. Coates	“FF” Section	Capt. L.S. Beaufoy
No. 6 Group	Capt J. Coburn	“W” Section	Capt. T.W. Dickson
No. 22 Group	Capt. R.H. Chapman	“M” Section	Capt. J.H. Clarke
No. 23 Group	Capt P.F. Yarwood	“GG” Section	Capt E.T. Hippisley

Period April 1918 - August 1918.

In April, the Germans commenced their LYS offensive and drove in the Army Front. The Army H.Q. and with it, the Field Survey Battalion was moved back to BLENDECQUES, the move taking place by road about April 13th, 75 lorry loads being required to complete the move. Part of the office in CASSEL was retained as an Advanced Map Store and Office for the Compiling Section, which was moved back from LOCRE. The Topo Section was also withdrawn from BOESCHEPE, going first to WATOU, then to ESQUELBECQ and finally to CASSEL.

Towards the middle of April, the central part of the Army front was taken over by the French and as this divided the Army front into two portions, a second Artillery Section was constituted under the command of Captain Coburn. The Groups and Sections were allotted to these two Artillery sections as follows :-

Northern Artillery Section. (LOCRE moving afterwards to VOGELTJE and eventually to LOVIE CHATEAU)

Nos. 1, 2, 3 and 12 Groups  
“S” “BB” “I” “FF” and “GG” Sound Ranging Sections.

Southern Artillery Section. (ST. SYLVESTER CAPPEL)

Nos. 4, 6 and 23 Groups  
“M” and “W” Sound Ranging Sections

As an immediate result of the battle, “M” “W” “I” and “GG” Sections and No. 23 Group were withdrawn from the line, the Sound Ranging Sections being withdrawn right back to ST. HOMELIN near ST. OMER and No. 23 Group to a farm near WATOU.

Shortly afterwards, about April 10th, the XV Corps was transferred to the Fourth Army and with it, No 7 Group, ( Captain Davies).

Early in May, “FF” Section was broken up and Nos. 2 and 4 Groups withdrawn from the line, being relieved by No 23 Group.

On April 29th, the German advance was definitely arrested and the Sound Ranging Sections were brought up into line again. During the battle, Captain Yarwood, O.C. No. 23 Group was severely wounded and shortly afterwards Captain Beech O.C. “I” Section was killed; their places were taken by Captain A.S. Buchanan and Captain H.H. Paine. Captain J.H.W. Wedderburn succeeded Major Coburn in command of No. 6



Group. Captain Davies was soon afterwards relieved of his command and replaced by Captain Wedderburn, the command of No. 6 Group being taken over by Lieut. A.C. James. Captain Coates, O.C. No. 4 Group was transferred to the 5th Field Survey Company as O.C. of an Artillery Section and eventually replaced by Captain E. Walford.

The situation in July after the new establishment was introduced was as follows :-

H.Q. Section

O.C.	Lt. Col. M.N. Macleod
Topo	Major H.J.S. Gaine
	Lieut. A.H. Bogle
Drawing Section	Captain K.S. Broad
	Lieut. R.B. Unwin
Printing Section	Captain S. Cursiter
	2/Lieut. A. Anderson
Compiling	Captain C.C. Goodwyn
Adjutant	Captain G. Evill
Asst, Adjutant	Lieut. J.G. Panrucker
O.C. Northern Artillery Section	Major A.H. Atkins
O.C. Southern Artillery Section	Major J. Coburn

Northern Artillery Section - N.A.S.

No 1 Group

Capain D.F. Ingleton

“S” Section

Captain T.M. Harbottle (sick)  
Captain F.A.A. Menzler

No 3 Group

Captain W.A. Bell

“I” Section

Captain H.H. Paine M.C.

No 12 Group

Captain W.H. Stephenson

“BB” Section

Captain E. Wynne Hughes

“GG” Section

Captain E.T. Hippisley

Southern Artillery Section - S.A.S.

No. 6 Group

Captain A.C. James

“M” Section

Captain I.H. Clarke

No. 7 Group

Captain J.H.M. Wedderburn

“W” Section

Captain T.W. Dickson  
Lieut. A.W. Cable

No. 23 Group

Captain A.S. Buchanan

No. 4 Group (In Reserve)

Captain E. Walford

No 22 Group was handed over to the 2nd Army R.A. and removed from the Establishment. “GG” Section, formerly a “Wind Section”, was now being used as an ordinary Sound Ranging Section on the Belgian front and special arrangements had to be made for “Meteor” wind determinations. These were placed in charge of Lieut. A.M. Bown, M.C., R.F.A. with a staff of three computers found

from the Sound Ranging Sections. (The dates on which the various officers joined or left the Battalion are given in Appendix "B")

No. 27 Group, under the command of Captain A.Frew, joined the Battalion on 19-8-18 and was posted to the Southern Artillery Section.

It should be noted that each of the Artillery Section Headquarters, though nominally part of the H.Q. Section, were actually located closer to the line and generally among or just behind the positions of Observation Groups or Sound Ranging Sections.

In July the N.A.S. was at LOVIE CHATEAU and the S.A.S. just south of ST SYLVESTRE CAPPEL. Each acted as an Observation Centre as well as a link in the chain of Command between the O.C. battalion and the groups and sections.

They were thus called upon to act as detached and semi-independent units, able to keep in close touch with the groups and sections in the line and in this position did valuable service during the battles of April.

In order to enable them to carry out these duties however, it was necessary to find for them, both a suitable staff and transport. The authorised W.E. allowed only a share of one batman and no transport, and the only way to provide them was to withdraw the necessary personnel and vehicles from the groups and sections, which were thereby correspondingly handicapped. Thanks to one group being in reserve and the transport of "FF" Sound Ranging Section still being at the disposal of the Battalion, it was possible to do this without altogether paralysing the units in the line.

The difficulty as regards Sound Ranging linesmen was still outstanding, and the Topo Sections, faced with a great increase of work due to the introduction of the "Bearing picket", were also in difficulties for men and transport. It became clear that yet another reorganization must be made before the Field Survey organization was placed on a satisfactory footing. Several meetings and discussions took place during the summer on this subject, but the war had come to an end before anything definite came of them.

#### Period August 1918 - December 1918.

In August, the Germans commenced their retreat from the LYS salient, and the operations assumed from that time on, a different and more mobile character. Details of special arrangements made for following up their retirement will be found under the heading of the Observation and Sound Ranging Sections. The battalion H.Q. moved back to CASSEL by road on the 9th-13th September, 76 lorry loads being required, and the Topo Section moved forward to ABEELE. A further move was made on November 2nd when the Battalion moved up by rail to ROUBAIX, the Topo Section going to MOUSCRON, in which position they remained when the Armistice was signed. The strength of the battalion month by month during this period was as follows :-

		Officers	Other Ranks
June 9th	1918	57	1116
July 7th	1918	57	1102
August 4th	1918	68	1145
September 1st	1918	68	1146
October 1st	1918	63	1004
November 1st	1918	59	939

After this no further technical work was done by the Observation Section, but preparations had to be made for the march to the Rhine.

Arrangements had to be made to prepare and issue the necessary maps and to reorganize the H.Q., and Observation Sections so that if necessary they could accompany the Army throughout its march.

The Army consisted of four Corps and it was decided to take forward one Group and one S.R. Section for each Corps. The units selected were brought up to a provisional higher establishment by taking men and vehicles from those units staying behind.

It was anticipated that during the march, communication with the Corps would be difficult and it was therefore decided to detail a Field Survey Battalion officer with a small staff to be attached to each Corps to exercise command over the Group and Section allotted to it.

As regards the H.Q. Section, it was found impossible to move the whole H.Q. up by road, so a small mobile unit of about 23 men was formed and accompanied the O.C. Battalion with the Advanced Army H.Q. which moved up by road, halting at NAMUR, SPA and DUREN.

The Groups and Sections even on the higher establishment were not completely mobile, i.e., they could not carry all their stores and equipment on their own vehicles in one journey, and as no Corps was able to provide additional transport, all were eventually left behind at ROUBAIX, except No. 6 Group who accompanied the Canadian Corps and was able to get assistance in carrying their stores from the Canadian Corps Survey Section. Even so, much material had to be dumped en route, and was only collected with considerable difficulty.

On arrival at COLOGNE, accommodation was found for the H.Q. billet and offices in two empty schools, while the old German Survey School at WAHN was taken over for the Observation Sections.

The remainder of the Battalion, less two groups, came up by train on January 8th, and the remaining groups about a month later.

The strength of the Battalion at the beginning of December was 46 officers and 743 other ranks.

#### HEADQUARTER'S SECTION

#### APPENDIX "A"

APPENDIX "A"

WAR ESTABLISHMENT OF A FIELD SURVEY COMPANY MARCH 1916.

HEADQUARTERS SECTION

	Officers	Warrant Officers	Clerks	Staff Sergeants or Sergeants	Rank & file	TOTAL	Bicycles	Motor Cycles
<b>(i) Personnel</b>								
Commander	1					1		
Adjutant & Qr Master	1					1		
Compiling	1					1		

Officer				1		1		
Qr Master								
Sergeant								
Clerks			2			2		
Other ranks					6	6		1
(a)								
Total (excl. attached)	3		2	1	6	12		1
<b>Attached</b>								
Batmen					3	3		
Despatch					1	1		
Riders								
Drivers, A.S.C., MT					2	2		
<b>TOTAL</b>	3		2	1	12	18		1

(a) 1 N.C.O. for Pay duties, 1 Computer, 1 Optician, 1 Draughtsman, 2 Buzzer Pioneers.  
Ranks cannot be laid down.

(ii)

Transport	Vehicles	Drivers
Motor Cars	1	1
Box Cars	1	1
Motor Cycles	1	
	3	2

TOPOGRAPHICAL SECTION

	Officers	Staff Sergeants or Sergeants	Rank & file	TOTAL	Bicycles	Motor cycles
<b>(i) Personnel</b>						
Officer in charge	1			1		
CSM or Sergeant		1		1(b)		
Rank and File			12	12(b)	9	
TOTAL (excl. attached)	1	1	12	14	9	
<b>Attached</b>						
Batmen			1	1		
Drivers,			2	2		

A.S.C., M.T.					
TOTAL	1	1	15	17	9

(b) 1 Computer, 3 Draughtsmen, 3 Observers, 6 Topographers

(ii)

Transport	Vehicles	Drivers
Motor Cars	1	1
Box Cars	1	1
	2	2

PRINTING AND MAP SECTION

	Officers	Clerks	Staff Sergeants or Sergeants	Rank & file	TOTAL	Remarks
<b>(i) Personnel</b>						
Officer in charge	1				1	
Clerk		1			1	
TOTAL (excl. attached)	1	1			2	
<b>Attached</b>						
Batmen				1	1	Excl. Motor Drivers
Drivers, A.S.C., M.T. Section, Printing Coy				3	3	
(c)				11	11	

TOTAL	1	11		15	17	
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(c) 2 Photographers, 6 Lithographers, 3 Printers

(ii)

Transport	Vehicles	Drivers
Box Cars	1	1
3-ton Lorries	1	2
TOTAL	2	3

OBSERVATION GROUP H.Q.

	Officers	Rank & file	TOTAL	Horses Riding	Motor Cycles	Remarks
<b>(i) Personnel</b>						
Officer in charge	1		1	1	1	
Batmen		1	1			
TOTAL (excl. attached)	1	1	2	1	1	
<b>Attached</b>						
Drivers, A.S.C., M.T.		1	1			
TOTAL	1	2	3	1	1	

SURVEY POST SQUAD

	Staff Sergeants or Sergeants	Rank & file	TOTAL	Horses, draught	Remarks
Sergeant* or Corpl or 2/Cpl if RE	1		1	1	
Other Ranks		6	6		To include 2 Bomdrs or L/Corpls.
TOTAL (excl. attached)	1	6	7	1	
<b>Attached</b>					
Drivers, A.S.C., M.T.		1	1		
TOTAL	1	7	8	1	

\*Total Sergeants in Section not to exceed 33% of number of Squad.

(ii)

Transport	Vehicles	Drivers
Motor cycles with side cars, or light cars	1	1
Two-wheeled carts: per Squad	1	1
TOTAL	2	2

SOUND RANGING SECTION

	Officers	Staff Sergeants or Sergeants	Artificers	Rank & file	TOTAL	Remarks
<b>(i) Personnel</b>						
Officers	3				3	
Sergts or Corpl		1			1	
Instrument repairer			1		1	
Other Ranks (d)				9	9	To include 2 Bomdrs or L/Corpls.
TOTAL (excl. attached)	3	1	1	9	14	
<b>Attached</b>						
Batmen				3	3	
Drivers, A.S.C., M.T.				4	4	
TOTAL	3	1	1	16	21	



(d) 1 Photographer, 3 Telephonists, field line, 2 Buzzer Pioneers, 3 Forward Observers

(ii)

Transport	Vehicles	Drivers
Motor Cars, light	1	1
Box Cars	1	1
30 cwt Lorries	1	2
TOTAL per det.	3	4

Notes:-

1. The officers of the Company to consist of:-  
1 Major )  
2 Captains ) Exclusive of Sound Ranging Sections  
Remainder Subalterns )
2. Officers will be seconded and men detached from their units when posted to the Company.
3. All promotions will be temporary, for duration of War.

HEADQUARTER'S SECTION

APPENDIX "B"

NOMINAL ROLL OF OFFICERS WHO SERVED WITH 4TH FIELD SURVEY BATTALION R.E.

FEB 1916 - FEB 1919

PERIODS.

<u>(1) Feb 1916 - March 1917</u> Formation of Company. Somme Battle.	Nos.	1 - 52.
<u>(2) March 1917 - June 1917</u> The German retreat to, and occupation of the Hindenburg Line.	Nos.	53 - 59.
<u>(3) June 1917 - Nov 1917</u> Operations on the Coast	Nos.	60 - 77.
<u>(4) Nov 1917 - April 1918</u> Winter on the Ypres Salient	Nos.	78 - 147.

(5) April 1918 - Aug 1918

German Offensive in Flanders. ( Company becomes a Battalion 14-6-1918.) Nos. 148 - 187.

(6) Aug 1918 - Nov 1918

German Retreat and British Offensive in Flanders. Nos. 168 - 171.

(7) Nov 1918 - Feb 1919

Armistice and Army of Occupation. Nos. 172  
- 179.

HEADQUARTER'S SECTION

APPENDIX "B"

NOMINAL ROLL OF OFFICERS WHO SERVED WITH 4TH FIELD SURVEY BATTALION

FEB 1916 - FEB 1919

No.	Rank	Name	Employment	Date of Joining	Date of Leaving	Remarks
1	Lt Col	M.N. MacLeod D.S.O. M.C.	C.O.	18-2-16		
2	Capt	B.F.E. Keeling	Topo	18-2-16	19-7-16	To 5th F.S.C.
3	2 Lieut	R. Quigly	Printing	18-2-16	12-12-16	To G.H.Q. Transportation
4	Major	J. Coburn M.C.	O.C. Obs Gp & Artly Section	18-2-16		
5	Lieut	C.Q.L. Penrose M.C.	O.C. Obs Gp	18-2-16	31-5-17	To Regimental Duty
6	Lieut	F.R. James M.C.	O.C. Obs Gp	18-2-16	2-7-17	To 3rd F.S.C.

7	Lieut & Qr Mr	T. Johnson	Topo	18-2-16	19-7-16	To 5th F.S.C.
8	Lieut	H.H. Cowan	O.C. Obs Gp	18-2-16	19-7-16	To 5th F.S.C.
9	Capt	G. Evill M.C.	Adjnt & Qr. Mr.	22-3-16		
10	Major	A.H. Atkins M.C.	O.C. S.R. Sect & Artlly Section	23-3-16	17-1-19	Demobilised
11	Lieut	E.T. Paris	S.R.	7-4-16	26-6-17	To England for duty.
12	a/ Capt	W.A. Bell	O.C. Obs Gp	8-4-16	19-7-16	To 5th F.S.C.
				20-11-17	28-11-18	To 2nd F.S.CBn
13	Lieut	R.B. Peters	S.R.	11-4-16	2-10-16	To Regt. Duty.
14	2/Lieut	S.F. Tarrant	O.C. Obs Gp		19-7-16	To 5th F.S.C.
15	Lieut	T.G. Hodgkinson	O.C. S.R. Sect	17-4-16	19-7-16	To 5th F.S.C.
16	2/Lieut	M.R. Gillanders	S.R. Sect	24-5-16	19-7-16	To 5th F.S.C.
17	Lieut	J.A. Lynch	O.C. SR Sect	23-4-16	19-7-16	To 5th F.S.C.
				14-2-19		
18	a/ Capt	E. Walford	O.C. Obs Gp	29-5-16	19-7-16	To 5th F.S.C.
				15-6-18		
19	2/Lieut	A.G. Bishop	Obs Gp	29-5-16	20-10-16	To Regt duty.
20	Lieut	E.G. Gardiner	G.S. 4th Army	5-6-16	1-4-18	To 5th F.S.C.
21	Major	H.J.S. Gaine M.C.	Topo	14-7-16		
22	2/Lieut	B.W. Edwards	O.C. Obs Gp	26-8-16	2-7-17	To 3rd F.S.C.
23	2/Lieut	A.S. Philpot	S.R.	12-10-16	9-11-16	To 2nd F.S.C.
				25-6-17	25-7-17	To Depot F.S.C.
24	2/Lieut	P. Rothwell	SR	14-10-16	24-11-16	To 5th F.S.C.
25	A Capt	C.C. Goodwyn	O i/c Compiling	17-11-16	12-10-18	Struck off strength. Still in England.
26	Capt	W.R. Darwin	O.C. S.R. Sect	24-11-16	5-7-17	To 3rd F.S.C.
27	2/Lieut	L.Y. Sanders		3-12-16	7-1-17	To 3rd F.S.C.
28	2/Lieut	J.J. Welch	S.R.	17-12-16	2-7-17	To 3rd F.S.C.
29	Lieut	R.A. Colvin	Compiling	19-12-16	13-2-17	To Regt. Duty.
30	a/ Capt	L.S. Beaufoy	O.C. S.R. Sect	27-11-16	15-2-17	To 5th F.S.C.
				20-11-17	22-4-18	To 1st F.S.C.
				14-2-19		
31	2/Lieut	J.E. Lott M.C.	S.R.	30-12-16	7-5-17	Died of wounds.
32	Lieut	V.P. Leyson	Obs Gp	16-1-17	2-7-17	To 3rd F.S.C.
33	2/Lieut	H.B. Davies	Corps Topo.	15-1-17	8-4-17	To Regt Duty.
34	Capt	H.C. Golding M.C.	O.C. S.R. Sect	17-1-17	15-2-17	To 5th F.S.C.
35	a/ Capt	K.S. Broad	O i/c Drawing	21-1-17	2-2-19	Demobilised
36	Lieut	H.D. Allen		25-1-17	14-2-17	To Regt Duty
37	2/Lieut	J.L.A. Gibbs	Obs Gp	26-1-17	2-7-17	To 3rd F.S.C.
38	Lieut	A.S. Buchanan	Corps Topo	26-1-17	15-2-17	To 5th F.S.C.
39	Capt	T.M. Harbottle	O.C. S.R. Sect	27-1-17	2-7-17	To 3rd F.S.C.
				14-11-17	13-2-19	Demobilised
40	2/Lieut	O.A. Chapman	Obs Gp	30-1-17	2-7-17	To 3rd F.S.C.
41	2/Lieut	A. Burgess		1-2-17	15-2-17	To 5th F.S.C.
42	a/ Capt	J. Beech	O.C. S.R. Sect	1-2-17	17-2-17	To 2nd F.S.C.
				20-11-17	12-5-18	Killed in Action.
43	Capt	A. Godwyn- Austen	Corps Topo	8-2-17	23-11-17	To 1st F.S.C.
				13-4-18	16-11-18	To 2nd F.S.Bn
				3-2-19		
44	2/Lieut	R.W. James	S.R.	8-2-17	18-3-17	To 5th F.S.C.
45	Lieut	J.M. Favell	Corps Topo.	20-2-17	24-5-17	To 2nd F.S.C.
46	Lieut	A.M. Champion	Corps Topo.	1-3-17	31-5-17	To 3rd F.S.C.
47	2/Lieut	C.J. Strachan	Obs Gp	8-3-17	2-7-17	To 3rd F.S.C.
48	2/Lieut	H. Buckley	S.R. Sect	14-3-17	2-7-17	To 3rd F.S.C.
49	a/ Capt	S. Cursiter	Printing	19-3-17		
50	2/Lieut	G.H. Welch	S.R.	21-3-17	2-7-17	To 3rd F.S.C.
51	2/Lieut	F. Hare	S.R.	21-3-17	21-7-17	To 3rd F.S.C.

52	Lieut	E. Marsden	O.C. S.R. Sect	21-3-17	21-7-17	To 3rd F.S.C.
53	2/Lieut	P.M. Chadwick	Drawing	2-4-17	28-4-17	To Regt Duty
54	2/Lieut	W.F. Anderson	Corps Topo.	7-4-17	2-7-17	To 3rd F.S.C.
				26-11-18	22-11-18	To 2nd F.S.Bn.
55	Lieut	W.W. Hitching		11-5-17	2-7-17	To 3rd F.S.C.
56	Lieut	G.E. Mitchell	S.R. & Corps Topo.	19-5-17	3-6-17	To 2nd F.S.C.
				28-12-18	9-2-19	Demobilised
57	2Lieut	H.B. Harrison	Topo	23-5-17	28-6-17	To Depot F.S.C.
58	Lieut	R.G. Peache	O.C. S.R. Sect	10-6-17	2-7-17	To 3rd F.S.C.
59	2Lieut	G. Green	S.R. Sect	10-6-17	2-7-17	To 3rd F.S.C.
60	Lieut	I.G. Gott	O.C. Obs Gp	25-6-17	19-7-17	To Depot F.S.C.
61	Lieut	F.A.A. Menzler	S.R.	25-6-17	13-1-19	Demobilised
62	a/ Capt	N. Cayley	O.C. Obs Gp	16-6-17	15-12-17	To 5th F.S.C.
63	a/ Capt	P.F. Yarwood	O.C. Obs Gp	16-6-17	8-4-18	Evacuated wounded
64	a/ Capt	R. H. Chapman	O.C. Calibration Section	24-6-17	29-4-18	To England for duty
65	Lieut	H.S. Shiner	Obs Gp	5-7-17		To 5th F.S.C.
66	2/Lieut	B. L. Worsnop	SR	21-7-17	22-9-17	To 1st F.S.C.
67	a/ Capt	E.W. Hughes	O.C. S.R. Sect	23-7-17		
68	Lieut	W.H. Cable	S.R.	24-7-17	25-8-17	To 2nd F.S.C.
				20-11-17		
69	Lieut	E.T. Hippisley	S.R.	5-8-17	25-8-17	To 3rd F.S.C.
				18-3-18	28-11-18	To 2nd F.S.Bn.
70	Lieut	W.J. Leach	S.R.	4-8-17	11-10-18	Killed in Action.
71	Lieut	H.J. Gossling	SR	5-8-17	1-9-17	To Depot F.S.C.
				20-11-17	20-8-18	To 3rd F.S.C.
72	Lieut	M. Mackenzie	Calibration	16-8-17	27-2-18	To 1st F.S.C.
73	Lieut	J.G. Panrucker	Obs Gp, Asst/Adj	19-8-17		
74	2/Lieut	B.A. Smith	Calibration	5-9-17	13-11-17	Evacuated Wounded
75	Lieut	J. Miller		18-9-17	22-9-17	To 1st F.S.C.
76	Capt	E. Graves		11-9-17	28-4-18	To Depot F.S.C.
77	Capt	H.H. Payne M.C.	O.C. S.R. Sect	29-10-17	28-11-18	To 2nd F.S.Bn.
78	Capt	W.V. Coates	O.C. Obs Gp	20-11-17	14-5-18	To 5th F.S.C.
79	Capt	T.W. Dickson M.C.	O.C. S.R. Sect	20-11-17		
80	Capt	D.L. Drew	O.C. SR Sect	20-11-17	5-1-18	To 5th F.S.C.
81	a/ Capt	D.F. Ingleton M.C.	O.C. Obs Gp	20-11-17		
82	Capt	R.S. Webb	O.C. Obs Gp	20-11-17	29-8-18	To 5th F.S.Bn.
83	a/ Capt	J.H. Clarke	O.C. S.R. Sect	20-11-17		
84	a/ Capt	R.F.S. Mitchell M.C.	O.C. S.R. Sect	20-11-17	20-8-18	To 3rd F.S.C.
85	a/Capt	W.H. Stephenson M.C.	O.C. Obs Gp	20-11-17	18-1-19	Demobilised
86	Lieut	B.C.M. Andrew	Corps Topo	20-11-17	31-3-18	To 5th F.S.C.
				11-7-18	16-11-18	To 2nd F.S. Bn
87	Lieut	J.E. Brittenden	Corps Topo	20-11-17	13-5-18	To VIII Corps H.Q.
88	Lieut	G.E. Dunnage	Obs Gp	20-11-17	11-2-18	To Hospital.
89	Lieut	W. Hope-Jones	S.R. Sect	20-11-17	20-2-18	To 3rd F.S.C.
90	Lieut	P.A. Laing	Corps Topo.	20-11-17	12-2-18	To 5th F.S.C.
91	Lieut	J.A. Slater	Obs Gp	20-11-17	1-1-18	To Italy
92	Lieut	W.W. Smith	S.R. Sect	20-11-17	20-2-18	To 3rd F.S.C.
93	Lieut	P.M. Sparling	SR Sect	20-11-17	25-12-18	Demobilised
94	Lieut	R.B. Beilby	Corps Topo	20-11-17	2-1-19	Demobilised
95	Lieut	J.H.L. Johnson		20-11-17	19-12-17	To Depot F.S.C.
96	Lieut	C.W. Bayliss		20-11-17	19-12-17	To Depot F.S.C.
97	Lieut	E.D. Blackwood	Corps Topo.	20-11-17	12-2-18	To 5th F.S.C.
				27-6-18	16-11-18	To 2nd F.S.Bn.
98	Lieut	H.E. Beresford	Corps Topo	20-11-17	26-12-17	To 5th F.S.C.
99	2/Lieut	G.A. Bryant	S.R. Sect	20-11-17	28-11-18	To 2nd F.S.Bn.

100	2/Lieut	W.O. Clarke	S.R. Sect	20-11-17	5-1-18	To 5th F.S.C.
101	Lieut	R.H. Fergusson	S.R. Sect	20-11-17	5-5-18	To Depot F.S.C.
102	Lieut	J.D. Grogan	S.R. Sect	20-11-17		
103	Lieut	L.S. Palmer	Obs Gp	20-11-17	11-10-18	To 2nd F.S. Bn.
104	2/Lieut	J.M. Peakman	.	20-11-17	1-1-18	To Italy
105	2/Lieut	G.H. Stevens	SR Sect	20-11-17	5-1-18	To 5th F.S.C.
106	Lieut	H. Townshend	S.R. Sect	20-11-17	7-10-18	Evacuated wounded
107	2/Lieut	H.N. Green	S.R. Sect	20-11-17	19-12-17	To Depot F.S.C.
108	Lieut	R.O. Lefeaux	Obs Gp	20-11-17	22-7-18	To 1st F.S.Bn.
109	Lieut	C.E.E. Pargeter M.C.	S.R. Sect	20-11-17		
110	Lieut	A.H. Bogle	Trig Office	6-12-17	31-12-18	Demobilised
111	Lieut	H.L.P. Jolly	S.R. Sect	15-12-17	15-1-19	Demobilised
112	2Lieut	J.A. Collinson	S.R. Sect	15-12-17	27-1-18	Returned to Regt duty.
113	Lieut	P.L. Forwood	S.R. Sect	20-12-17		
114	Lieut	A.M. Brown M.C.	S.R. Sect	7-1-18	7-12-18	Evacuated
115	Lieut	J.D. Crichton	Obs Gp	22-1-18	31-1-19	Demobilised
116	Lieut	A.V. Couling	.	22-1-18	16-9-18	To 1st F.S.Bn.
117	Lieut	C.P. Wright	S.R. Sect	22-1-18	29-4-18	To Regt duty.
118	Lieut	E.A. Clemmow	S.R. Sect	22-1-18	9-4-18	To Regt duty
119	Lieut	H.D Anthony	S.R. Sect	22-1-18	28-11-18	To 2nd F.S.Bn.
120	2/Lieut	J.P. Musgrave	S.R. Sect	22-1-18		
121	Lieut	W.T. Lunt	S.R. Sect	12-2-18	5-5-18	To Depot F.S.C.
122	2/Lieut	W.E. Darlington	Calibration Sect	12-2-18	21-10-18	To 2nd Army Calibration Section
123	2/Lieut	H. Platt	Obs Gp	12-2-18		Commisioned from Obs Gp.
124	2/Lieut	F.A. Eyre	Obs Gp	12-2-18	25-1-19	Demobilised Commisioned from Obs Gp
125	2/Lieut	C. Cochrane	S.R. Sect	17-2-18	15-9-18	To 5th F.S.Bn.
126	Capt	J.H.M. Wedderburn	O.C. Obs Gp	23-2-18		
127	Capt	A.C. Stewart	S.R. Sect	25-2-18	5-5-18	To Depot F.S.C.
128	Lieut	F.M. Colebrook	S.R. Sect	25-2-18	13-5-18	To Depot F.S.C.
129	Lieut	A. Dudgeon	Calibration Sect	25-2-18	21-10-18	To 2nd Army Calibration Sect
130	2/Lieut	C. Proud	Calibration Section	25-2-18	10-3-18	To 1st F.S.C.
131	Lieut	J. Munro	S.R. Sect	2-3-18	14-5-18	To Depot F.S.C.
132	Lieut	W.B. Turner	Obs Gp	2-3-18		
133	2Lieut	S.H. Ferrier	Obs Gp	2-3-18	1-8-18	To Regt Duty.
134	Lieut	W.E. Rolston	SR Sect	4-3-18		
135	2/Lieut	A.F. Finney	Calibration Section	6-3-18	17-3-18	To 3rd F.S.C.
136	2/Lieut	A. Wakely	S.R. Sect	6-3-18		
137	2/Lieut	G.E. London	S.R. Sect	4-3-18	30-7-18	To Regt Duty.
138	2/Lieut	W. Shercliff	S.R. Sect	4-3-18	14-1-19	Demobilised
139	2/Lieut	C.F. Tyrell	S.R. Sect	18-3-18	28-11-18	To 2nd F.S.Bn.
140	Lieut	R.C. Morton	S.R. Sect	18-3-18	28-11-18	To 2nd F.S.Bn.
141	Lieut	R.B. Henderson	O.C. Calibration Sect.	18-3-18	21-10-18	To 2nd Army Calibration Sect.
142	Lieut	G.H. Mason	S.R. Sect	26-3-18		
143	Lieut	R.G. Foster	S.R. Sect	26-3-18	26-8-18	To Regt Duty
144	Lieut	P.E. Phillips	S.R. Sect	26-3-18	28-11-18	To 2nd F.S.Bn.

				20-1-19		
145	Sub. Lieut	E.E. Ede	S.R. Sect	26-3-18	22-5-18	To Depot F.S.C.
146	Lieut	R.B. Unwin	Drawing Office	4-4-18		
147	2/Lieut	H. Porter	Trig Office	4-4-18	12-4-18	To Depot F.S.C.
148	a/ Capt	H.C. Davies	O.C. Obs Gp	13-4-18	4-6-18	To 5th F.S. Bn.
149	2/Lieut	E.N. Parker	Obs Gp	13-4-18	26-11-18	To 1st F.S.Bn.
150	2/Lieut	E. Taylor	Obs Gp	13-4-18	16-9-18	Evacuated
151	a/ Capt	A.S. Buchanan	O.C. Obs Gp	26-4-18	2-2-19	Demobilised
152	2/Lieut	L.T.A. Robinson	Printing Office	28-4-18	2-6-18	To Regt duty.
153	Lieut	J. Macgregor	Corps Topo.	1-5-18	27-9-18	To 1st F.S. Bn.
154	2/Lieut	G.H. Ince	Obs Gp	13-5-18	15-6-18	Evacuated Wounded
155	Lieut	L. Hutchison	Obs Gp	13-5-18	6-1-19	Demobilised
156	Lieut	P. Taylor	Obs Gp	16-5-18	29-8-18	To 5th F.S.Bn.
157	Lieut	S. Hall	Obs Gp	27-5-18	24-10-18	Evacuated
158	2/Lieut	C.R. Lynam	Obs Gp	27-5-18		
159	A Capt	A.C. James	O.C. Obs Gp	6-6-18		
160	2/Lieut	H. Byrom	S.R. Officer	12-6-18	9-9-18	To 5th F.S.Bn.
161	a/ Capt	E. Walford	O.C. Obs Gp	15-6-18	16-9-18	To 1st F.S.Bn.
162	Lieut	H.L. Neate	Obs Gp	26-7-18		
163	Lieut	J.W. Talbot	Obs Gp	26-7-18	16-9-18	To 1st F.S.Bn.
164	2/Lieut	A.W. Andrews	Printing Office	29-6-18	3-8-18	To Depot F.S.Bn.
165	2/Lieut	A. Anderson	Printing Office	2-8-18		
166	2/Lieut	H.M. Gimson	Obs Gp	10-8-18		
167	2/Lieut	S.H. Crease	S.R. Sect	16-8-18		
168	Capt	A. Frew	O.C. Obs Gp	19-8-18	11-10-18	To 2nd F.S.Bn.
169	Lieut	G. Smith	O.C. Obs Gp	19-8-18	29-8-18	To 5th F.S. Bn.
170	2/Lieut	W.P. Swaine	O.C. Obs Gp	19-8-18	11-10-18	To 2nd F.S.Bn.
171	a/ Capt	W.M. Bocquet	O.C. S.R. Sect	13-9-18	28-11-18	To 2nd F.S. Bn.
172	a/ Capt	W.T. Smellie	O.C. Obs Gp	27-12-18		
		O.B.E.				
173	Lieut	H.C. Scott	Obs Gp	5-1-19		
174	2/Lieut	W.M. Stephenson	Obs Gp	23-1-19		
175	a/ Capt	R.B. Foster	O.C. S.R. Sect	23-1-19	28-1-19	Demobilised
176	Lieut	W.W. Cooper	S.R. Sect	27-1-19		
177	2/Lieut	K.W. Hartland	Drawing Office	9-2-19		
178	2/Lieut	J.H. Hope	S.R. Officer	14-2-19		
179	Capt	J. Welch	O.C. S.R. Sect	14-2-19		

HEADQUARTERS SECTION

APPENDIX "C"

HONOURS AND AWARDS WON BY OFFICERS, N.C.O's AND MEN  
OF THE  
4th FIELD SURVEY BATTALION, R.E.



HEADQUARTERS SECTION

APPENDIX "C"

HONOURS AND AWARDS WON BY OFFICERS, N.C.O'S AND MEN

OF THE

4TH FIELD SURVEY BATTALION R.E.

HONOURS LISTS.

D.S.O.	1	
O.B.E.	1	
M.C.	8	
D.C.M.	7	
M.S.M.	7	
M.M.	1	
Mentions	9	Officers
	20	Other Ranks

IMMEDIATE AWARDS.

M.C.	4
D.C.M.	1
M.M.	26
M.M. (Bars)	3

FOREIGN DECORATIONS.

Croix de Guerre (French)	2	Other Ranks
Croix de Guerre (Belge)	2	Officers
Croix de Guerre (Belge)	3	Other Ranks

HEADQUARTERS SECTION

APPENDIX "D"

LIST OF CASUALTIES

LIST OF CASUALTIES OF THE 4TH FIELD SURVEY BATTALION R.E.

	<u>Killed</u>	<u>Wounded</u>	<u>Gassed</u>	<u>Missing</u>
<u>OFFICERS</u>	2	5*	-	-

\* 1 died of wounds.

OTHER RANKS

June 1916	-	2	-	-
August 1916	1	6	-	-
Sept 1916	-	2	-	-
Oct 1916	2	2	-	-
Jan 1917	-	1	-	-
Feb 1917	-	1	-	-
April 1917	-	1	-	-
May 1917	5	4	-	-
June 1917	2	1	-	-
Aug 1917	-	5	-	-
Sept 1917	-	2	-	-
Oct 1917	-	3	-	-
Nov 1917	-	4	2	-
Dec 1917	-	-	1	-
Feb 1918	1	2	4	-
March 1918	-	1	6	-
April 1918	4	20	13	3
May 1918	2	13	1	-
June 1918	-	2	2	-
July 1918	-	2	-	-
Aug 1918	1	1	2	-
Sept 1918	1	1	-	-

Oct 1918	2	15	-	-
TOTALS	21	91	31	3

PART II.

TRIG. AND TOPO. SECTION.

TRIG AND TOPO SECTION  
4TH FIELD SURVEY BATTALION R.E.

Officers in Charge :-

Captain Keeling	-	February 1916 - July, 1916.
Captain Gaine	-	July 1916 - December 1916
Lieut. Bogle (Assistant)	-	December 1917 - December 1918

Period February 1916 - March 1917

The area occupied by the Fourth Army on its formation had previously formed part of the Third Army area and the Topo. Section, under the command of Captain Keeling, R.E. which formed the nucleus of the 4th Field Survey Company, was first employed on Plane-Table Survey in the vicinity of BEAUMETZ.

As soon as the 4th Field Survey Company was formed, this detachment came to QUERRIEU and took over the Artillery board work of the Fourth Army from the 3rd Field Survey Company.

In March instructions were received from the M.G., R.A. Fourth Army to make preparations for the supply of Artillery boards to a large number of batteries which were to be concentrated for the SOMME offensive, and at the request of the Field Survey Company an order was placed forthwith by the C.E. Fourth Army, for a supply of large and small Artillery Planchettes, with the R.E. Base Workshops.

At this time Artillery "Boards" were mounted with plain paper ruled with a grid, with the position of the gun and aiming point plotted thereon, and a paper arc. On these the ranges were plotted. Gradually, however, the R.A. were demanding that more and more of the trench systems should be sketched in and it was therefore suggested to the M.G., R.A., in view of the large number of boards required and the few men available for this work, that it might be sufficient to cut up and stick the map down on to the grid squares instead of drawing in the trenches by hand. The system was tried and approved and finally adopted.

The triangulation of the Army area was old French work and many of the points were very inaccurate. Resections in the forward areas showed serious discrepancies, giving uncertainty in the final position of one point so fixed of 20 metres, or even more.

This had been observed by the 3rd Field Survey Company, and some observations had been made by Lieut. Salmon at BEAUQUESNE, BAISIEUX and other points with a view to putting the trig. work on a satisfactory footing. It was decided to continue these observations and observe a series of triangles based on the French geodetic side BEAUQUESNE - RAINVILLE, and extending right through the Army area up to the Front Line. This was started in May and completed by the end of June.

For the Somme Battle, Artillery Boards were prepared for each Heavy, Siege and Field Battery taking part in the preliminary bombardment and several special boards were made for long range railway guns.

It was foreseen however, that as soon as any movement took place it would no longer be possible to keep touch with the Field Batteries or, with the staff available, to supply them with boards.

It was decided, therefore, to concentrate our efforts on the Heavy Artillery only and an order was issued by the M.G.R.A., to the effect that after July 1st, Artillery boards would be issued by the Field Survey Company to heavy Artillery only; Field Batteries must get on without them.

In order to avoid all delay in getting these boards out to the batteries, one Topographer was attached to each Corps H.A. and an Advanced Topo Section was established at DERNACOURT beside the III Corps H.A., solely for this work.

In addition each Corps H.A. was supplied with a number of printed copies of the Instructions as to how to obtain a new board and what to do with the old ones, and also a supply of forms on which could be entered all the particulars required for preparing the board. These arrangements worked well and the system of having a Topographer with each Corps H.A. was much appreciated by the Artillery. The Advanced Topo Section remained with the III Corps H.A. up till the end of the Battle, before which time it had moved up from DERNACOURT to FRICOURT WOOD.

The preliminary bombardment for the Somme attack completely obliterated every single trig point visible in the enemy's lines, and the Topo Section had therefore to carry forward the triangulation into the battery and O.P. areas. This was done by extending the series previously referred to, breaking it down into small triangles of two or three-mile sides, and establishing a large number of Survey marks, indicated by a signal pole with a small flag. These frequently aroused the suspicion of the troops and many were pulled down and destroyed, causing considerable inconvenience and delay in the work.

The triangulation in fact was executed under conditions of considerable difficulty.

In December 1916 the Fourth Army commenced to take over the front held by the French on its right, eventually extending the front as far south as ROYE, and in doing so taking over a large area in which hardly a single trig point was left standing. The French system of fixing batteries from "Cheminements" was of little use to us and the triangulation had to be extended south over the new area. This had to be done in the worst possible weather, which compelled the use of very small triangles and a slow rate of progress. The chain was approaching ROSIERES when the German retreat commenced on March 18th.

Previous to their retirement the Germans had destroyed every trig. point over an area of more than 200 square miles.

The extension Southwards was therefore stopped and two parties were directed to extend the chain of triangles due East, one working north and the other South of the Cologne river.

In order to use larger sized triangles, a special signal consisting of a collapsible iron tripod was designed and made in the Army Workshops. Several of these were put up but they proved to be altogether too collapsible and the original design had to be considerably modified.

Good progress was made by both triangulation parties in spite of bad weather and lack of transport and the two series were connected at HERVILLY with most satisfactory results.

In April the Advanced Topo Section moved up to PERONNE where it remained under the command of C.S.M. Archer till the Army left the area.

Period June 1917 - November 1917.

In July the Fourth Army moved to the Coast, the Trig. area extending from the Coast as far South as PERVYSE. The Belgian Triangulation of this area was of good quality and the work calls for little remark, being confined to the usual fixation of O.Ps., gun positions etc.

Period November 1917 - August 1918.

In November the Fourth Army took over the YPRES front from the Second and Fifth Armies, who handed over all data of trig. work carried out by them. An examination of this showed considerable discrepancies between the two Army systems and it was necessary to re-survey that portion of the front held by the Fifth Army to bring their points into sympathy with the Second Army system. This, when completed, gave a complete and coherent system over the whole Army area, of an accuracy such that when observations were made at any point, it was unusual to find from the direct observation a discordance of more than 15" to 20" between the computed and observed measures of the angles forming the fourth and fifth rays in a resection.

The system was a continuation of that laid out and observed by Captain Simms (2nd F.S.C. )

This, unfortunately, had not been carried very far back into our lines, and when the German attacks on the LYS drove back our line, all the southern points of this system were destroyed.

A chain of triangles was therefore carried back through POPERINGHE to ST. OMER. This chain included every old trig. point in the Army area and was executed during May and June. It was ultimately extended, at the request of Maps G.H.Q. to AIRE and HARLETTE to connect with the First Army and French Geodetic work. A connection with the French Admiralty Survey was also made at BERGUES, HONDSCHOOTE, ROSENDAEL, and DUNKERQUE. The area covered by this triangulation amounted in all to about 600 square miles.

The geographical coordinates of these points were computed for Army purposes on Clarke's first figures of the earth, but complete records were kept with a view to a subsequent adjustment, proposed by G.H.Q., with the new French Surveys.

Owing to the very long Army front and the great number of batteries in action the Trig. and Topo. Section during this period was entirely detached from the Mapping Section, and occupied an office in RENINGHELST, from here the Section retired to BOESCHEPE early in 1918, which place they were compelled to evacuate by the German advance in April: the Section then moved to WATOU and eventually back to CASSEL.

At the beginning of 1918 a new development of Artillery procedure was brought into general use in the Army, namely the employment of "Director Stations", now sometimes known as "Bearing Pickets", for laying out line.

The first "Director Station" put in by the 4th Field Survey Company was a picket put out in July 1916 for a 12 inch Railway Gun at DERNANCOURT, but the system had not come into general use, and its value was not apparently appreciated by the R.A. until the importance of surprise bombardments was established by the First Battle of CAMBRAI in Nov. 1917.

Bearing Pickets were gradually established all along the Army front and at the Army Artillery School during the spring and summer of 1918.

Classes were also held to instruct R.A. officers in their use. The first of these was held in February at the S.O.S. School, MONT des CATS, with the idea of training a few selected R.A. officers as instructors. Two courses, each lasting a week, were held. This course included resection and simple

trig. and Plane Table survey. Subsequently a shorter two-day course in the use of Bearing Pickets only was held weekly at CASSEL, six officers attending at one time. These courses were continued until September 27th and were much appreciated by the officers attending them, all of whom showed the greatest interest in the system.

Period August 1918 - December 1918.

In August the Germans commenced to evacuate the "LYS Salient", destroying churches and other prominent points as they retired. These points had to be re-established as we advanced.

In September orders were received to prepare for a large concentration of Artillery for the fourth and last battle of YPRES. Some 60 Field and a number of Heavy batteries were to take up their positions on the II Corps front the day before zero and open fire without registration.

The warning given to the Field Survey Battalion of this operation was so short that it was only possible to complete the arrangements for giving line and position to these batteries by concentrating practically all available trig. resources of the Battalion on this one Corps front.

The attack was completely successful and the last work of the Topo. Section was the carrying forward of the Trig. series over the old YPRES battlefield, till a connection had been established with the points still standing to the East of it.

PART III

MAPPING AND PRINTING SECTION



## MAPPING SECTION

### Period Feb 1916 - March 1917.

At the time when the 4th Field Survey Company was formed, the war had become entirely a “war of positions”; each side had entrenched itself on a line which had remained virtually unaltered for a year. This war of positions had engendered a demand for large scale maps which was new to warfare and to supply which no machinery existed. During the year 1915 the machinery for supplying these large scale maps had been gradually built up in each Army in various ways. This machinery and organization was put on to an official footing by the formation of a Field Survey Company for each Army at the end of 1915, and the duty of the Mapping branch of each Company was to prepare large scale maps showing the topography and the defences in the country in which the Army was operating.

The drawings for these maps were prepared at Army H.Q. and sent to Southampton where they were reproduced and printed and returned to the Field Survey Company for distribution. The scales adopted for these large scale maps were 1/20,000 and 1/10,000 and they were prepared by compilation of French Cadastral material supplemented by air photographs, the whole controlled by the existing French Triangulation. In our own lines a certain amount of plane table survey had also been done and was incorporated in these maps which were the “tactical” maps used by the troops in the line. These maps were printed in three colours. Grey for topographical detail and contours, blue for water and red for enemy defence works.

In addition to these maps the troops were also supplied with 1/100,000 and 1/40,000 maps, prepared at Southampton, and printed in several colours. No trenches were drawn on these.

All maps were printed on linen-backed paper and folded before issue.

The main distinction between trench and non-trench maps, which had led to the former being drawn in the field, was the fact that the former required frequent revision and keeping up to date as the new trenches were dug. New editions of trench maps were prepared at intervals whenever the amount of new work was considered to justify it. The length of these intervals varied therefore according to the activity of the enemy on his defences, and the frequency with which photos of them were received. As a rough average about four months was the normal interval between editions.

These 1/20,000 and 1/10,000 maps were arranged in a continuous series of sheets, each 32,000 by 20,000 metres on the 1/20,000 scale, extending down the whole forward area.

In addition to these tactical maps issued to the troops, certain other types of maps had come into use mainly for the use of staffs or special services for administrative work; examples of these were maps showing M.T. traffic circuits or maps showing Army and Corps areas. These maps showed special information not required by all troops, and showed it by an overprint on a grey print from the outline plate of the 1/100,000 series.

As the line was stationary such maps once printed remained current for a considerable period and were usually printed at Southampton also.

The whole system in fact depended on the Ordnance Survey for reproduction. The Field Survey Company was supplied however with a small printing equipment consisting of a demy hand press and a Zygad duplicator intended for reproduction of sketch maps, diagrams and the like required for illustrating reports or orders.

Such was the system when the 4th Field Survey Company was formed and took over the mapping of part of the front held by the Third Army

The mapping area taken over comprised six 1/20,000 sheets and eight 1/10,000 sheets as follows :-

<u>1/20,000</u>	<u>1/10,000</u>
57 D. N.E.	HEBUTERNE MEAULTE
57 D. S.E.	BEAUMONT MARICOURT
62 D. N.E.	LE SARS BOUCHAVESNES
62 C. S.W.	OVILLERS PERONNE
57 C. S.W.	

MAUREPAS ( Combined sheet parts of 62 C. N.W. and S.W. ) This sheet had been prepared by reduction of 1/10,000 sheets. The other 1/20,000 sheets had been drawn on that scale.

These sheets had all been compiled by the 3rd Field Survey Company and were either published or under publication, being prepared from French Cadastral material supplemented as far as possible by air photos, which however at this time were rarely available for areas more than 4,000 yards behind the German front line.

Trench plates for the German lines only had been prepared. The tactical policy at this time on both sides aimed at maintaining the integrity of the front line and support trenches. Few new trenches were being dug and most of the labour was put into the construction of deep dugouts, machine-gun and mortar emplacements.

The work of the mapper after completion of the initial compilation was confined to plotting such new trenches as appeared and attempting to locate these dugouts and special works. The latter could rarely be detected with certainty and usually not at all, so that the trace of the trenches on the map altered very slowly.

All plotting of new work was done by proportional compass on a copy of the last edition of the map, the amendments being inked up in green or violet ink.

When this "correction" copy began to assume a sufficient coloured appearance new drawings of the trenches and corrections to detail were made and sent to Southampton for a new edition. From the start of the drawing to the receipt of the map ready for issue took about a month so that every trench map when it reached the troops could not be expected to show any trenches dug during the last three weeks.

The work of the Mapping Section taken over from the 3rd Field Survey Company consisted of this correction and maintenance of the above named sheets. The staff available at first was only a small nucleus of about 6 or 8 men from the Ordnance Survey and this had to be supplemented by draftsmen found and trained in the Army before any further work could be undertaken.

As soon as the extra men had been found and taught their work new compilation of :-

1/20,000sheet 57 C. N.W. and  
1/10,000 sheets GUEDECOURT  
LONGUEVAL  
COMBLES

was put in hand and in addition work was commenced on the mapping of all British trenches in the Army area with a view to preparing "Secret" editions of the 1/10,000 series.

At this time maps showing British trenches were regarded as very secret and every precaution was taken to prevent such maps falling into enemy hands. The scale of issue was very small and each copy had to be accounted for in the same way as other secret documents.

Photos were rarely taken of our own trenches and the only material available for preparing these maps were plans and sketches executed by the Divisions in line of their own sectors. Copies of these were obtained from the Divisions and the trenches taken from them. In all cases they proved to be most inaccurate and great difficulty was found in adjusting their common margins. The Infantry however attached more importance to maps of their own trenches than to those of the enemy's and it was considered advisable to get out some kind of a map even if inaccurate rather than wait till all discrepancies had been cleared up. This work was therefore pushed on as fast as possible and completed by about the end of April.

In April instructions as to mapping requirements for the Somme offensive were received from the General Staff. These instructions were to the effect that on the day of the attack each officer participating should have in his possession the following six 1/20,000 sheets :-

57 D. N.E. 57 C. N.W.  
57 D. S.E. 57 C. S.W.  
62 D. N.E. 62 C. N.W.

New editions of all these sheets should be timed so that they were issued just before the battle opened.

Since the system of reproducing maps at Southampton did not, as explained above, allow of any trench map issued to the troops being less than three weeks out of date on the day of issue and as the day of the attack had not been decided, this plan could not be rigidly carried out. It soon appeared moreover that the enemy had detected the preparations for the battle and that he had commenced work on two completely new trench systems.

It was evident that a map even three weeks out of date might omit trenches which were of the utmost importance to the attacking troops and whose existence and position must be known to them before the attack.

It was decided therefore to aim at getting out new editions of the above six sheets on June 1st; to prepare and print locally on the hand press a set of tracings showing the position of all new work since the preparation of the map and issue one of these to each unit so that all officers in that unit could correct their maps by hand just before the operation began.

It was hoped that the attack if completely successful would lead to a period of open warfare for which trench maps would not be required, but it was foreseen that if only partial success was obtained the enemy would "dig in" on a new line. The attack would have been renewed on this line without delay and to carry out this attack it would be necessary that its position and nature should be made known to, the troops.

Time would not permit of new editions of the regular series maps being printed at Southampton and the printing equipment at the Army did not permit of such large sized maps being printed there at all.

In this dilemma it was decided to continue the principle governing the issue of the tracings already referred to, namely to prepare on the hand press a number of demy sized sheets sufficient to issue one to each unit. On these would be shown all new work and from them each officer could bring his own map up to date by hand.

It was decided to print these sheets as new maps rather than tracings showing trenches only, partly to overcome the danger of the tracing being incorrectly superimposed on the map and partly because supplies of rag litho or L.B. paper were more plentiful and it was less liable to tear in use than tracing paper.

To prepare for these sheets it was necessary to provide a supply of "backgrounds" beforehand so that the final printing could be kept down to one colour.

The G.S. attached great importance to this information about new trenches reaching the fighting troops at the earliest possible moment and we were directed to give priority in these maps to speed rather than finish or extreme accuracy of plotting.

Another point to which great importance was attached was that of keeping the troops informed of the position of our front line at all times, this being regarded as of even greater importance than the position of new works.

It was therefore decided to issue a separate special map at the end of each day showing only the position of the front line without waiting till photos had been received and new trenches plotted. For this a 1/40,000 "background" taking the whole Army front on one sheet was drawn in the Printing Section and put down on stone.

For showing new work drawings were made on transfer paper of the ordinary 1/20,000 sheets and a stone prepared for each half dividing the standard sheet vertically down the centre. This procedure gave a number of demy sized sheets which could be printed on our own presses.

It was estimated however to supply one copy per unit at least 400 copies would be required of each sheet and that if several such sheets had to be printed it would be more than one press could turn out. To increase our resources therefore, Maps G.H.Q. supplied an extra hand press just before the battle and recourse was had to civilian presses in AMIENS for some of the work.

In AMIENS were several firms owning printing machines and arrangements were made to have the "backgrounds" printed on these. 2,000 of each were so printed and held in stock at the Field Survey Company. Later on arrangements were made for these to be printed at Southampton in batches of about 6,000

The attack was launched on July 1st and the map showing the position of the front line was produced daily from that date onwards. The information was obtained from the G.S. at 9 p.m. and the maps sent out by D.R. or box-car at midnight.

At first only 150 copies were printed but this number gradually rose to 360 by the end of the battle.

The first of the "special" maps showing new trenches was issued on July 7th as an overprint on the western half of 57 C. S.W., 600 copies being taken off on the handpress. Subsequent editions were issued on July 13th, 17th and 31st.

In addition to the six 1/20,000 regular series sheets ordered by the Army requests were received from some of the Corps for special maps for the first day's attack. In some cases only an increased issue of the regular 1/10,000 series was asked for but three "special" maps were also produced :-

- (1) A special small 1/20,000 sheet for the X Corps showing the Corps front only and with certain points and objectives specially marked. The whole generally similar to the modern "message" map. This was drawn by the Printing Section and printed in two colours in AMIENS, 2,000 copies being printed.
- (2) A special large 1/5,000 map of the III Corps front. This was printed at Southampton and about 1,000 copies issued, also in two colours.
- (3) A special combined 1/20,000 sheet "MONTAUBAN" for XV Corps. This was prepared at Southampton and printed in three colours, the trench names being added in blue.

This map was originally intended to be a 1/10,000 combined sheet but through a mistake in the orders was photographed down to 1/20,000. It proved to be an excellent map and owing to its handy size was very much appreciated. So much so that it became the precedent for two other similar maps "MARTINPUICH" and "GINCHY" which replaced it as the line advanced.

All these special maps however proved most useful and those Corps who had them conducted all their operations upon them.

The production of these maps threw a heavy strain on the Printing Section. This is better understood perhaps by a consideration of the number of maps actually printed which rose from 13,500 in June to 25,000 in July.

On July 18th the Reserve Army took over the northern portion of the Army front and somewhat relieved the pressure. After this practically the whole Army front was covered by the two halves of 1/20,000 sheet 57 C. SW. of each of which supplies of backgrounds were now arriving from Southampton.

It soon became evident however that the policy of supplying one map per unit and correcting maps by hand was inadequate for the needs of the troops. These special sheets being the most up to date maps available quickly superseded the regular 1/20,000 sheets as the tactical map and pressing demands for increased issues were received from all sides.

It was also found that the 1/40,000 situation map though very popular and much appreciated by all recipients did not give the position of the line in sufficient detail. From October 1st onwards it was therefore supplemented by two small special maps prepared on the duplicator known as Map A and Map B. These two sheets were "brief sized" sheets taking in the greater part of the front line area of the Army front. The "background" was printed by litho on duplicator paper by transfer from the 1/20,000 detail plates. The trenches were printed on this in red by Zygad. New work and the position of the front line was overprinted again on this in blue.

In order to get this map out at the earliest possible moment the grey and red were printed beforehand. As soon as the photos taken during the day were received the new work was sketched in and the blue printing prepared, the maps being usually ready to go out by the mid-day D.R. from Army H.Q. As soon as this had been done a new red plate was prepared incorporating both red and blue of the current day's map. This was printed off in the afternoon and the prints held ready as backgrounds for the next day's blue printing and so on.

There were thus two "situation" maps current from Oct 1st onwards. One sent out at midnight showing the approximate position of the front line only and a second which followed it at mid-day next day showing the front line in more detail and the positions of all new trenches dug during the previous 24 hours. These new maps were printed at great speed and it was therefore not possible to supply large numbers. Only about 200 copies of each were issued daily.

To provide a sufficient supply of up to date trench maps for issue to the troops it became necessary to print much larger numbers of the demy 1/20,000 special sheets.

To enable us to do this recourse was again had to the civilian presses in AMIENS pending arrangements which were being made for the D. of A.P. & S.S. to install a printing machine there.

The Army front was at this time covered by two demy 1/20,000 sheets but owing to the boundaries of the Corps areas, two of the Corps had to use both sheets so that to supply 600 copies to each Corps 1,200 copies of one sheet and 600 of the other had to be printed.

At the end of August it was decided to disregard the sheet lines of the regular series maps altogether and take each special sheet to suit a particular Corps front and issue it to that Corps only. This involved printing 3 special sheets instead of two but no increase in the total number of prints. The first of these exclusively Corps front sheets was issued on the 11th Sept 1916, 1,000 copies being printed in AMIENS for the XV Corps. A second edition of this sheet was issued on 17th Sept immediately following the successful "Tank" attack of Sept 15th.



Sections. Even so it was found that it was not possible to get out the "A" and "B" situation maps quickly enough and suggestions were put forward that this map should be prepared by Corps, a Topo Section with each Corps being formed for the purpose.

It should be noted that up till March 1917 no vandyke or photographic apparatus was available and all maps were prepared by drawing on Transfer paper. The printing outfit in fact was not designed for the preparation of topographical maps for general issue and that it was possible to supply these was due to the fact that at AMIEN, within easy reach of the Army H.Q. , were a number of civilian presses of which we were able to make use. The types and natures of maps issued were decided on by the O.C. Field Survey Company after consultation with the Corps and Army Staffs and many of them were tentative only.

As a result of experience however all the special maps became more or less standardized into the form of a special sheet for each Corps taking in its own front and published in four styles.

- |                           |   |
|---------------------------|---|
| (1) German trenches only, | Red overprint on grey background.                 |
| (2) Secret edition,       | British & German trenches. Blue overprint on (1). |
| (3) Hostile Batteries,    | Green overprint on (1).                           |
| (4) Enemy Tracks,         | (Artillery Targets) Dark blue overprint on (1).   |

In addition to these special sheets the following maps became also "Standard" maps produced at fairly regular intervals.

- (1) Situation map showing the front line and dispositions of the enemy's forces.
- (2) Traffic circuit maps showing the M.T. circuits.
- (3) Special maps of enemy strong points.
- (4) Map showing Army and Corps areas.

By the middle of November 1916 the line had again become stationary and the Fourth Army soon after commenced to take over the front held by the French Army on its right.

New compilation of the following sheets was put in hand :-

- |          |   |
|----------|---|
| 1/20,000 | 57 C. S.E.<br>62 C. N.E.  |
| 1/10,000 | BERTINCOURT<br>GONNELIEU<br>SOREL-LE-GRAND<br>VILLERS GUISLAIN<br>LIERAMONT<br>EPEHY<br>BUIRE<br>ROISEL |

Trench plates were prepared for :-

- |          |                         |
|----------|-------------------------|
| 1/20,000 | 62 C. N.W.              |
| 1/10,000 | BOUCHAVESNES<br>PERONNE |

as well as for a new series of Corps front maps corresponding to the new Corps areas (SAILLY SAILLISEL, MOISLAINS and TORTILLE VALLEY, etc)

Concurrently with the above, the northern portion of the Army area from LIGNY THILLOY to LE TRANSLOY was gradually taken over by the Fifth Army, who took over the plates of the III Corps front sheets and the regular series sheets :-

- BAPAUME  
BEUGNY  
GUEUDECOURT  
LONGUEVAL

The compilation of 57 C. S.E. and 62 C. N.E was rendered somewhat difficult by the fact that we were at first unable to obtain "cadastrals" for the villages on the eastern edge of these sheets which were outside the Department of the Somme. The first editions of these sheets were therefore completed from enlarged 1/80,000 and were correspondingly inferior in consequence.

In February, the Fourth Army took over the front south of the Somme as far as ROYE. This change was effected at very short notice, and the first maps issued were photographs of the French Plans Directeur of these areas. Redrawing and replotting of the following sheets of this area was taken up at once, and pushed on as quickly as possible.

1/20,000            62 C. S.W.            66 E. N.E. & 66 D. N.W. ( combined)  
                         66 D. N.E.            62 C. S.E.            66 E. S.E. & 66 D. S.W. (combined)

1/10,000            DOMPIERRE, VRELY, NESLE, ROYE, BARLEUX, PUNCHY,  
GUERBIGNY,            AMY, VERMANDOVILLERS, BEAUFORT, ROYE, BOUVINCOURT,  
                         ST. CHRIST, HATTENCOURT, MARQUIVILLERS, VERMAND, ATHIES.

While these were in preparation the "Corps Front" series was extended southwards and the policy of issuing these in the various styles mentioned above was continued

Towards the end of February evidence of the approaching enemy withdrawal, in the shape of numerous fires, began to appear and a number of special maps were published for the G.S. (Intelligence) designed to show his tactical policy. Such maps were a series of maps showing fires and explosions and maps showing the defensive lines and organization.

As a background for these a reduction of the 1/40,000 to 1/100,000 was found useful, the squares on the map greatly assisting the identification of points.

Other maps produced during this period were :-

- (1) Map of VAUX-en-AMEINOIS for T.M. school.
- (2) Map of FLIXECOURT region for Infantry School.

About the 1st February the first photos were received of the famous "HINDENBURG LINE" the construction of such elaborate defences so far in rear of the enemy's front line indicated some remarkable change of policy and arrangements were made at once to map them. Our own compilation of this area had not been started but French Plans Directeur of the area were available. These were however merely the 1/80,000 map enlarged and redrawn, and on comparison with the photos proved to be most inaccurate.

The trenches were plotted on these as well as possible, and, after correcting the detail to some extent, a map in four sheets entitled "The Hindenburg Line" 1, 2, 3 and 4 was drawn in the office and published in two colours. The first of these sheets was issued on 7th March and the last on 13th March.

On March 18th the Germans evacuated their front line trenches and the retreat to the Hindenburg Line commenced.

The experiences and lessons drawn from the Somme battle may now be summed up.

From the mapping point of view the system of printing all maps at Southampton which had served very well for stationary warfare, had broken down and the necessity for greatly increased printing outfit with the Armies had been established.

For tactical purposes the superiority of the "Special Sheet" over the "Regular Series" sheet was generally admitted as also was the need for special machinery for getting out "Situation Maps" at great speed.

The types of special maps known as Battery Maps and Track or Target Maps issued at frequent intervals had become the accepted way of indicating artillery targets.

The multiplication of types and styles of maps and the necessity for issuing them at short notice and frequent intervals necessitated a recasting of the printing equipment and the introduction of



photographic methods to replace the slower methods used. In consequence of this a vandyking unit was obtained from G.H.Q. and brought into use and arrangements were made for the supply of demy power presses to all Field Survey Battalions.

To expedite the preparation and issue of the "Situation Maps" the decision was taken to form a Topo Section with each Corps as part of the Field Survey Company and the formation and training of these units was commenced early in 1917, and completed by the end of March after which date the issue of the 1/20,000 Situation Maps for the Army H.Q. was discontinued.

Statistics of the number of maps printed locally during this period are as follows :-

February	700	Mostly diagrams
March	3,900	Many diagrams
May	12,500	Many diagrams and maps illustrating reports
June	13,500	Including the first "backgrounds" for "special" maps.
July	25,000	
August	17,000	Decrease due to shortening of Army front.
September	30,000	
October	39,000	
November	27,200 )	
December	27,500 )	Battle dying down.
January	16,400 )	
February	25,000	Front increasing in length again.

#### Period March 1917 - June 1917.

The advance to the Hindenburg Line was carried out mainly on 1/40,000 maps. No considerable fighting took place and no special maps were required. All labour was therefore concentrated on maps of the Hindenburg Line area so as to have these ready for issue when the troops reached it.

The drawing for 62 C. N.E. and S.E. and 57 C. S.E. had been sent to Southampton some time previously as well as all the drawings for the 1/10,000 sheets mentioned above.

The maps, both 1/20,000 and 1/10,000 of the old line were received just as the retreat commenced but too late to be brought into use.

The compilation of 57 B. SW., 62 B. N.W. and S.W. was started but as no cadastrals of this area were available and only photos of very small parts of these sheets, it was decided to concentrate first on a series of special Corps front sheets of the Hindenburg line area only and work on these while the Ordnance Survey pushed on with the drawing of the regular series, copying the French Plan Directeur. Five demy special were accordingly put in hand :- FLESQUIERES, BANTEUX, LE CATELET, BELLENGLISE, and OMISSY covering the front from HAVRINGCOURT to ST. QUENTIN inclusive. These were recompiled from photos only, drawn in the Drawing office, vandyked, and printed in three colours - grey, brown and red. While these were in preparation the Vandyke outfit was got into working order and the first vandyked map ( sheet 66 D. N.E. Western Half ) was printed on 31st March.

The five sheets of the Hindenburg Line were completed, vandyked and printed in three colours, grey, brown and red, and were ready for issue on April 4th, 2,000 copies of each being printed in AMIENS.

Two special maps one of PERONNE 1/5,000, and one of LENS for First Army, also 1/5,000 were printed about this time. The latter job is of interest. The original was sent down by special D.R. and 300 copies were printed in two colours within 24 hours. A very good piece of work on the part of the Printing Section.

As soon as the series of special maps was out, work was started on re-compiling the regular series.

The second edition prepared at the Ordnance Survey from the French Plan Directeur was received about this time but being only enlarged 1/80,000 it differed violently from the "special" sheets already

published locally and though issued it was of little use, an order being issued by G.S. that all references in operations should be to the special sheets.

The compilation of 62 B. N.W and S.W. was very difficult as the cadastrals were not yet available and an attempt had to be made to compile by adjusting photo mosaics between trig points. One good series of photos between BELLICOURT and LE TRONQUOY being so adjusted between three points only. This adjustment was afterwards modified as it disagreed so much with the French Plan Directeur, but events proved subsequently that the original adjustment was far the better of the two and unexpectedly accurate. ( This was doubtless due to the fact that the R.F.C. at this time were commencing to use the 6 inch wide angle lens and the photos for mapping purposes were exceptionally good. ).

As the recompilation progressed new editions of the special maps based on it were got out.

The company moved up to VILLERS CARBONNEL in May and shortly after its arrival was supplied with a Royal sized Printing Machine on which practically all maps were subsequently printed., AMIENS being now too distant to be of any use. ( It should be noted that the A.P. & S.S. had by now installed printing machinery at AMIENS. Little use could be made of this as the personnel working it were unused to map work and did not appear able to turn out work of the accuracy and general standard required. )

During this period, the only other points worthy of note were that the rule regarding British trenches only being shewn on Secret maps was partially relaxed, that the R.F.C. commenced to take photographs specifically for mapping purposes, and that the first attempts were made at Helio work in the field. The last edition of the special "Hindenburg Line" sheets were prepared by helios done with the 5 x 4 inch Panros camera and requiring 36 negatives per map, one sheet being patched up and transferred in 38 pieces. A remarkable effort ! ( Before leaving VILLERS CARBONNEL the Company was supplied with a whole plate camera for this work ).

The ordinary compiling and other work of the regular series both 1/20,000 and 1/10,000 was continued but calls for no special comment.

It was during this period that the Corps Topo Sections commenced work. The instructions issued to these on their formation are attached as an appendix. A large number of duplicator backgrounds were printed for these sections.

Statistics of the maps printed locally during this period are as follows :-

March	27,000
April	41,000
May	40,000
June	21,000

It should be noted that the increase is greater than appears from the increase of numbers only, since in most of these maps the backgrounds as well as trenches were printed by the Field Survey Company

The number of colours on each map was also greater than heretofore.

#### Period July 1917 - November 1917.

About the end of May the XV Corps was detached from the Army and moved to the coast. A special Field Survey Company detachment being formed under Major KEELING, R.E. to supply the maps required by them.

At the beginning of July the Fourth Army moved up to the coast also and all the mapping work in the Somme area was handed over to the Third Field Survey Company The command on the Coastal front passed to Fourth Army on July 8th.

For the coastal areas the Belgian 1/20,000 were available but required redrawing and in some cases recompiling.

The special detachment had redrawn two 1/20,000 demy special sheets and published these pending the issue of the redrawn regular series sheets. On 10th July the enemy attacked and pushed back our line necessitating a new edition of our maps. The opportunity was taken to replace the two demy sheets by a series of "Royal" sheets covering the whole front. This was supplemented by a special 1/10,000 Royal sheet which took in practically the whole of the Army front ( first line trench systems ) on one sheet. Owing to the intricate nature of the trenches and topography it was necessary to modify the style of printing and these sheets were published in three colours, grey, blue and red. It was also necessary to "generalize" the trenches considerably on the 1/20,000 scale and omit all the wire in the forward systems. the contours on these maps were in the main copied from French Plan Directeur and it was found that those showing the dune area were very difficult to read. The dunes formed many small isolated "peaks" and circular depressions which were almost indistinguishable from each other on the map.

These dunes were therefore carefully studied by means of stereoscopic photographs and eventually shown by hachures, which gave a much clearer and more practical representation of the ground than the former contours.

Owing to the short front held by the Army, the Field Survey Company was able during this period to issue the editions of special maps at much shorter intervals than formerly, and also produced a 1/40,000 series by helio from the French 1/20,000 Plan Directeur, which was found very useful. The first regular "Message" maps prepared by the 4th Field Survey Company were also issued during this period, though the attack for which they were intended never took place.

By the end of October all the 1/10,000 sheets in Sheet 12 had been completed ( the 1/20,000 series being prepared by photographic reduction of these).

An administrative map known as "Administrative Situation Map" was started during this period. This was issued fortnightly on the 1/40,000 scale and showed the positions of various administrative organizations and units such as C.C.S., Repair Shops, Water Supply, Railways, Lorry Parks, etc. It was printed in four colours. This map was continued when the Army took over the Ypres front; but the Army area then became so large that two double demy sheets were required and the map had to be published monthly instead of fortnightly. It was considered by the Fourth Army Staff to be a most useful if not indispensable map, but was discontinued by the Second Army when the command passed to it in April 1918.

Statistics of the number of maps printed by the Field Survey Company during this period are as follows :-

July	55,000
August	59,000
Sept	44,500
Oct	41,000

Nearly all these maps were entirely Field Survey Company products as the practice of obtaining backgrounds from England has been discontinued. Many of these maps were in five or six colours.

#### Period November 1917 - March 1918.

In November 1917 the Fourth Army left the Coast and took over the Ypres front formerly held by the 5th and 2nd Armies. The mapping area comprised sheets 20 SW., 20 SE., 28 NW., NE., SW., and SE., and 36 NW. and NE.

Both 2nd and 5th Armies had however published a number of special sheets on which operations during the summer had been conducted, and the plates for these sheets as well as for the regular series sheets were handed over by the 2nd and 5th Field Survey Company. With the changes in Corps areas involved by the reliefs it was found that the arrangement of these special sheets was not very convenient and it was decided to continue the policy of letting each Corps have its own front on one sheet, the arrangement of all the 1/20,000 and 1/10,000 special sheets was therefore recast accordingly. As there were five Corps in line on the Army front this involved heavy work for the mapping and printing sections, the more so as it was found on examination that during the battles in the summer many names, given to farms and buildings which were shown on the regular sheets, had not been entered on the regular series plates from which transfers were taken to patch up the new sheets.

The first work therefore was to bring the regular series plates into line with the old special maps by getting out new editions of all the 1/10,000 sheets concerned. When this had been done a series of 5 special 1/10,000 maps and 7 special 1/20,000 sheets were prepared and published. New editions being published at frequent intervals and boundaries of the sheets varied from time to time to conform to the frontages held by the various Corps.

Each exchange naturally entailed preparation of a new background and it says much for the efficiency of the Printing Section under Capt. Cursiter that it was able to cope with these changes and at the same time maintain the frequency of the editions.

The efficiency of the Section in fact was such that it was able to turn out a complete 1/10,000 or 1:20,000 map of any portion of the Army area, printed in 2 colours, in 12 hours.

The area comprising the Ypres salient presented several special features. The surface of the ground had been completely destroyed in the battles of the previous summer and now bore no resemblance to the maps of it which were in use.

All the lower lying areas had become waterlogged and impassable and had become serious military obstacles which it was important to indicate on the map. Air photos of this broken ground were most difficult both to interpret and to plot, wire could not be seen at all and the front line positions, consisting of pill boxes and occupied shell holes, could not be located with certainty.

In view of these facts it was necessary to produce :-

- (1) A special map for use in the air.
- (2) Pay special attention on large scale maps to vertical relief by printing "Layers" on the special Corps front series.
- (3) Rely largely on Corps Intelligence Summaries, captured maps and similar data for the position of the enemy's forward defences.

The special R.F.C. map was printed in five colours. Grey outline, black railways, brown roads, blue water and green woods, and showed such features as they actually existed at the time, irrespective of whether they appeared on old maps or not.

Hostile Battery Maps ( which were used in the air) were printed in four colours. Grey outline, blue water, green woods and black batteries.

1/10,000 "Corps front" series in four colours, grey outline, red trenches, blue trenches and one brown layer tint.

With the exception of the first of these, all these maps were issued at frequent intervals throughout the winter of 1917-1918.

At the end of 1917 the collapse of the Russian Empire compelled us to change our policy which had hitherto been almost entirely offensive, to one of defence, and we commenced to devote much more attention to maps of our own lines than heretofore. At the same time the rules regarding showing British trenches on non-secret maps were greatly relaxed.

The R.A.F. were asked to photograph practically the whole Army area and each Corps Topo Section was directed to carry out surveys of all defensive and other works in their own Corps areas and the work of mapping our own area hurried on as much as possible.

It is of interest to note as illustrating the backward state of mapping in our own lines at this time that in November when the Fourth Army took over this front the Company was asked to supply maps showing the new roads constructed for and during the previous summer's offensive. They were only able to do so by taking their positions from captured German maps the information not being available in our own offices.

During the winter in view of possible eventualities a number of S.P.Os. were trained in plane table work and the recompilation of 1/10,000 sheets of 27 N.E. and 27 S.E. put in hand.

Statistics of maps printed by the Field Survey Company during this period are as follows :-

November	45,500	Change from Coast to Ypres.
December	87,000	)
January	74,000	) Great increase in size of Army front.
February	87,000	)

Period March 1918 - August 1918.

In March, the great German offensive of 1918 commenced and the first attack on the Third and Fifth Armies drove back our line for a great distance. As a result of this operation, our defensive policy was greatly "intensified". The defensive "Zones" were made much deeper and work was started on positions still further back than heretofore.

In the Field Survey Companies the work on sheets in the enemy's lines was reduced to a minimum, and all possible labour concentrated on sheets in our own area.

Early in April, the German "Lys attack" was launched and again drove back our line causing a withdrawal all along the Army Front.

1/20,000 sheets were available as far west as ST. OMER, but these were drawn from Plane Table Surveys hurriedly executed in 1914 and 1915 and required revision and correction. Many new trench lines were dug which had to be plotted. It was decided, in spite of the limited time available, to recompile all these sheets; 36 A. N.E. which was most urgently required on the 1/20,000 scale, and the remainder on the 1/10,000 for reproduction at 1/10,000 or 1/20,000 as required.

The system adopted for compiling differed slightly from previous procedure, and it was proved the best and quickest method used for mapping by the Battalion, it is perhaps worth describing in some detail. It was as follows :-

A number of plane tablers were sent out into the area with instructions to resect the positions of all main cross roads and to check the road classification on the existing sheets. Simultaneously the cadastral reductions were laid down in the usual way being checked as the Plane Table results came in.

As soon as the positions of the main cross roads were satisfactorily established, the negatives of all available photos were obtained from the R.A.F. and handed to the draftsman, who selected the control points on each photo and marked them on the back of the negative. The corresponding points on the compilation diagram were traced off on a piece of paper. The negative was then placed in an enlarging lantern and an image thrown on to a board mounted vertically on a universal joint. The focus and board were then manipulated until the points on the image coincided with those on the tracing and a point was then taken. This point was then traced direct on to the fair drawing. This method proved to be very quick and when sufficient points were available, very accurate. As soon as the fair drawing was sufficiently advanced, oroverax prints of it were made and topographers sent out to do the contouring and check the interpretation of the photos on the ground, putting in by eye the positions of any features such as cuttings, banks, trees, etc. omitted; these being then plotted by reference back to the photo, and noting any errors of interpretation such as hedges instead of ditches. When, owing to the proximity of the enemy, this check could not be carried out, it was done as far as possible by studying panoramas and oblique photographs. The contouring of such areas, as for example, the MONT DES CATS hills on which topographers could not move about freely, was done by stereoscopic study of selected air photographs controlled by a certain number of heights observed from Survey Posts. This method, though rather slow and requiring considerable judgement and experience, gave fairly good results. In many cases it was possible, when stereo photos were not available or the ground unsuitable, to trace out the bottoms of valleys on air photographs, often a small stream or ditch at the foot of the valley could be identified and in other cases the "lush" meadows could be clearly seen; still more often the arrangement of hedges and cultivation lines would reveal to an experienced examiner the direction of the drainage. The contouring of such regions as the area around METEREN and STRAZEELE was elaborated and much improved by these methods.

The maps contoured in this way, though not perfect, were a great improvement on any that existed before, subsequent verification showed that in almost every case the main valleys had been correctly shown, and the absolute heights were rarely seriously ( more than ten metres ) in error. The chief

inaccuracies were in the position and heights of under-features and in small side-valleys - more particularly in the flatter portions of the country.

Working in this way a staff, averaging six topographers and twenty draughtsmen, succeeded in mapping more than twenty 1/10,000 sheets including detail, water, contour and trench plates, in three months.

Most of these maps were reproduced at the Overseas Branch of the Ordnance Survey, but every drawing was vandyked before being sent away, so as to have plates available in case of emergency.

Great numbers of maps of all kinds had to be produced during the LYS battles, but they presented no special features except that in such rapid movement it was not possible to prepare special maps for each Corps.

The Battalion moved from CASSEL to BLENDECQUES during the battle, and there was an interruption of a week while the presses were re-erected. When this had been done the Double Demy press ran continuously for 38 days, only stopping to change colours. Over 360,000 runs were printed in this time. The Demy machine on one occasion printed 80,000 runs in 24 hours.

Gradually the line stabilised and the pressure relaxed. By the beginning of June the map situation was once more well in hand, and the preparation of special "Corps front" maps was recommenced. Of these the most noteworthy was a Double Demy map of the MONT des CATS area showing layers and hill shading as well as two colours for trenches. (in all 6 printings).

Throughout this period of heavy pressure the want of a camera capable of taking up to double demy size was much felt and an extension to the 24 x 20 camera was constructed by the Battalion carpenters. Unfortunately it proved impossible to get glass plates and dishes for this and we were never able to make use of it.

The statistics of maps issued during this period are interesting as shewing the remarkable increase in the output of the Field Survey Battalion.

The figures are as follows :-

March	73,500	
April	139,000	German offensive.
May	122,500	German offensive arrested.
June	104,000	Line stabilizing. French held part of the front.
July	205,000	Exit of the French. Two new Corps come into line.

#### Period August 1918 - November 1918

In August the enemy commenced to withdraw from the LYS salient and efforts were once more concentrated on maps of the enemy's lines. It is interesting to note however, comparing this period with that of the SOMME, how much less attention was now paid by the fighting troops to the position of trench lines and their up-to-dateness on the maps. Topography, not trenches, had regained the paramount ascendancy and with it the need for showing ground forms, by layers, shading or otherwise, as clearly as possible and if necessary sacrificing some of the details of the trench drawings to avoid obscuring the detail plate.

In September preparations commenced for the last battle of YPRES and a large number of special message maps were prepared for the principal Corps concerned. The desire for layered maps was again noteworthy, but otherwise these maps presented no new features.

After this operation, pressure on the mapping sections eased off considerably, as it was not necessary to issue trench maps of any kind, the troops making use of the regular series 1/40,000 and 1/20,000 sheets only. The popularity of the layered 11/40,000 series again exemplifying the value of this style of map.

At the end of October the Battalion moved up by train to ROUBAIX and were installed in a large school on the outskirts of the town. In November the Armistice put a stop to all need for tactical maps.

Statistics of maps published by the Field Survey Battalion during this period are as follows :-

August	100,000 mobile warfare
September	452,000 British offensive, the 4th Battle of YPRES

Period November 1918 - End of the Year.

At the end of October in view of the possibility of rapidly moving operations the Battalion was supplied with an American Printing lorry carrying a Double Demy rotary press. This came in useful for printing traffic circuit and similar maps at ROUBAIX while the flat bed presses were being installed. In the past one of the chief causes of delay in installing these had been the necessity of setting the engines driving them on concrete, which had to be left about a week to set before the engine could be used.

To get over this difficulty, two concrete blocks about 3ft x 2ft x 2ft carrying the necessary holding down bolts had been prepared at BLENDÉCQUES and were carried up to ROUBAIX as part of the equipment. These were "dug in" outside one of the windows of the Printing Shop, the counter shafting fixed to the wall, and the belt passed in through the window after removing one of the panes of glass. This arrangement enabled us to start the presses in 3 days from the time of arrival at ROUBAIX.

As soon as it was heard that the Second Army was to advance into Germany, arrangements for map supply were commenced. The available maps were a 1/250,000 series printed in several colours and a 1/100,000 being prepared by the Ordnance Survey from German maps. Advanced copies of these last were received about the 11th November, and all available draughtsmen were at once put on to tracing them with a view to preparing "backgrounds" or skeleton maps for administrative purposes, such as maps showing traffic circuits and Corps areas.

The maps were divided up and traced in small portions, then vandyked and patched together on double demy plates, which were ready by November 24th.

In addition to this a 1/250,000 map of the area occupied by the British Army in Germany was prepared by photographing a grey 1/250,000 railway map received from G.H.Q. a short time previously.

On November 24th the Army Commander with part of the Army staff moved forward to NAMUR. The Field Survey Battalion equipment and machinery now amounted to about 75 lorry loads and it was not possible to move this up by road.

A mobile detachment was therefore formed of about 25 men equipped with :-

- 1 Double Demy Hand press
- 1 Swift Treadle Press and a supply of type
- 1 Panros Camera
- The American Printing Lorry

and taking the plates of the 1/250,000 and the skeleton 1/100,000 maps just referred to. This detachment under the command of the O.C. Battalion accompanied the Army H.Q. It carried a supply of maps ( 1/250,000 and 1/100,000) and paper, the whole, including men, was carried in 3 3-Ton lorries. The maps produced on the road were principally "Army and Corps Area Maps", but owing to the non-arrival of certain of the maps of Germany from the Ordnance Survey it was necessary to print off a supply of sheet 1M 1/100,000 to enable the troops to advance. 6,000 copies of this sheet were accordingly printed and distributed.

The distribution of maps during this advance was very difficult, and a reinforcement of four men, map clerks and storemen packers, with a 30 cwt lorry and a box car were sent up from ROUBAIX, and joined the Advance Party just before leaving NAMUR.

Subsequent halts were made at SPA and DUREN and the detachment arrived at COLOGNE on December 19th.

The above concludes the War History of the Mapping Section of the 4th Field Survey Battalion. A few remarks may be added in conclusion on the general question of war maps in FRANCE.

It will have been observed that the operations can be classified into three categories :-

- (1) Position or stationary trench warfare.
- (2) Limited objective attacks.
- (3) Open or mobile warfare.

Each of these types of warfare requires special types of maps suited to it, and each type of map requires a different kind or amount of machinery to produce it.

In position warfare the fighting is confined to Artillery fire and infantry raids. Each unit operates on a definite section of the front of which the limits are defined with considerable precision and known to all. The trenches change slowly, and it is not of great importance that new work should be immediately shown on maps. The types of map which are most of use therefore, for this class of warfare are very large scale maps (1/5,000 or larger) for the infantry, taking in only their own sector, and maps for the Artillery. These maps do not require frequent renewal but should show the defences in fullest detail.

For limited objective attacks the ruling factors are "up-to-dateness" and convenience for use in the Field. A map of handy size, taking in only the necessary area on one sheet is the best. This prevents the use of a very large scale - 1/10,000 for a short objective, and 1/20,000 for a deeper one appear to be most suitable. A new map should be prepared for each attack, and issued in sufficient numbers to give every man likely to be called on to exercise command, his own copy; which should be clear and completely up to date.

With the specialization of the different arms, it is probable that each arm, Air Force, Infantry and Artillery should have its own special type of map. Attacks are organized in great detail and the maps should show defences if possible with corresponding minuteness, but clearness is always the first consideration.

New editions must be frequent, and it appears unnecessary therefore to use expensive weather-resisting paper.

In open warfare, the area over which a unit operates is less restricted, and the use of a smaller scale is essential. Nevertheless, to enable the aeroplane to indicate targets by wireless, a grid or similar system of references is essential, and the map must be of large enough scale for "scientific" Artillery work and to enable organised defensive positions to be shown in some detail. 1/50,000 and 1/40,000 seem to be the best scales for this sort of fighting, supplemented by a 1/100,000 for the preliminary movements. Maps will be difficult to renew during the operations and should be printed on durable paper. Frequent editions are unnecessary, as details of defensive works lose their former importance.

Mapping and printing equipment for this, consequently need not be so elaborate as for (ii), but must be completely mobile.

As regards the maps produced in France, the organisation first devised was suitable for (i) only, and had to be completely overhauled and expanded to deal with (ii), and finally proved too immobile to be thoroughly satisfactory for (iii).

The question of the best scale for Compilation was much discussed. In the 4th Field Survey Company, the 1/10,000 scale was preferred and 1/20,000 maps were prepared whenever possible by reduction from it.

In general, it is advisable that all maps in use and to which "square references" are made should agree exactly, and this is best assured by doing all the drawing on one scale and preparing all maps by photography from these drawings.

Compiling on a large scale is generally easier and requires less fineness in the drawing. The actual drawing will commonly stand reduction better than the typing, which should therefore be done separately for each scale. Vertical relief should, whenever possible, be shown by layers as well as contours as they are usually easier to read quickly.



As regards the mapping staff. When the organisation for preparing and printing maps has to be decentralised, as it has to be in any sort of moving warfare, it is essential that the machinery should be such that the strength with each formation can be adjusted in proportion to the area it occupies and the amount of work it is called upon to do.

The organisation of Field Survey Battalions always suffered from this defect, which was never satisfactorily overcome.

The necessity of having to send drawing to England for reproduction was another serious handicap which was only partially overcome by the establishment of the Overseas Branch of the Ordnance Survey in France. If the drawing of any map has to be sent away, it may happen that a reproduction of it is urgently required before it can be returned; however, if the drawings are away for any time, they get out of date and their correction requires very careful examination. It is far better when possible to keep all drawings at Battalion HQ and keep them up to date from day to day as the photos come in. A new edition can then be got out at any moment, almost as a matter of routine, without any delay.

This is a matter of importance when, as at the end of the War, the Field Survey Battalions may be expected to produce special maps for an operation at very short notice. The difficulty in getting drawings returned from England in reasonable time undoubtedly led to much extra work in preparing new trench drawings for sheets of which trench plates were already in existence.

When an area had been much fought over, the trench plates often became so crowded that the map becomes almost unreadable if all the defences and organisations of each side are printed in one colour. This was the case on the Ypres front in 1917 and 1918. An attempt was made to overcome this by transferring all the enemy railways and communications to the "Blue" plate on which the British trenches were drawn. This served well for one edition and greatly increased the clearness of the map.

The considerable alterations of the line however, necessitated large alterations on the drawings which could not be carried out and the scheme had to be dropped, and all trenches were drawn on one sheet which was vandyked twice, first masking out all the British work and again masking out all the German work, giving two plates which were printed in blue and red.

If a Double Demy camera had been available it would have been possible, by preparing two drawings on "Whatman" paper, to carry out the idea in spite of fluctuations in the line without undue increases of work and with great benefit to the clearness of the map.

Nothing has been said above of the work of the Corps Topo Sections. Their position in the Field Survey Company organisation was never very satisfactory as their activities were directed by the G.S. of the Corps who commonly called upon them to do much work; manuscript drawing and so on, for which they were never intended. The type and style of work turned out by the different sections varied widely and depended very much on the personal characteristics of the OC and the General Staff under whom he served. A history of the XV Corps Topo Section, the most efficient of those which formed part of the 4th Field Survey Battalion, is attached as an example of their work and activities.

MAPPING AND PRINTING SECTION

APPENDIX "A"

INSTRUCTIONS FOR CORPS TOPOGRAPHICAL SECTIONS.

## INSTRUCTIONS FOR CORPS TOPOGRAPHICAL SECTIONS.

### 1. Object.

The operations of 1916 showed that the regular trench series of 1/10,000 and 1/20,000 maps are inadequate in themselves to meet the needs of a "war of movement" and that many special maps have to be issued to supplement them.

The Principal of these are :

- (i) Maps showing the position of all enemy trenches, etc., particularly new work, at the earliest possible moment after the photographs, or other information about them, are received.
- (ii) Maps showing enemy tracks and lines of approach.
- (iii) Maps showing British trenches and dispositions.
- (iv) Maps showing dispositions of enemy forces, schemes of defence, and other information.
- (v) Reproduction of information from captured German maps.
- (vi) Immediately after an attack, a map showing the position of the British and enemy's front line.

The time and labour required to produce these maps simultaneously for several Corps is too great for them to be satisfactorily produced at the Army.

It was also found during the operations that expert assistance was required by the Field Artillery in fixing their own positions and preparing Artillery Boards. The Army was not able to supply these.

The Corps Topo Sections and Branch Intelligence Sections have been formed therefore to undertake :-

- (a) The preparation of such "operations" and other maps as may be required by the Corps to supplement the regular issues.
- (b) To assist the Field Artillery of the Corps by fixing their positions and aiming points, possibly also by preparing Artillery Boards

### 2. Personnel.

To carry out these duties the personnel of a Corps Topo Section consists of :-

- 1 Officer in charge.
- 3 Topographers.
- 6 Draughtsmen (2 with Branch Int. Section).
- 1 Litho Draftsman..

with the addition of the necessary batman, M.T. Drivers etc.

The transport consists of :-

- 1 Bicycle and sidecar.
- 1 Motor bicycle.
- 2 Pedal bicycles.

The equipment consists of :-

- 1 Ellams duplicator, brief size.
  - 1 Roneo duplicator,
- and various drawing and technical instruments.

### 3. Duties.

The duties of the Corps Topo Section are :-

- (i) To prepare for reproduction by the 4th Field Survey Company all maps required by the Corps to supplement the regular issues, with the exception of such maps as (i) and (vi), para 1, in which speed rather than accuracy is aimed at. These will be prepared by the Branch Intelligence Section with the Corps Squadron.
- (ii) To print locally by means of the Ellams duplicator, and issue such maps as may be required by the Corps which are not sufficiently important or suitable for reproduction by lithography.
- (iii) To fix the positions of batteries, aiming points, etc., of the Field Artillery of the Corps.
- (iv) To supply the 4th Field Survey Company, H.Q. information required by them for the preparation of Secret trench maps showing the British trenches.
- (v) To supply to the 4th Field Survey Company, H.Q. any other topographical, tactical, or other information obtained by the Corps which should be incorporated in the regular series of trench maps.

The O.C. Corps Topo Sections will work under the orders of the G.S.O. for Intelligence of the Corps, who will instruct him as to what maps are required and arrange to place the necessary information and material at his disposal.

In respect to the methods of work and reproduction, the Corps Topo Section will be under the direction of the O.C. 4th Field Survey Company, who will arrange for the supply, when possible, of "foundation maps" or "backgrounds", on which to print trenches or other information.

The O.C. Corps Topo Section should keep the O.C. 4th Field Survey Company informed in good time as to what "foundation maps" are likely to be required by the Corps in the future, bearing in mind that it takes about a fortnight to obtain these maps from England. He will also see that when the stock of "backgrounds" is getting low, extra copies are asked for in sufficient time to obtain them from England. It takes about ten days to obtain a fresh supply of such maps.

The final authority for the location of any trench or other feature on the map is the 4th Field Survey Company, and the position of any trench or other object once shown on a map issued by the Army is not to be altered without reference to the O.C., 4th Field Survey Company.

The O.C. Corps Topo Section will keep a "correction copy" of each 1/10,000 sheet affecting his Corps front, on which all new trenches etc., will be entered up in green, with the photo from which they are taken.

The O.C. 4th Field Survey Company will notify the O.C. Corps Topo Section when it is intended to get out a new edition, and before the trench plate is sent to England the O.C. Corps Topo Section will bring this "correction copy" to the Field Survey Company H.Q. and compare it with the Trench plate to ensure that it conforms to the information at the Corps, and no trenches are omitted.

The O.C., 4th Field Survey Company will supply the O.C. Corps Topo Section with a list of triangulation and other points fixed by him for the use of the Topographers. The O.C., Corps Topo Section should keep him informed what his requirements in this respect are.

All lithographic printing is done at 4th Field Survey Company H.Q. Draft maps should be prepared as far as possible exactly as the map is to appear after reproduction. It is recognized that time does not always permit of this, and this rule may be relaxed when occasion demands.

If the Litho drawing is not done at the Corps the essential point to remember is that drafts should be complete and clear. Proofs will not be submitted unless specially asked for. Corrections in proof stage cause great trouble and delay, and every effort should be made to avoid them.

In preparing such maps the conventional signs approved by the General Staff, G.H.Q. must be strictly adhered to.

#### 4. Administration.

Drawing materials and technical instruments, according to the authorised scale, will be obtained through the Adjutant, 4th Field Survey Company.

Returns. A "Casualty Report", in manuscript, will be rendered each week. This should reach H.Q. on Saturday morning. In addition to actual casualties, this return must include everything that is required by Records, Paymaster, or A.G. Base, that is :-

- (a) Men joining or leaving Section.
- (b) Men admitted to, or discharged from, hospital.
- (c) Men proceeding on leave.
- (d) Punishments awarded.
- (e) Increase or decrease in allotments, etc. etc

Casualties. It is extremely important that men killed or wounded in action should be reported by wire to H.Q. at once. Wire need only give number of casualties (e.g. 2 O.R. killed aaa 1 O.R. wounded). Full particulars of Regimental Number, rank, number, name, etc., being sent on by D.R.L.S. to H.Q.

Personal effects of casualties will be collected as soon as possible, an inventory of them will be made, and they will be sent to H.Q. for despatch to the Base.

Motor Transport. is on the repair strength of the 4th Army Troops Supply Column. Cycles and Motor-cycle combinations should be sent to Headquarters periodically for overhaul.

All spare parts will be demanded from H.Q., the frame number of the cycle for which they are required being given.

Pay, Clothing etc. O. i/c Corps Tops Sections will endeavour to arrange with the respective Corps H.Q. Camp Commandant to attach their Sections to Corps Troops for purposes of pay and all personal equipment.

Technical Stores. All technical stores, stationery, etc., will be demanded from H.Q. Indent should be sent in before stocks at the Sections have run out, so as to allow for delays in getting stores up from the Base, in case H.Q. cannot supply.

( Signed )                      M.N. MACLEOD.

Major, R.E.  
4th Field Survey Company.

Notes on Instructions for Corps Topographical Sections.

For the present, as there are not sufficient trained Topographers to supply all Sections, the Topographers will be retained under the direction of 4th Field Survey Company.

Eventually they will be attached to Corps. Their duties are to fix the position of guns and aiming points only. Exceptionally they may be called in to assist in fixing O.Ps. and datum points.

The boards will be prepared by the 4th Field Survey Company, Advanced Section, or by the Artillery themselves from the information supplied by the Topographers.

During operations, if movement is rapid, it may happen that it is impossible to carry forward the triangulation fast enough to keep up with the Field Artillery. The Topographers must be practised in fixing points for themselves by plane table triangulation, and in fixing positions from the topographical detail on the map.

They should also be encouraged to make use of their work to verify the map, particularly the contours. Any discrepancies or inaccuracies in detail or contours should be at once reported to the O.C. Corps Topo Section who should endeavour to visit the ground himself, and then submit a correction slip to H.Q.

Battery maps of the Corps front will continue to be prepared at 4th Field Survey Company H.Q. as heretofore. The information upon which they are based is collected at the Corps Counter-Battery Office and at Field Survey Company H.Q., and it is unnecessary for the Corps Topo Section to undertake any work in respect of them.

During a war of movement it may be very difficult to maintain close touch between Corps and Armies, and the Corps may have to rely largely on the Corps Topo Section for maps of all sorts. The O.C. should watch the situation so that he can forecast the probable requirements in good time and give sound advice to the General Staff of the Corps as to the best styles of maps to produce.

( Signed )            M.N. MACLEOD.

1st March 1917

Major, R.E.  
4th Field Survey Company.

MAPPING AND PRINTING SECTION.

APPENDIX "B"

HISTORY OF THE XV CORPS TOPOGRAPHICAL SECTION.

HISTORY OF XV CORPS TOPO SECTION.

PART I.

Collection of Personnel.

Previous to the establishment of Corps Topo Sections, the maps necessary for the various Branches of Corps H.Q. had been prepared by Draughtsmen attached to the Branches, i.e., "G", "I", "Q" and R.A. These men already had a knowledge of the requirements of the various Branches, the interpretation of air photos, use of small duplicator, etc., and were incorporated in the Corps Topo Section. The balance required to make up the establishment laid down consisted of men who had been found in the Army and then trained and tested by the Field Survey Company. Two draughtsmen were attached to the Branch Intelligence Section ( with the Corps Squadron), lately these men have been transferred to B.I.S. The XVth Corps Topo Section was constituted in February 1917 consisting at first of draughtsmen only. Three Topographers arrived after a short time and these were attached to Field Artillery H.Q. ( either Brigades or D.A.H.Q.).

In order to follow the History of the XV Corps Topo Section the period between its inception and the date of the Armistice has been sub-divided into four sub-divisions, each dealing with a different section of the front, viz :-

Period	Section of Front.
1. February to May 1917	SOMME.
2. June to November 1917	NIEUPORT.
3. November 1917 to April 1918	ARMENTIERES.
4. April 1918 to November 1918	HAZEBROUCK to RIVER ESCAUT.

Period February to May 1917.

The front held by the XV Corps during February and March 1917 extended from RANCOURT to CLERY and comprised part of the area devastated by the Battle of the Somme. There were very few well-dug fire or communication trenches on our side of the line and batteries were for the most part in the open. The German side of the line contained more defences, and these were steadily improved during February and March. Records of progress of our own defences were kept on traces compiled from Photos and Reports and duplicator sheets were drawn showing progress of enemy work, positions of T.M.s, M.Gs., dumps, tracks, H.Q., etc. and issued about every two or three weeks.

About the middle of March, signs of an impending German withdrawal became noticeable and a closer study of his back areas was consequently necessary. This withdrawal began about the beginning of April and lasted for about one month. During this time "Situation Maps" were issued almost daily and the latest information regarding the enemy incorporated in them. During their withdrawal, the Germans obstinately defended many of the villages and the capture of each such village became a distinct minor operation. For each of these operations a special large scale map of the village was prepared, based on air photos and on plans of villages obtained through the French Authorities. These maps showed all available information as regards defences, cellars, wells, sunken roads, etc., in addition to the topography. To provide for the requirements of the Artillery, the topographers moved with the D.A. to whom they were attached, and assisted the batteries as best they could. Time did not permit them to prepare and issue boards, but much work was done in resecting positions.



At the beginning of May, as the Hindenburg Line was approached, our own front line became more stable and Lines of Defence were laid down. Duplicator maps were issued illustrating the Corps defence scheme and were much used for co-ordination between units. Records were also kept of the work done.

#### Period June to November 1917.

At the end of May 1917, the Corps was transferred to the NIEUPOINT Sector, taking over from the French. Corps H.Q. arrived before the troops, so that there was an opportunity to collect information and prepare duplicator maps ready for issue when the latter arrived - the only Trench maps available at the time being the French ones with our grid overprinted. At about this time, the Corps H.Q. office was hit by a 15" shell which demolished most of the offices and destroyed a large number of maps prepared by the Corps Topo Section. These had to be renewed. The casualties sustained by the Corps Topo Section amounted to five killed and two wounded. The Topographers, as before, were retained with Field Artillery Brigades and for some time were kept very busy both owing to the large number of batteries which had to be dealt with and the frequency with which batteries changed their positions. Their work was also rendered more arduous on account of the intensity and frequency of the enemy artillery fire. After July, the front became quieter, but the Corps defence schemes had to be modified to suit the new situation created by the German advance along the dunes to the YSER. A new Reserve line was constructed and all the M.G. Emplacements in this were resected, and each emplacement provided with a map, used for indirect M.G. fire, on which the position was marked, a zero line defined, and an arc and scale attached. These scales and areas were printed by the Field Survey Company on stiff paper and large numbers, subsequently supplied to G.H.Q. Small Arms School. The wire was also surveyed and incorporated in the defence map.

In addition to the above, special surveys of NIEUPOINT and NIEUPOINT BAINS were also made, showing trenches - open and covered - tunnels, M.G. emplacements, dug-outs, etc., The light railways were also surveyed throughout the Corps area and special maps showing them issued to all concerned.

The area was handed over to the French in November.

#### Period November 1917 to April 1918.

The XV Corps then moved to HINGES, taking over from the XI Corps, a wide sector including the Portuguese Front and extending from ARMENTIERES (inclusive) to CUINCHY. This front had been quiet for a long time, and consequently everything was in a settled state. For a short while after taking over the Sector, until they formed their own Topo Section, and undertook to do the work themselves, the Corps Topo Section was responsible for supplying the Portuguese Division with Duplicator trench maps, fixing their battery positions, and supplying artillery boards. No up-to-date detail maps of the Lines of Defence existed, these were therefore carefully surveyed, and a Defence Map prepared. Battery positions were of a fairly permanent nature - 1/10,000 scale boards always being provided.

In January the portion of the Corps front South of the Portuguese area was handed over to the XI Corps, and the strengthening of the whole Corps front was commenced. This comprised a new Defence Line on the left bank of the LYS RIVER, and a Defensive Line including ARMENTIERES, FLEUR BAIX, ROUGE DE BOUT and LAVENTIE. A series of 1/10,000 maps showing the proposals for these works was prepared, and issued to units doing this work. Whilst the work was in progress, all the new work was surveyed, and put on the Defence Map. As part of this scheme, battery positions were selected by Divisional R.A. Staffs North of the river LYS - these were surveyed, and the boards prepared (42 in all) and handed over to the Divisions. Duplicator sheets, covering the whole of the Defences in the Corps area, were also held in reserve. When the enemy attacked on April the Ninth, the rapidity of his advance soon rendered these Artillery Positions untenable, but about half the boards prepared were used, and several thousands of the Duplicator Maps issued to reinforcing troops.

#### Period April 1918 to November 1918

When the German advance was brought to a standstill at the end of April, the front held by the Corps was covered by maps which required considerable revision and correction. As the Corps HQ happened

to be in the premises occupied by the Overseas Branch of the Ordnance Survey, who held the plates of the sheets required, arrangements were made with them to print a series of 1/20,000 Duplicator Backgrounds and a 1/40,000 Background covering the Corps front. Information regarding enemy dispositions, our own defences, etc., was overprinted on these by means of the Duplicator and within ten days these were issued to all concerned. As revised maps became available, these backgrounds were subsequently replaced by others taken from the revised plates. Enlargements to 1/10,000 scale were first made from the original plates and issued to Divisions for patrol work until replaced by extracts from the new 1/10,000 plates. Battery boards with the enemy batteries shown were at first made up from Duplicator maps. These were replaced as soon as possible by boards made up with the revised maps as they became available. Special barrage and operation maps were supplied later for operations in the neighbourhood of VIEUX BERQUIN, MERRIS, OUTTERSTEENE and METEREN, also maps in connection with back lines of defence, especially the East and West HAZEBROUCK lines and LE PEUPLIER Switch. The contours in the Corps area were revised by the Topographers and the construction of our defences surveyed. In August, as the line went forward, fresh forward points were fixed by the Topographers in conjunction with the Army Topo Section, and the Field batteries given their position. 1/20,000 Duplicator Backgrounds of forward areas were also held in readiness and maps printed on them issued as the line advanced. A short halt occurred on the line of the LYS River and 1/10,000 Duplicator sheets again came into use in the operations in the neighbourhood of HILL 63, PLOEGSTEERT WOOD and WARNETON. In October, when the advance recommenced, it was much more rapid, and a series of 1/40,000 Duplicator maps which had been prepared beforehand, was used for showing situation etc. This advance continued until the River Escaut was reached, the Corps front extending from ESPIERRE to PECQ on the West bank of the river. Another halt occurred on this line and 1/20,000 Duplicator sheets were introduced again for showing the latest information. As before, batteries were given their positions and forward points fixed. An Operation was planned for the crossing of the Escaut in conjunction with operations further North and barrage maps prepared; this operation however, did not take place as the enemy abandoned his positions without a fight. The Corps front became gradually narrower and eventually was squeezed out about three miles East of the Escaut by the convergence of the XIX and XI Corps on each flank. All 1/40,000 Duplicator Backgrounds of forward areas were handed over to the XIX Corps Topo Section.

The Armistice came into operation a few days later and the work of the Corps Topo Section came to an end.

## HISTORY OF XV CORPS TOPO SECTION.

### PART II.

#### PARTICULARS OF WORK.

##### (1)- OUTDOOR WORK.

(i).- The total number of boards prepared from November 1917 to November 11th 1918 was 381.

(ii).- The number of positions resected exceeds this figure by 25%, as during moving warfare, many positions were resected for which no artillery boards were prepared.

##### Artillery Boards.

All artillery boards were prepared in the office, one of the draughtsmen being specially detailed for the work. When the front was in a settled state, and movement of the batteries only occasional, demands for the fixing of batteries were sent by batteries through Brigades and Divisional Artillery, who forwarded them to the Corps Topo Section. In the event of a new front being taken over, or during moving warfare, lists showing the location of batteries were obtained from Corps R.A., and sent out to the topographers. Each of the batteries was then visited in turn, and its position fixed.

The O.C. personally checked the laying-down of all boards, plotting of positions and zero, and laying down of the arc before the boards were sent out. He also frequently checked the resection of positions in the field.

##### Transport.

The delivery of artillery boards was sometimes done by side-car, but owing to a side-car not being suitable for carrying them, this method was not satisfactory. On rough roads, a light load in a side-car generally results in broken springs. Accordingly delivery was mostly done through Corps R.A., who delivered the boards to Divisional Artillery H.Q., Brigades or Batteries, and collected old boards from them; orders being issued by D.A. for the return of old boards to their H.Q.

##### Surveys of our Trenches.

Where photographs covered the area, these were used to prepare maps, but maps shewing our Trenches and wire were frequently required as the work proceeded, and before it was possible to obtain aeroplane photographs of them. In this case a survey was made on the ground itself by Plane Table - the detail of the map being used in conjunction with trig. points. Photos of the Front System trenches were practically always available, so that the Second and Third Systems only, had to be dealt with, this could be done conveniently by Plane Table. The office plan showed photo work and field work in different colours, so that when photographs were taken, the result could be checked.

##### (2)- ORGANIZATION OF WORK.

For General Routine work the office staff was divided, and work allotted as follows :-

(i) Sergeant in charge. Aeroplane photo plotting and general supervision.

(ii) General Staff requirements. Works Map. Defence Map. H.Q. Staff Maps (Situations etc.) and manuscript work.

- (iii) Artillery board and field work.
- (iv) Intelligence Branch requirements.
- (v) Duplicator work.

Latterly in addition to the Field Survey Battalion Staff one draughtsman for "Q" Branch, and one for R.A. were attached to the Topo Section. Actually four draughtsmen were trained to do Duplicator work to allow for casualties. In the event of a large amount of work being required urgently by one Branch, the whole of the staff were, if necessary, put on to do it.

### (3)- RECORDS.

The principal office records maintained were as follows :-

(i) Record Maps of Enemy Lines on 1/10,000 or 1/20,000 scale from Aeroplane Photographs. In order to follow the progress of work easily, the colour in which these were done was changed each month. Duplicate sets of these maps were kept up for the Corps Commander, B.G.G.S., and G.S.O. (2)I.

(ii) Record maps of British lines, i.e. Defence maps. Information obtained by Photos or Survey. It was found inadvisable to include any work reported by Divisions etc., owing to the discrepancy between (a) the amount actually done and (b) the location of the work. Where a map shewing work done was called for by "G", the photo and survey work was traced first and if ( as was generally the case ) more work had been reported than could be vouched for, it was shewn in a different colour.

(iii) General map showing Situation on British and Allied fronts.

### (4) DUPLICATOR WORK.

The following hints may be useful :-

(i) Use a very fine stencil - an ordinary needle mounted in a holder gives the best results for fine work.

(ii) The slate of the drawing board should be removed and a sheet of plate glass substituted. By placing the board over a box in which an electric light is placed - fine or indistinct backgrounds can easily be seen. When not being used for Duplicator jobs, this board is very useful for ordinary tracing.

(ii) Mark on the slate or glass the "registering corners" of the paper - Frames only go into the duplicator one way and it is necessary therefore to get the frame the right way up. Also by marking the sheet corner on the slate it is always known exactly how much of the paper can be covered. It is advisable to stick the original lightly to the drawing board at the corner of the paper.

(iv) Inks vary considerably in consistency. Red is generally required and is one of the worst colours to print. It is usually much too thick, with the result that the wax soon gets destroyed. Thinning down can be done by careful mixing of colours, grey being the best for mixing with a "thick" colour. Turpentine also has been used but is not altogether satisfactory. Towards the end of Operations, inks deteriorated considerably in quality, and much difficulty was experienced in getting clear prints.

(v) The original should always be completed before being put under the wax, otherwise registration cannot be ensured.

(vi) In rolling-up, it is advisable to change the direction of rolling after a time, i.e. from "bottom to top" to "top to bottom"; if one direction is kept up all the time, the wax will get worn through where the roller first touches it.

### Special Jobs (Duplicator)

(For example, Enlargements of certain area to say 1/5,000 for special operations or section of 1/10,000 worked up for special purposes.)

The background in these cases would have to be drawn and particular attention paid to the watercourses, hedges, and other topographical features. This part of the work would take probably two days at least - a careful study of all photos of the area being necessary. The plotting of trenches, defences, etc. would probably take another day, the whole job involving the use of three colours would probably take from three to four days. Divisions were notified that if such work was required, at least three days notice was necessary. Two or three men would be required, according to the time available.

(5) DIFFICULTIES AND SUGGESTIONS.

(a) The services of a clerk are very necessary in a Topo Section for the following jobs :-

- (i) Indexing and filing aeroplane photographs.
- (ii) Correspondence.
- (iii) Distribution of maps.
- (iv) Supervision of equipment, stationery, drawing material etc.
- (v) Messages etc., at HQ.

The above work will take the whole of one man's time so that under existing arrangements, one Draughtsman is permanently lost as such to the Section.

(b) A side-car driver is also very necessary. The best arrangements as regards Topographers is undoubtedly to have them billeted with a Field Survey Group or Section in the area for which they are responsible. The delivery of maps etc., upkeep of the side-car etc., would then have to be done by one of the draughtsmen, the greater part of another man's time being lost in this way.

(c) Although the Standard Board now issued to Field Artillery Batteries at the rate of one per Battery is supposed to take the place of that formerly provided by the Topo Sections, the latter is in my opinion far superior to any that the Battery can fix up for itself on the Board supplied, for the following reasons

- (i) In the case of the Ordnance board the map is pinned down to the board, which is made of hardwood, no allowance being possible for the expansion and contraction of the paper, which under Active Service conditions is considerable.
- (ii) In the event of an area running into more than one 1/20,000 sheet, considerable error is likely to be made in pinning down the separate sheets.
- (iii) The Battery is often divided into sections under separate control so that one board is insufficient. Accordingly I consider that the issue of boards by Topo Sections should continue while possible, the Ordnance board being held as a reserve.

As regards the delivery of Boards to Batteries. This could be done direct to Batteries if some other means of transport than a side-car was available, or perhaps a side-car adapted to take boards in addition to a passenger. Otherwise the delivery through Corps R.A. ( in a Ford car supplied to R.O.R.A.) to D.A. Brigade or Battery seems to me to be the best arrangement.

SCHEDULE OF DUPLICATOR MAPS.

Type	Number Printed.	Distribution	How sent out	Frequency of issue	No of men employed	Time	Remarks
(a) Situation	160-300	Generally down to Batteries through Divisions. Corps. Troops, H.A. Cyclists etc.	D.R. to Div. H.A. etc.	Daily during movement	Two	2-3 Hours	Situation containing "I" information would take 1-2 hrs. longer
(b) Operation ( barrage )	80-150	Depending on size size of Operations down to 2 per Battery concerned and a few for Infantry Brigades	D.R. to Divns. & H.A.	Depending on Operations	2 - 3	3 to 5 hours including Skeleton background depending on no. of colours used	
(c) Operation (Special areas ) 1 Division.	200-300	Down to 8 per Battalion and 2 per Battery.	D.R. to Div. & H.A.	Weekly	2 - 3	Background 1.5 days. Overprint half a day	Including Examination of photos for Topographical detail but not enlargement of map.
(d) Patrol maps.	150-450	Down to 2 per platoon	D.R. to Div.	Weekly	Two	Two days.	Background only. Sufficient run off for 2-3 weeks supply.
(e) Revised Trench map 2 Divnl. basis	200-400	Down to 2 per Battalion and 1 per Battery	D.R. to Divns. H.A.	1-4 per month Depending on situation.	3	One day.	
(f) German Order of Battle	150	By "I"	D.R.	Variable, 3-4 days to 4 weeks	2	Half day.	
(g) Administrative	60-150	By "Q"	Through "Q"	Variable	2	Half day.	
(h) Lines of Defence	200-400	60 per Divn. 20 to H.A. Reserve kept.	Through "Q"	Variable	3	2-4 days.	

The above is worked out on two Divisions in Line and One in Reserve basis. The "Time Taken" in above schedule only applies to cases where a prepared "background" is available except when otherwise stated. The preparation of a background on the Duplicator would take 1.5 to 2 days for 1/40,000 and 1/20,000, 1 to 1.5 days for 1/10,000 in addition to the times stated.

Note :- During the German offensive April 8th 1918 over 10,000 maps were issued by Corps Topo Section in 10 days mostly to reinforcements who were rushed up.

PART IV

MAP DISTRIBUTION SECTION

Map Distribution Section

4th Field Survey Battalion R.E.

Period Feb 1916 - March 1918.

The maps issued to the troops consisted of 1/250,000, 1/100,000, and 1/40,000 "tactical" maps and 1/20,000 & 1/10,000 trench maps. These were printed at Southampton, folded and sent over to France tied up in bundles of 10 and packed in wooden boxes containing 100 maps each, and weighing about 30 lbs. The scales of issue of these maps were laid down by G.H.Q. and the issues were made by the Field Survey Companies as follows :-

- (1) To Army H.Q. and all Army Units, to each Unit.
- (2) To Corps and all Corps Troops, in bulk to the Corps "Intelligence".
- (3) To Corps H.A. and all H.A. units, in bulk to Corps H.A. Headquarters.
- (4) To R.F.A. and all R.F.C. units, in bulk to Brigade and Army H.Q.
- (5) To Divisions and all Divisional Units, in bulk to Divisional H.Q.

In round figures the numbers of each sheet issued to a normal Division were as follows :-

1/250,000	200
1/100,000	1200
1/40,000	250
1/20,000	750
1/10,000	350 (Secret Edn. 15 )

Renewals were demanded from the Field Survey Company as required by the Formations to whom the original issues were made. The great majority of the maps were sent out by the Company in its own vehicles. Small packages however were often sent by post. The D.L.R.S. service was of little use for map distribution. This system was continued virtually unaltered till the end of the war though it had many defects and in times of stress had often to be modified for short periods. It was however easy to work during stationary warfare and was obviously devised for such.

In 1916 when the 4th Field Survey Company was formed, all printing was done in England and renewals of stock rarely took less than a fortnight. It was necessary therefore to hold a large reserve of maps to be prepared for unforeseen contingencies.

This reserve consisted of two categories of maps :

- (1) A reserve of sheets actually issued and in use, and ready for issue to new Units and formations reinforcing the Army at short notice.
- (2) A reserve of maps of areas not in use, ready for issue to the whole Army in case of unforeseen movement. The first category was known as the "Reinforcement Reserve" and was fixed by G.H.Q. at a number sufficient to give a complete issue of all current maps to 3 Infantry Divisions.

The sheets included in the second category, known as the "Army Reserve", were laid down by the Army staff and the numbers held were sufficient to give a full issue to all Formations in the Army and still leave over the reinforcement reserve of 3 Divisional issues.

The maps held in stock were those affecting the Army Area only, plus a supply of small scale maps of the rest of the front sufficient to equip Divisions etc moving to other Armies for their march or journey to their new area.



On formation of the Fourth Army the Reinforcement Reserve comprised 2 x 1/250,000, 2 x 1/100,000, and 4 x 1/40,000, 6 x 1/20,000, and 8 x 1/10,000 sheets about 40,000 maps in all.

The Army Reserve comprised 2 x 1/250,000, 2 x 1/100,000, and 1 x 1/40,000 sheets and consisted of about 70,000 maps. These "Army Reserve" maps did not get out of date and were therefore stored in a separate store from that in which current issues were made. The Reinforcement Reserve of trench maps was renewed whenever a new edition was issued, the old editions (with any other surplus copies) being sent back by returning Supply train to the Map Depot L. of C.

All maps of the regular series were ordered from Maps, G.H.Q., the number required being estimated from information supplied by the G.S. of the Army. These maps when ready were brought from G.H.Q. by lorry. The system of stock-keeping, record of receipts and issues is given as an appendix. It was introduced in March 1916 and continued virtually unchanged till the end of the war.

As explained above, the great bulk of the maps were distributed in the Company's own transport. For this purpose generally 2 box cars and 1 motor cycle were available, the 3 ton lorry being generally kept for collecting maps in bulk from G.H.Q.

Little use could be made of the Railway for sending maps up to the Company owing to the uncertainty of the length of time taken in transit and the difficulty of finding the maps when once they had been put on board the train should an unforeseen call on them occur.

The positions of the H.Q. of formations were notified from time to time, usually weekly, by the G.S. and each box car did a daily round calling at those places to which maps and similar documents had to be sent.

Up to the commencement of the SOMME battle the only maps issued were the regular series folded maps. After July 1st however many maps were printed locally including certain situation maps regarded as of great urgency and importance. One of these was sent out by special box car at midnight each night. After this date also, the issue of a number of special trench maps, designed to supplement the regular series, was commenced. The scales of issue of these were fixed by the Army and varied with the printing resources at the disposal of the Company and the number of formations requiring the map.

The period of the SOMME battle led to a great increase in the number of maps issued and an extra box car was obtained from G.H.Q. but even with this reinforcement there was the greatest difficulty in maintaining the supply. The roads were very congested and soon got into very bad condition, and this had its effect on the vehicles which continued to break down. In spite of these handicaps however, by various devices and expedients the supply of maps up to Division H.Q. was maintained without breakdown or serious delay throughout the battle: there is reason to believe, however, that interruptions between Division H.Q. and the front line were more serious and that on many occasions maps on which great effort had been put forth at Army H.Q. never reached the front line Troops at all. The machinery for distributing maps did not go beyond Division H.Q. and there was therefore no means of ascertaining exactly what became of maps beyond that point.

No exact statistics of maps issued have been kept previous to Nov. 1917. The estimated number of maps issued however between March 1916, and March 1917 is put at 1,200,000 this included Regular Series and Special Maps.

#### Period March 1917 - June 1917.

During this period occurred the German retreat from the SOMME battlefield to the HINDENBURG line. At the conclusion of this retreat the Company H.Q. was nearly 2 hours run by car from the line, the greater part of the route being over very bad roads. In consequence of this an Advanced Map Depot was established in PERONNE and one box car permanently stationed there. A second car plied daily between QUERRIEU, (the Company H.Q.) and the Advanced Map Depot. Divisions were requested to send to PERONNE themselves for as many as possible of the maps required.

This arrangement worked fairly well. All Divisions had been provided with a full issue of maps before the advance commenced and only small issues were required while it was in progress. PERONNE was

an important road centre and railhead and the Divisions had to send there frequently for mails, stores, and so on, so that they were able to collect their maps without much extra difficulty. The system was of advantage to the Field Survey Company as while a Division was on the move it was difficult to know exactly where the H.Q. was located at any particular time.

This Advanced Depot was maintained until the Fourth Army left the SOMME area in July.

The number of maps issued during this period was small. The line was not held in great strength and large stocks of maps were not required. Issues averaged 25,000 maps a month.

Period July 1917 - November 1917.

In July the Fourth Army moved to the coast where it held only a very narrow front. The country however was intricate and the front was very active. Many special maps were therefore printed and they were frequently renewed. Considerable increases had recently been made in the printing equipment of the Company and this led to an increase in the scales of issue of special maps. Only one Corps was in line so that the transport was able to cope with the distribution without difficulty. Issues averaged 40,000 maps monthly.

Period November 1917 - March 1918.

In November the Fourth Army took over the YPRES front, formerly held by the Second and Fifth Armies. This change led to a great increase in work in the Mapping Issue section owing to the increased length of the Army front and the increased number of troops in the Army. At the beginning of the period the 4th. Army comprised about half of the troops in the B.E.F.

Large stocks of reserve maps accumulated for the previous Summer's offensive were taken over from the Second and Fifth Armies. The H.Q. of the Company was the old H.Q. of the 2nd Field Survey Company at CASSEL and about half these maps were stored there. The remainder at LOVIE CHATEAU, a situation inconvenient, as regards roads and railways, for a map distributing centre.

Arrangements were made as soon as possible to acquire a building in POPERINGHE as an Advance Map Depot and all maps from LOVIE CHATEAU were moved there.

By this time the printing equipment of the Field Survey Company had reached its fullest development and for front line purposes the special sheet had practically superseded the regular series. The policy of keeping a large "Reinforcement Reserve" of Trench maps was therefore discontinued, unforeseen calls being adequately met by printing off any extra maps required at Company H.Q.

Owing to the large Army area and size of the Army the establishment of cars at H.Q. was increased by the loan of one box car from the Depot but even with this it was totally inadequate. It became necessary to call in part of the transport of Sound Ranging Sections to Company H.Q. and use these for map distribution. Another factor which greatly affected the transport question was the fact that the special sheets, being published much more frequently than the regular series sheets, required much more transport for their distribution than had been the case before they came into use. With the multiplication of styles of maps in use it became more and more necessary to keep the Corps informed of what maps were being issued to Divisions, and conversely, owing to the necessity of keeping down the numbers printed it became necessary for Corps to keep the Field Survey Company constantly informed as to what maps were required by any particular Division. A very close liaison was therefore necessary with the Corps Intelligence. This was effected as much as possible through the Corps Topo Section who were kept informed as to what issued were being made. They were also consulted as to the styles of maps required and their sizes and shapes. The Corps Topo Section in fact became an important agency in map distribution. In many cases of doubt or uncertainty the maps were actually sent to the Corps Topo Section and distributed by it to such units as required them.

From November 1917 exact records were kept of the number of maps issued. These were as follows :-

Regular Series

Special Sheets ( Excluding maps printed for Corps

Nov 1917	59,484	40,000	Topo Sections.)
Dec 1917	60,100	35,000	
Jan 1918	50,000	29,600	
Feb 1918	41,230	23,000	
March 1918	50,480	35,550	

Period March 1918 - November 1918.

In March 1918 the great German offensive opened, at the beginning of April by the battle of the LYS. This marked the commencement of a period of great activity, many fluctuations in the line, and much movement of troops.

Previous to the beginning of 1918 our policy had been almost entirely offensive and reserve maps were exclusively those of country occupied by the German, great stocks of these estimated at 300,000 maps, had been accumulated by the Second and Fifth Armies. As soon as the attacks showed signs of making ground it was necessary to evacuate these further to the rear and some 30 to 40 tons of maps were sent to CALAIS by train to be stored there.

The Advanced Map Depot at POPERINGHE was retained however for some time longer and proved most useful as a storehouse for Sound Ranging and other equipment belonging to other Field Survey Company units until compelled to retreat by the German attacks. It was given up in May when the enemy commenced to shell the town and withdrawn to CASSEL, from which place the H.Q. of the Battalion had moved to BLENDECQUES.

During the actual battle culminating in the German attack of April 29th, the pressure on the Map Issue branch was very heavy and the work most difficult. Many units arrived from other Armies, detrained and went straight into action. Maps for these had to be put on the train in back areas, while others had to be sent forward to Brigades near the front line. All vehicles were worked to the utmost capacity and a breakdown was only avoided by the fact that certain Sound Ranging Sections were put out of action and withdrawn ( and some broken up altogether ) and their transport became available for map distribution work. Much difficulty was also found during the whole of this period in keeping touch with changes of Divisional H.Q. and in many cases failure to notify "Maps" of a move led to wasted journeys and delayed deliveries. In the main however, supplies were well maintained.

During this period, the Battalion H.Q. received a number of visits from Infantry Battalion Intelligence Officers as part of their course of instruction. A point was made of asking these officers what maps they were using in the line and showing them the latest available. In hardly a single case was it found that the latest 1/10,000 or 1/20,000 map had reached the troops in the front line and it was eventually decided to publish monthly in A.R.O. full instructions as to how to obtain maps with copies of the scale of issue and to add a statement of all the latest editions supplementing this by publishing weekly a list of all maps printed during the week. In many cases Battalion I.Os. appear to have obtained their proper quota of maps on return to their units by applying to the Brigade but it is probable that the lack of machinery for distribution below Divisions was the cause of failure of map supply.

The numbers of maps issued during this period were :-

	<u>Regular Series</u>	<u>Special Maps</u>
April 1918	120,464	60,000
May 1918	79,450	40,500
June 1918	70,000	30,000
July 1918	167,854	80,000
August 1918	75,100	59,800
September 1918	107,000	35,000
October 1918	117,395	10,000

Period November 1918 - To end of war.

This period included the conclusion of the Armistice and the advance to Germany. The march commenced at the end of November 1918 and during this month large numbers of regular series maps were issued to the troops forming the Advancing Army for their march.

Unfortunately the necessary maps for the whole march had not arrived and it was only possible before the start to issue maps as far as the Belgian frontier. Maps of Germany itself had to be distributed actually on the march.

Army H.Q. moved up to NAMUR on November 24th by lorry, being there well in advance of the Division. It was hoped at first to distribute maps of Germany by sending them from Battalion H.Q. at ROUBAIX to Divisional railheads which were then in that vicinity. The supplies from G.H.Q. failed to arrive in time however, and a small map distribution section joined the Army H.Q. at NAMUR from which place it was intended to distribute as the Divisions came up and passed through. Unfortunately the lorries bringing up the maps from G.H.Q. broke down en route and the maps were again too late. The Divisions were by this time trailed over a great area of country and after a week's halt at NAMUR the Army H.Q. moved on the SPA.

In this situation the maps were distributed either by sending them to Divisional Railheads, delivering at the Corps H.Q., or dumping them at a suitable place in the line of the Division's advance and allowing them to pick them up on arrival. Breakdowns among M.T. vehicles and lack of telephone communications made distribution in this way difficult and precarious, and several times it very nearly broke down altogether. However eventually in spite of mishaps all units were supplied before crossing the frontier.

The numbers of maps issued were as follows :-

	Regular Series	Special Maps
November 1918	164,912	6,000
December 1918	70,250	-----

This concludes the operations of war. The total number of maps issued by the 4th Field Survey Company during its existence amounts to something over three and a quarter million maps.

The question of transport for distribution has been one of constantly recurring crises almost since the Company was formed. The strain thrown on the drivers and vehicles is exemplified by the following statistics which give the average mileage daily for map box cars :

Dec 1917	56.6 miles	May 1918	66 miles
Jan 1918	65	June 1918	60
Feb 1918	53	July 1918	69
March 1918	53	Aug 1918	60
April 1918	54	Sep 1918	75

#### Book keeping of Map Issue Sections.

The object of book keeping of Map issues is not to account in any way for the expenditure of maps but to enable the O.C. Field Survey Company to say at any time :

- (1) What is the stock of any sheet in hand at a particular time.
- (2) What issue of any particular sheet has been made to any particular unit.
- (3) To check the date and means of despatch of any maps of which the consignee does not admit receipt.

For this purpose two books were maintained.

- (a) Register of issues or "day book".
- (b) Stock book, showing receipts and issues of maps, with stock in hand.

Specimens of these books and entries are given below.

All maps were sent out accompanied by a receipt slip to be returned by the recipient. A counterfoil of this receipt was filled in and retained in the office. All the information on these was entered up in the day book shewing issues during the day and the stock book made up to date from this.

Stock lists were made up on a printed form each week and a copy to G.H.Q. This list was made up from the Stock book, each page of which showed the stock of a particular map. A specimen page of this book is given below.

Specimen of Day Book.

Index	To whom issued	Per	Date	Scale	Name of map	Number issued	Receipt received
353	9 <sup>th</sup> . Div. G.	Car	10-2-19	1/10,000 1/250,000	2L 59 Coln	200 50	14-2-19
354	2 <sup>nd</sup> . Army I.	Hand	10-2-19	1/250,000	Map "C" Corps & Army Areas	20	12-2-19
355	O.C. 64th C.C.S. Post		10-2-19	1/100,000	Tournai Sheet 5	5	
356	1st Cav Div	Car	10-2-19	1/25,000	Sheet 2	25	13-2-19

Specimen Page of Stock Book

1/10,000 Sheet 2L.

Date	To or From	Received	Issued	Stock
10-2-19	Maps G.H.Q.	10,000	10,000	
11-2-19	9th Div G		1,000	9,000
11-2-19	2nd Army I	50		8,950
11-2-19	34 Div Arty		150	8,800
12-2-19			1,000	7,800

PART V.

OBSERVATION.

Section (a) The work of Observation Groups and the Calibration Section.

Observation Section.

4th. Field Survey Battalion, R.E.

The work of Observation Groups and the Calibration Section.

The nucleus of the Section was taken over "in situ" from the Third Field Survey Company on March 12th 1916. It consisted of three officers and about thirty men accommodated in seven survey posts at ECLUSIER, MARICOURT WOOD, PERONNE AVENUE, (under construction) "GRAND STAND", BOUZINCOURT, ENGLEBELMER and AUCHONVILLERS, with a H.Q. at BOUZINCOURT. These posts had all been constructed by the R.E. and consisted of a protected O.P. with a mined dug-out leading off it in which the detachment lived. For communications all O.Ps were "Teed" in on a single line which ran into H.Q. From the H.Q. at BOUZINCOURT a line ran to the X Corps H.A. exchange across the road, from which point connection could be made with the General Army System.

The system of work was to observe bearings at random to any flashes seen and telephone the angles in to the H.Q. where they were plotted and all possible intersections computed.

This system had been in operation for some time without yielding many results, the necessity for some change had been realised and a Group organisation approved in principle. (G.H.Q. OB/1231 dated 10th February 1916. )

The first work on taking over was to obtain men to bring the post squads up to strength and reorganise the system.

All Divisions in the Army were therefore called upon to send in the names of suitable observers, R.A. men being preferred and from these a number were selected and transferred to the Company. The first detachment of these were sent out at once to the posts and trained there; later arrivals were trained in reading the instrument at H.Q. on a miniature range, flashes being simulated by cordite puffs fired from small brass tubes.

The next work was to reorganise the posts into Groups as laid down in the letter quoted above. The two Groups formed were No 1 Group located at BRAY consisting of Nos. 1, 2, 3, and 4 posts and No. 2 Group at BOUZINCOURT of Nos. 5, 6, and 7. At this time only two Corps, the X and XIII, were in the line and these Groups were connected to the H.A. of these two Corps: No. 2 to X Corps and No. 1 to XIII Corps.

Lines were relaid so as to give each post its own line to H.Q. and a "drop shutter" exchange, actuated by a bell-push in each post, put in at H.Q. All lines were laid by Signals and a considerable time elapsed before this reorganisation was complete.

The system of work was analogous to that now in use. Computing was discontinued and all results were plotted graphically. Intersections when obtained, were reported to Brigade Major, Corps H.A. by telephone immediately and a written report sent in daily to H.Q.

Of the three officers transferred from the 3rd. Field Survey Company each Group was placed under the command of one and the third was brought into H.Q. to act as Compiling Officer. It was necessary to have at least two officers at group H.Q. and in order to obtain the extra officers it was necessary to form, on paper, two more Groups. These expedients have already been described under the H.Q. Section and will not be gone into here. Only such Groups as actually worked in the line as such will be referred to. When the necessary sanction had been obtained, two more officers were found in the Army and attached to these Groups.

The organisation was complete by the middle of April. Shortly after this the VIII Corps came into the line and as the want of posts in the northern part of the Army front was felt it was decided to establish four more posts and form a third Group. This was done at the beginning of May.

The post South of the SOMME was handed over to the French and new posts were constructed by the R.E. at PERONNE AVENUE, MAXSE REDOUBT, LE MESNIL and COLINCAMPS SUCRERIE.

No 3 Group was formed for the VIII Corps with H.Q. at BEAUSART on May 6th 1916. The organisation at this time was as follows :-

XIII Corps	<u>No. 1 Group</u> Lieut. Penrose Lieut. James	H.Q. BRAY	Posts at Maricourt Wood Peronne Avenue Carnoy Grand Stand
X Corps	<u>No. 2 Group</u> Lieut. Cowan 2/Lt. Walford	H.Q. BOUZINCOURT	Posts at Maxse Redoubt Bouzin court Engelbelmer
VIII Corps	<u>No. 3 Group</u> 2/Lt. Tarrant 2/Lt. Bell	H.Q. BEAUSART	Posts at Le Mesnil Auchonvillers Colincamps- sucrerie

Observation was fairly good but the drop-shutter exchanges gave much trouble owing to "shorting" in the board. Results averaged 3 - 5 intersections daily. Owing to the delays in construction of posts, laying of lines, collecting and training personnel, No. 3 Group was not fully in action till the end of May. Preparations for the Somme battle were now nearing completion and in June two new Corps the III and XV came into line. To serve these Corps a line was asked for from No. 2 Group to III Corps and from No. 1 Group to XV Corps. The latter Corps however took little interest in the Group and some difficulty was experienced in getting these lines and keeping them in repair.

Ranging with Field Survey Company observation was first tried towards the end of April when an 8 inch Howitzer Battery was ranged by No. 2 Group on Pozieres Mill : 10 rounds were fired, 9 being satisfactorily observed and plotted.

Though the results were quite satisfactory little further ranging could be done owing to the difficulty in establishing and maintaining communications with the batteries.

Shortly before the opening of the Battle of the Somme, a proposal was put forward by the Army R.A. that on the day of the attack all Survey Posts should be handed over to the Corps for the use of Staff Officers.

It was pointed out in vain that each post was an integral part of the Group and could not be detached in this way without impairing the efficiency of the whole. However eventually the order was issued in a modified form which allowed of the post personnel remaining on duty during the day, and the whole control reverting to the Group at dusk.

The reason for this order was that the R.A. anticipated that the smoke and dust raised by the preliminary bombardment would completely put a stop to observation at any distance, that Groups could not therefore hope to obtain intersections, and that the posts would therefore be more useful to staff officers watching the course of the battle on their immediate front.

The preliminary bombardment lasted several days and did not, as a matter of fact, interfere with observation as much as had been anticipated. During the actual course of the attack observation was much more difficult but No. 2 Group did useful work, correctly reporting the enemy counter attack and recapture of his front line trench between THIEPVAL and ST. PIERRE DIVION. As was anticipated there was always more information at the Group H.Q. than at any particular post.

In the Southern Sector the attack succeeded and No. 1 Group moved up at once from BRAY to BILLON WOOD, thus very materially shortening their lines and enabling them to salve some cable.

After the capture of MAMETZ WOOD about July 10th, No. 1 Group moved forward, H.Q. and all posts to the MONTAUBAN RIDGE establishing posts above MAMETZ in MONTAUBAN ORCHARD and north of MARICOURT WOOD with a H.Q. in a German dug-out just west of MONTAUBAN. All lines were laid by the group using earth returns. Subsequently this group was subjected to heavy shelling in this position and proved unable to maintain these lines. Owing to the destruction of trig points great difficulty was also experienced in fixing the posts, the result being that results in the form of intersections were disappointing - practically nil.



On July 19th, the Reserve (now 5th) Army came into the line and Nos. 2 and 3 Groups, who had not moved, were handed over "in situ", complete, to the 5th Field Survey Company.

No. 1 Group was then split up into two, and a second No. 2 Group formed under Lieut. James, the Divisions in the Army being again asked for the necessary personnel. Each group was given three posts and No. 2 Group took up its H.Q. in a German dug-out south of FRICOURT WOOD, with posts at LONE COPSE, FRICOURT CRATERS and MAMETZ. No. 1 Group giving up the post at MAMETZ and establishing another one east of MONTAUBAN instead. Observation was bad from both places as the enemy guns were screened by the FLERS-POZIERES ridge. The better results were obtained by No. 2 Group, which being further from the line, was less disturbed by hostile shell fire.

Following the capture of TRONES WOOD and MAUREPAS, the O.C. No. 1 Group made another attempt to move the whole group forward and establish observation practically from the front line. Advanced H.Q. was established at MAUREPAS with posts at SAVERNAKE WOOD and ANGELUS COPSE.

These positions were occupied and lines laid, but no communication from H.Q. to the rear could be established, nor the posts properly fixed. The lines between posts moreover could not be maintained, and though flashes were seen, no results were obtained; and the whole party was withdrawn after three or four days, to positions further in the rear.

No. 2 Group, as the advance continued adopted a policy of advancing posts one at a time, and keeping at least one and generally two posts behind the most heavily shelled areas. They were thus able to remain continuously in action and maintain communication both with the H.A. and with posts without prolonged interruption. They maintained an average of about five satisfactory locations daily as well as a number of single rays, which, coupled with good air photos then being taken, were able to give valuable indications of the hostile batteries' activity.

As explained above, previous to the beginning of the battle both construction of posts and laying of lines was done by the R.E. of the Army. After the start of the battle no further help could be obtained from this source and the Groups were thrown entirely on their resources except for a certain amount of assistance in laying lines from the Sound Ranging Section. Both groups, besides the lack of trained personnel, were very much handicapped by the impossibility of obtaining adequate supplies of cable causing difficulties and delays in establishing and maintaining communications with their posts. This difficulty continued throughout the battle though towards the end of it, as the Corps began to appreciate their efforts, more assistance was forthcoming. Nevertheless great delays occurred in "setting the wheels in motion" and getting any new work required started. (This was particularly apparent later on when the Fourth Army took over the front from SAILLY SAILLISEL to the Somme)

During this period, various attempts were made to improve the method of both observing and recording flashes. 2/Lieut. Quigly in May made two attempts to photograph gun flashes from BOUZINCOURT O.P. but was unable to overcome the difficulty caused by the numerous flares and Verey Lights sent up from the line.

Later on in September, a tape machine for recording at Group H.Q. suggested by 2/Lieut. Edwards was constructed by Army Signals and given a trial by No. 2 Group. The machine was a makeshift and never worked satisfactorily and was soon superseded by the present "Flash and buzzer board".

In September after the capture of FLERS No. 2 Group moved its H.Q. up to BAZENTIN-LE-GRAND occupying a small cellar in the ruined village. Posts were established on the ridge S.W. of MARTINPUICH, in a tree on the edge of BAZENTIN WOOD and just East of HIGH WOOD. The first and last were subjected to constant heavy shelling and had to be moved two or three times. The Army was asked therefore to construct a series of protected O.Ps, right along the ridge with mined dug-outs attached. Five such O.Ps. were put in hand at the end of September.

Great delay was again experienced in carrying out the work due to changes in the Corps and Divisions holding the various sectors and the consequent changes in responsibility for executing the work, also to the difficulty in getting up material over the broken ground. The last of these O.Ps. was not completed till the end of November. By this time the weather had become unfavourable for observation and the line was two or three miles in front of the ridge so that the best opportunity for observation was lost.

In December No. 1 Group moved from MONTAUBAN to TRONES WOOD being housed in Nissen Huts in the Wood. Both groups found great difficulty in rationing their posts, a single horse being unable to pull a Maltese cart across broken ground in such weather. (Eventually two extra light draught horses were obtained from the Army additional to establishment). At the end of December, the Fourth Army commenced to take over the front from SAILLY SAILLISEL to ROYE from the French, the sector MARTINPUICH - LONGUEVAL being handed over to the Fifth Army. This resulted in a considerable increase in the front to be watched and the Army was asked to sanction the formation of two more groups of four posts each. Approval was given, and No. 3 and No. 4 Groups under Lieuts. Coburn and Edwards were formed, on the 10th and 18th of January respectively. No. 2 was split up the greater proportion of the Group being left "in situ" and handed over to the Fifth Army with all its equipment to form the nucleus of a new Group. No. 2 Group was then reconstituted and transferred to the ROYE sector. Each group was now allotted a definite Corps front to watch.

Personnel for these groups was again found in the Army and trained at Company H.Q.

On completion of this reorganisation the situation was as follows :-

		<u>HQ</u>	<u>Posts</u>
XIV Corps	<u>No. 1 Group</u> Lieut. Penrose 2/Lt. Chapman	Trones Wood	Les Boeufs Morval Leuze Wood above Combles
XV Corps	<u>No. 3 Group</u> Lieut. Coburn 2/Lt. Strachan	S.E. of Maurepas  Biaches	Rancourt Summit Copse Meri-court Wood
III Corps	<u>No. 4 Group</u> 2/Lt Edwards 2/Lt Gibbs	Dompierre  Lihons	Meri-court Wood Biaches Estrees
IV Corps	<u>No. 2 Group</u> Lieut. James 2/Lt. Leyson	Pozieres	Lihons Rozières Church Warvillers - Pylon Bouchoir Church

Great delay was experienced in establishing No. 3 and No. 4 Groups. The area was completely devastated and no accommodation of any kind was available, nor could labour be spared for constructional work. Eventually each group had to build its own H.Q. with what little R.E. assistance that could be obtained.

No. 3 Group constructed four "Cut and cover" dug-outs S.E. of MAUREPAS and No. 4 Group occupied two cellars and a Nissen Hut in the ruins of DOMPIERRE. No. 3 Group was in action early in February and No. 4 Group by the beginning of March. No. 2 Group was able to get good accommodation at ROZIERES and take over their O.Ps. from the French and were soon established.

The weather however was misty and unfavourable up till the beginning of March by which time the enemy had started to withdraw his artillery. On March 18th the retreat definitely commenced and a period of rapid movement followed.

The operations of this period may now be briefly summarized. When the Observation Section first commenced work there was definitely no counter battery policy. The R.A. were sceptical as to the possibility of locating batteries satisfactorily by the methods used and had little confidence in the results - which they had not the means of checking. Much valuable support was given to the observation section by Lieut. Colonel E.R. Ludlow-Hewitt, Commanding 3rd Wing, R.F.C. who quickly appreciated the value of the results obtained, but it was apparently not until the formation of the

Corps Counter Battery Offices that the R.A. was able to form any real idea of the value of the work done.

The majority of the Corps C.B. Officers at once began to appreciate the use of the observation groups and our organisation was, when possible, so arranged that each Corps was served by one Group which was directed to work in close touch with the C.B. Officer and to supply him as far as possible with the information he required in the way he required it.

The Group soon gained the confidence of the C.B. Offices and in most cases received much support from them. It cannot be said that, judged by modern standards, the number of intersections was very great; it must however be remembered that the organisation was devised for stationary warfare and that practically all the personnel were new to the work. The Somme battle was the first experience of any sort of war of movement and it was hardly to be expected that an organisation which was little more than tentative and designed moreover for stationary conditions should have been equal to coping with the difficult conditions prevailing during the battle. All ranks of the Observation Groups showed the utmost keenness to make a success of their work and throughout the battle, though never relieved and living in conditions of danger and all sorts of discomfort, they displayed great endurance and their work steadily improved.

By the end of 1916, all Groups were not only efficient at observation but were capable of laying and maintaining their own lines, siting, surveying and constructing their own H.Q. and posts. They were in fact, with adequate transport, fully mobile and self-contained units.

#### Period March 1917 - July 1917.

The German retirement to the HINDENBURG line afforded little scope for Field Survey Company observation as but little artillery was in action and that only by day from temporary positions. All Groups followed up the advance, maintaining usually two posts in action, and sending information back by visual to H.Q. As soon as the enemy resistance stiffened in the HINDENBURG outpost position all groups got into action on their respective Corps fronts. To help the Groups in moving forward the greater part of the transport of the Sound Ranging Sections was placed at their disposal.

The H.Q. of the Battalion did not move forward till May and some difficulty was experienced in keeping up communications with Groups. To improve this an advanced office was started in PERONNE under charge of C.S.M. Archer and a box car was sent daily taking out stores, letters etc., and bringing back Groups' reports and returns. (The reports submitted by Groups are dealt with under the heading of "Compilation".)

The situation of the Groups opposite the HINDENBURG position was as follows :-

	<u>H.Q.</u>	<u>Front</u>
No. 1 Group, Capt. Penrose,	South of Metz en Couture	XV Corps front, from BERTINCOURT to GOUZEAUCOURT.
No. 3 Group,	GENIN WELL COPSE	XV Corps front, GOUZEAUCOURT to EPEHY.
No. 4 Group, Lieut. Edwards,	West of HARGICOURT	III Corps front, EPEHY to LE VERGUIER.
No. 2 Group, Capt. James,	HARTEVILLE	IV Corps front, LE VERGUIER to HOLNON.

With the exception of the first sector where most of the hostile artillery was hidden behind the FLESQUIERES RIDGE, observation was good and many results obtained.

In May the French took over the front as far as the OMIGNON and No. 2 Group H.Q. moved to the wood south of HESBECOURT retaining however a post in HOLNON WOOD.

In June Capt. Penrose returned to Regimental duty and Lieut. Leyson took command of No. 1 Group.

The front during this period was exceptionally quiet and a good deal of ranging was carried out by No. 2 and No. 3 Groups.

Most of the observers became very expert at taking sound bearings and often useful results were obtained in this way, sometimes by intersection of sound bearings and others by timing the arrival of reports at different posts and working out a position in a manner rather similar to the German Sound Ranging system.

In June 1917, the Fourth Army was transferred to the Coast and all groups were handed over "in situ" to the 3rd Field Survey Company.

Period July 1917 - November 1917.

The move of the Fourth Army to the coastal area in July was preceded by the move of one Corps to this Area. The XV Corps being withdrawn from the line at GOUZEAUCOURT and taking over the NIEUPORT Sector about the end of May. A provisional Field Survey Company under the command of Major Keeling, R.E. was formed to deal with all F.S. work required by the Corps pending the arrival of the Army. The Observation Section of this Company consisted of one Sound Ranging Section and one group from the reserves at G.H.Q. and in other Armies. This group, under the command of Lieut. Cayley R.G.A., took over from the French and consisted of three posts. One in NIEUPORT, one in NIEUPORT BAINS and a third about half way between. All posts were in houses with strong concrete protection. The H.Q. was in a dug-out on the OOST DUNKETRQUE-NIEUPORT Road about 3,000 yards from the front line.

The sector had been a quiet one and the facilities for observation exceptionally good. Gun flashes could be seen by day as well as night, on any but the mistiest days, in all parts of the enemy's lines

The frontage however held by the Army was very narrow and the town of NIEUPORT cut the sector in two, so that O.Ps. to the north of it could not see the Southern part of the front and vice versa.

The lines taken over by the group consisted of a single circuit joining up all the O.Ps. and running in to H.Q. This line ran parallel to the front and close behind it. As the sector had been quiet there had apparently been no difficulty in maintaining this.

With the arrival of the British the activity of the enemy's artillery at once increased and this line was constantly cut thereby putting the whole group out of action.

This was the situation when the 4th Field Survey Company arrived with the Army and took over this front on July 8th.

On July 9th the enemy opened a very heavy bombardment which was kept up all day and followed by an attack next morning. Following this attack was a period of intense artillery activity during which large quantities of gas shells, chiefly "Mustard", were fired into NIEUPORT.

The observation group was completely paralysed by this shelling. The continual gassing made the O.Ps. in NIEUPORT and NIEUPORT BAINS uninhabitable and the line was almost completely demolished.

It was decided therefore to give up NIEUPORT as an O.P. and withdraw the group to a position further back and at the same time install another group opposite the southern portion of the Army front. As soon as sanction had been received for this, Capt. Coburn, M.C. who had been in command of a group on the XV Corps front on the Somme, was selected to command it and rejoined the Company with a nucleus of 16 selected N.C.Os, and men from his old group.

In order to take full advantage of the good observation facilities, approval was asked from the Army to install 5 Survey posts in this group and 4 in the existing one.

These two groups, in the general re-numbering which now took place, became No. 6 and 5 respectively. Reinforcements to supply the personnel for these were supplied by the Depot Field Survey Company.

The situation by the end of July was as follows :-

No 5 Group, H.Q. south of COST DUNKERQUE, 4 posts, OOST DUNKERQUE BAINS Hotel, Dunes North of OOST DUNKERQUE, Farm behind NIEUPORT and Farm just east of WIELPEN.

No. 6 Group, H.Q. BRIQUETERIE on Canal East of WIELPEN, 5 posts, in farms in the Belgium area.

No. 5 Group had to construct their own H.Q. but a good deal of assistance was given by the Corps in laying lines.

No. 6 Group, in the Belgium area, were little disturbed by enemy fire and quickly began to obtain remarkable results.

No. 5 Group in its new position also proved that security of lines and organisation were of far greater importance than good visibility. Though their O.Ps. were all much further from the line than those occupied in their first position, they were able to obtain at least six times as many intersections. Their O.Ps. however were abnormally far back, being so selected in order to expedite getting into action again and they were moved forward one by one as soon as conditions as regards cable, buried lines and construction of protected O.Ps. permitted.

By the middle of August, both groups were effecting large numbers of locations, averaging 15 to 20 or more daily (excluding pieces located more than once during the day ) during reasonably clear weather.

A word must be said here about the Calibrating Section as its activities had ultimately a considerable influence on the work of the Observation Groups.

The method known as "Screen Calibration" had been suggested at the Artillery School on Salisbury Plain during the previous Winter and General Kirwan, then Commandant of the School had taken the matter up. On returning to France as G.O.C., R.A. XV Corps, he had got the Army to ask for a Sound Ranging Section to be detailed to make experiments with the method. As the result of these representations "D" Section with a reduced staff had been placed temporarily at his disposal in June 1917 and installed on the coast near COXYDE BAINS. This section was taken over by the 4th F.S.C. on its arrival in July.

Up to this time the calibration had been done by screens only and the guns so calibrated sent back into the line. The Battery Commander presumably being asked to give an opinion after a suitable interval on the utility of the work. This procedure, though it would doubtless ultimately have collected a body of opinion either for or against the method, could hardly be expected to furnish any very precise data as to the value of the method and it was accordingly suggested to General Kirwan that by installing 3 O.Ps. along the coast and observing the fall of shot in the sea, it would be possible to make an exact comparison between the M.V. determined by the screen method and the M.V. determined from observation in the usual way. In proposing this, it was also hoped that many R.A. officers visiting the calibration range would be able to see under favourable conditions, while actually in operation, the methods used by the Field Survey Company in observing fire and be able to carry away with them a good idea of its accuracy and its possibilities when used in the line.

After some discussion the establishment of these O.Ps. was agreed to by the Army and G.H.Q. agreed to supply on loan from the Depot Field Survey Company, the personnel to man them. A good deal of delay was experienced in laying the necessary lines. "D" Section consisted of only 22 men and the personnel asked for the O.Ps. was kept down to the minimum required for observation only. No one was available to lay lines. Thanks however to the interest and assistance of Lieut-Col B.A.B. Butler R.F.A. this trouble was overcome and the section was working satisfactorily by the beginning of August. The fall of each shot in the sea was observed from 3 posts and plotted on a 1/5,000 board at the firing point. The M.V. worked out from observed range being tabulated for comparison with the M.V. from screens.

The expectation that this method of observing would arouse the interest of R.A. officers was fully borne out and the establishment of this section was quickly followed by a great increase in the demand for ranging by the groups in the line. So much so that this work commenced to interfere seriously with the normal work of location.

The demands were met to some extent by doubling the instruments in some of the posts and putting in another post in No. 6 Group, but with increasing use and confidence the demands on the group steadily increased also. Eventually it was suggested to the G.O.C. R.A. that it might be possible to find personnel from among the R.A. of the Army to form a small group, solely for ranging, to work under the direct orders of the G.O.C. Corps R.A. This group could be trained and equipped by the Field Survey Company and given a start by it.

This proposal was agreed to and an officer and about 15 men were trained by the O.C. No. 6 Group and installed under his supervision. It was entirely successful and continued to do useful work till the Army left the coast, considerably relieving the pressure on the two Field Survey Company groups.

Thanks largely to the excellent work done by the Field Survey Company Observation Section our C.B. information on this front was exceptionally good and complete. The Intelligence Branch of the G.S. were now trying to work up the system of "Wireless interception" recently started, to try and establish connection between wireless calls from the air and the batteries answering them and their targets. Every effort was therefore made to co-operate in this by getting the Observation Section to report the area shelled each time a gun was located. Many of the enemy pieces on the front however were H.V. guns of a very long range and it was found that when these fired on back areas they usually did so two or three at a time and it was difficult to say which target was engaged by which gun.

To improve our information in this respect arrangements were made with the Corps to establish 3 "lookout" posts in back areas to report shelling, collect information as to the calibre of the guns and types of shell used and to give warning to the Groups when shelling commenced and ended. Personnel for these posts were found by the Corps R.A. and they were equipped and established by the Field Survey Company being connected by telephone to the Corps C.B. office and the observation group.

Efforts were also made to improve the co-operation between the Observation Section and the R.A.F. (both planes and balloons) and a wireless receiving set was supplied to both S. Section and No. 6 Group by the R.A.F. with a view to picking up and verifying N.F. calls sent down from the air.

All these achieved a certain measure of success though hardly as much as had been hoped, though it may be said that, thanks to the excellent facilities for observation and the cordial co-operation and assistance given by the 15th Corps R.A., the operations of the Field Survey Company during this period were exceptionally successful.

As an instance of the possibilities of flash intersection it may be mentioned that on one occasion No. 5 Group located an A.A. gun (firing at night at our planes) at a distance of over 14 miles. The plotted position proved to be only 60 yards distant from the position of a concrete A.A. emplacement visible on a photo.

In November 1917 the 4th Army moved to the YPRES salient and the Groups were withdrawn shortly afterwards. No. 5 Group going to the Fifth Army and No. 6 rejoining the 4th Field Survey Company.

Just previous to the move the Company was called upon to supply staffs for the Experimental Sound Ranging Section at Salisbury Plain and also for a special Group to exhibit the possibilities of Field Survey Company observation for ranging. Capts. Atkins and Coburn were selected for these duties and were despatched to ENGLAND with a small staff.

#### Period November 1917 - April 1918.

The front now taken over by the Fourth Army had previously been held by the Fifth and Second Armies during the battles of the previous summer.

The following groups were taken over in situ:-

No. 12 Group,	H.Q. near YPRES.	OPs on the PILKEM ridge.
No. 3 Group,	H.Q. BRANDHOEK,	O.Ps on the WESTHOEK ridge.
No. 1 Group,	H.Q. LA CLYTTE,	O.Ps near HILL 60 & WYTSCHAETE.
No. 2 Group,	H.Q. KEMMEL,	O.Ps in WYTSCHAETE & MESSINES.
No. 4 Group,	H.Q. WESTHOF,	O.Ps on HILL 63 & in ARMENTIERES.

Each of these groups had three posts in action.

Another group in position on the PILKEM ridge was relieved by No. 6 Group as soon as the latter could be brought down from the coast, giving a total of six groups to cover the Army front.

Facilities for observation were bad on the Northern half of the Army front from POLYGON WOOD northwards and good from this point southwards.

The winter had however well set in and the weather was very unfavourable for visual work.

The situation on the Southern portion of the Army front, as regards groups, was satisfactory. Nos. 1, 2 and 4 Groups were well installed on the high ground between Hill 60 and ARMENTIERES and were getting good results. North of this however the situation was bad, the 3rd Battle of YPRES had been raging since August and the heavy shelling had completely disorganised the telephone communications of all Groups. Observation at the extreme north of the line was fairly good as at the beginning of December No. 12 Group took over two steel towers from the French and these with two O.Ps. on the PILKEM Ridge gave satisfactory observation over the HOUTHULST Forest. The Group H.Q. however was in the Canal Bank north of YPRES and badly placed, telephonic communication being so bad, that it was necessary to move it further North. From HOUTHULST southwards however the situation was very bad. No. 3 Group, the next group to the south, had its H.Q. beside the XXII Corps C.B. Office at BRANDHOEK and O.Ps. on the WESTHOEK Ridge. Practically no communication existed between H.Q. and the O.Ps, nor could the O.Ps see any flashes but an occasional sky reflection. There was virtually no Field Survey observation between HOUTHULST Forest and HILL 60. The first work therefore was to install No. 6 Group between No. 12 and No. 3 Groups (its H.Q. was established at MOUSE TRAP FARM with 5 O.Ps. along the PILKEM Ridge as far south as FREZENBERG ) and to move No. 3 Group forward on to the high ground about POLYGON Wood. This still left a gap extending from PASSCHENDALE to BROODSEINDE comprising the whole of the VIII Corps front.

It was therefore decided to form another group to fill this gap and to continue to make each group responsible for observation on a particular Corps front. The G.O.C. R.A. was then asked to affiliate the Groups to the various Corps. This was done as follows :-

No. 12 Group	XIX Corps.
No. 6 Group	II Corps.
No. 23 Group (new)	VIII Corps.
No. 3 Group	XXII Corps.
No. 1 Group	IX Corps.
No. 2 Group	Aust Corps.
No. 4 Group	Aust Corps.

Of these No. 12, No. 6, No. 1, No. 2, and No. 4 Groups were soon well established and working well. The problem on No. 3 and No. 23 Groups was more difficult. As the Fifth Army was at this time taking over the front opposite ST. QUENTIN and forming new Groups the Depot was unable to supply any reinforcements. The O.C. No. 6 Group had been sent to Salisbury Plain and had not yet returned so that neither officers nor men were available to form the new Group.

In this situation the Army was again called on for men and 50 men from infantry battalions were obtained. Lieut. YARWOOD of No. 6 Group was selected for command of No. 23 Group and undertook the training of these men ( in addition to his acting in command of No. 6 Group ) pending Capt. Coburn's return.

As officers it was decided to commission two selected N.C.O.s (Sergts. Platt and Eyre) from No. 6 and No. 12 Groups to fill the vacancies.

While the training of these men was proceeding, the siting and construction of posts was taken in hand. The shape of the front made conditions most difficult. The line ran on a sharp salient at PASSCHENDALE and from there southward ran just in front of the ridge as far as POLDERHOEK Chateau.

All the front line area and battery areas in rear were heavily shelled making it almost impossible to maintain continuous telephonic communication between O.Ps on the ridge and H.Q. behind it.

All Corps had therefore got out plans for deeply buried cable routes leading up to the ridge, and arrangements were made for lines in these buries to be given to the groups. At the same time Corps were asked to construct 4 protected O.Ps. at selected places along the ridge, with a small mined dug-out beside each, sufficiently large to act as a "Funkhole" for the men on duty. The shape of the line however made it difficult, by any combination of ground O.Ps. along the ridge to obtain a suitable "base", for intersecting flashes opposite to the apex of the salient.

It was therefore decided not to attempt any O.P. on PASSCHENDALE, at least till work on the bury and on communications generally up to it had made further progress, and to attempt to overcome the difficulty by using steel tower O.Ps. on the ridges in our own lines behind. Owing to the complete destruction of all trees, there was little prospect of concealing these towers, and it was therefore necessary to place them sufficiently far back to make them difficult to hit. Three "Redpath Brown" Towers were obtained from Maps G.H.Q. and two of them were handed over to No. 23 Group for erection at PILKHEM and White Chateau. Some little difficulty was experienced in obtaining permission to erect them, as there was a general fear that they would "draw fire", though it is not at once evident why the erection of a steel tower should in any way stimulate the enemy's artillery to increased activity, nor why the drawing of fire to its immediate vicinity should be anything but an advantage to people who lived elsewhere ( particularly seeing that their sites were selected so that they were as far as possible from any huts of billets ).

All these arrangements took some time to carry out, and it was not until February that all groups were working satisfactory. The affiliation to Corps however had had fairly good results and most of the Corps did a good deal to assist the working and improve the comfort of the Groups.

The great increase in the number of groups and the size of the Army Area entailed some modifications to the previous routine for sending in reports to H.Q. and in the Administration of Groups and Sections generally.

Previous to the arrival of the Fourth Army, the greater part of the front had been held by the Second Army who had established an "Observation Centre" at LOCRE. The Army had been stationary on this front for three years, and had a very complete system of telephone communications so that all the Second Army Groups and Sections were connected through not more than one exchange to this centre. Here a daily summary of the day's work was prepared and sent out, though no actual "compilation" was attempted.

Owing to the difficulty of administering so many units from H.Q. and also to the impossibility of collecting all reports with Field Survey Company transport, or getting them back to CASSEL in quick enough time by D.L.R.S., it was decided to move the Compilation Section forward to LOCRE, to have all reports sent there, and further, to place an officer at LOCRE in charge of all the Field Survey Company observation in the Army. Capt. A.H. Atkins, M.C., R.G.A. was selected for this appointment and took up his H.Q. at LOCRE on April 1st.

This officer was empowered to supervise the working of all groups and Sound Ranging Sections, and to deal direct with Corps on any matters affecting them. He also supervised the compilation and working of the Observation centre, and investigated at once any apparent discrepancies between locations obtained by the various units.

The situation at the end of March was as follows :-

<u>Group</u>	<u>H.Q.</u>	<u>Sector</u>	<u>Corps</u>
No. 12 Group	FERME ROUGE	HOUTHULST Forest	XIX
No. 6 Group	MOUSETRAP Farm (Adv)	POELCAPELLE	II



REIGERSBERG (Rear)				
No. 23	Group	St. JEAN	PASSCHENDAELE	VIII
No. 3	Group	DOLLS HOUSE	BECELAERE	XXII
No. 1	Group	LA CLYTTE	ZANDVOORDE	IX
No. 2	Group	KEMMEL	WYTSCHAETE	Aust.
No. 4	Group	WESTHOF FARM	WARNETON	Aust.

From the beginning of January onwards the collapse of Russia had led to a policy of defence on the Western Front, and throughout the Winter work had been proceeding on the defences of certain zones known as the Forward, Battle, and Rear Zones.

In accordance with the general Army scheme of defence reconnaissance's were carried out during the Winter for reserve H.Q. and O.Ps, and plans were made for occupying them in case of retirement. The orders issued are given as an annex.

Each group was allotted a H.Q. suitable for each zone and a few reserve . (steel towers for the most part ) were constructed. All preparations were complete by the end of February.

During this month, the XXII Corps was withdrawn from the line. This was followed later by other changes. The Aust. and IX Corps also left the Army and the XIX Corps eventually came back into line. In April, three French Corps took over the centre of the Army front.

#### Period April 1918 - August 1918.

On April 9th, in thick fog the battle of the LYS commenced. The attack on the MESSINES RIDGE followed next day. The attack on the First Army, accompanied as it was by heavy gas shelling of ARMENTIERES had caused the withdrawal of No. 4 Group's post in the town, the detachment being slightly "gassed". The subsequent attack gained MESSINES, HILL 63 and eventually ARMENTIERES. In the thick fog little could be seen but thanks to the buried lines to the posts, communication was maintained till a late hour and a good deal of information, obtained from the infantry, was sent back. All posts were withdrawn with the loss of 2 or 3 men missing and a few wounded, and positions taken up on KEMMEL and NEUVE EGLISE HILLS. As the attack progressed on subsequent days No. 2 and No. 4 Groups fell back on to LOCRE and vicinity.

The advance had now created a large re-entrant in our line greatly lengthening the front.

Owing to the extensive use of buried lines neither No. 2 nor No. 4 Groups were able to salvage much cable and were forced pro tem to occupy very short bases. This consequently left gaps in the line. A large gap appeared between No. 1 and No. 2 Groups and between No. 4 and the First Army Group, No. 7.

Previous to the battle, the XIX Corps and Australian Corps had been withdrawn and transferred to another Army and their front taken over by the II and IX Corps respectively. About April 11th, the Command of the XV Corps passed to II Army and with it No. 7 Group was transferred from 1st to 4th Field Survey Company.

A few days later, French troops commenced to arrive and take over the Kemmel Sector from the IX and XXII Corps. Eventually three French Corps came into line and the IX Corps was withdrawn and transferred to another Army.

Orders were now issued by the Army to retreat from PASSCHENDALE to the Battle Zone in front of YPRES. This resulted in a considerable shortening of this part of the line. Orders were therefore issued for No. 6 and No. 23 Groups, which were in the salient, to pull out and come into action between No. 4 and No. 7 and between No. 1 and No. 2 respectively, to fill the gaps above-mentioned. The order of battle North to South was then :-

No. 12 Group II Corps  
No. 3 Group )  
No. 1 Group ) XXII Corps

No. 23 Group )

No. 2 Group )

No. 4 Group ) IX Corps

No. 5 Group )

No. 7 Group ) XV Corps

The VIII Corps was withdrawn into reserve.

No. 23 Group established posts on KEMMEL, MONT ROUGE, and about MOUNT NOIR, with Headquarters near WESTOUTRE; the Group was handled with great energy and boldness by Captain Yarwood, but soon sustained heavy casualties, Captain Yarwood himself being severely wounded on MONT NOIR. After this, being much disorganised, it was withdrawn to reserve, the sector being taken over by the French.

The French brought with them one Group, S.R.O.T. 90, which came into action on the right of No. 1 Group with O.Ps. on MONT NOIR and MONT ROUGE.

No. 6 Group was also most skilfully handled by Captain Coburn, and got into action in two days between FLETRE and NIEPPE Forest and at once began to obtain many locations. On April the 29th the German attack on SCHERPENBERG was decisively repulsed and the line commenced to stabilize.

This found the Groups as follows :-

H.Q.

No. 12 Group FERME ROUGE ( no change )

No. 3 Group REGERSBERG CHATEAU

No. 1 Group BRANDHOEK

S.R.O.T. 90 South of POPERINGHE

No. 2 Group MONT KOKEREELE

No. 4 Group MONT-DES-CATS

No. 6 Group BORRE

No. 7 Group GRAND HAZARD ( South of HAZEBROUK )

During the retirement Nos. 2 and 4 Groups had become considerably disorganized and suffered somewhat in morale. Both were thoroughly tired and were relieved as soon as possible by No. 23 Group coming into the line again about the end of April and taking over from both Groups.

The French soon after brought up another Group, S.R.O.T. 91, which had come into action between No. 23 and No. 6 with its H.Q. near EECKE. In order to ensure good liaison between these French Groups and the British Units on each side of them, arrangements were made whereby one British soldier from each Group lived with the French and one Frenchmen lived with the British Unit. This man was responsible for telephoning through any information obtained to the proper quarter. This procedure worked quite satisfactorily.

As the situation stabilised the Groups were distributed to Corps as follows :-

No. 1 )

No. 3 ) II Corps

No. 12 )

No. 6 )

No. 7 ) XV Corps

No. 23 )

with No. 2 and No. 4 in reserve. No. 2 Group was soon afterwards transferred to Fifth Army.

Throughout this period of retreat the dispositions of the Groups were controlled by Major Atkins. During the first stages of the battle, owing to continuous mist, little work could be done, but both No. 2

and No. 4 Groups maintained touch with the IX Corps C.B. Office and were able, by sending runners to Brigade and Battalion H.Q., to pass back a good deal of useful information.

For a time after taking up their position along the MONT NOIR - MONT DES CATS ridge the results were disappointing. There was a shortage of cable and both Groups, besides having had no previous experience of moving warfare, were tired out and in need of relief. As soon as No. 23 Group came into line the work greatly improved and the number of locations increased rapidly.

No 7 Group had also got greatly disorganised in the retreat and though duplicating part of the front of No. 6 Group were obtaining no results. This Group could not be relieved but an exchange of some of the personnel with No. 6 Group was effected and led to a very marked improvement in its work.

The situation in which the enemy was now placed was most favourable to us and these three Groups ( Nos. 6, 7 and 23 ) took full advantage of it, achieving remarkable results and again exemplifying the possibilities of cross observation under favourable conditions.

It is of interest to note that during the month of August ( the most favourable for the R.F.C. ) the Observation Groups located nearly three times as many batteries as did the Army planes, and, as was eventually proved, with much greater precision. The situation of April 29th continued virtually without alteration till the end of August, except that the French Troops were relieved by the XIX Corps and the XIX Corps came into line. No. 12 Group was therefore transferred from the northern part of the line, which was handed over to the Belgians, and came into line on the XIX Corps front ( its old Corps )

The dispositions were now :-

II Corps	No. 1 and 3 Groups
X Corps	No. 23 Group
XIX Corps	No. 12 Group
XV Corps	No. 6 and 7 Groups

In May, in anticipation of the new Field Survey Battalion establishment, the Observation Section was organised into two Artillery Sections under Major Atkins and Major Coburn, ( known as the Northern and Southern Artillery Sections ) the II and XIX Corps Groups and Sections being under Major Atkins, and the X and XV Corps Groups and Sections being under Major Coburn.

It was known that the enemy was planning further big attacks, and our policy was still defensive. Rear positions were reconnoitred and the Reserve Group ( No. 4 ) used for reconnoitring and constructing reserve O.Ps. Three O.Ps. were constructed on the ridge west of POPERINGHE, and three more, very strongly protected, on the MONT DE RECOLLECTS.

In June the new Inglis Towers commenced to arrive from England. The first of these was erected in NIEPPE FOREST and TROIS TOURS.

No. 27 Group joined the Battalion on the 19th August 1918.

In July as it became clear that the probabilities of an offensive were passing away No. 4 Group was brought into line again and used as a ranging group, being put in between Nos. 6 and 23 Groups to take full advantage of the very good observation from this vicinity.

In August the enemy commenced to withdraw from the LYS Salient. The withdrawal was slow and deliberate and the Groups had no difficulty in following up, locations being obtained by one or other of the Groups during every day. A certain amount of difficulty was experienced in obtaining billets for H.Q. but as the weather was generally fine this did not cause great hardship.

The effect of this advance was to considerably shorten our line, and No. 4 Group was withdrawn again and transferred to another Army.

At the conclusion of this withdrawal the situation was as follows :-

	<u>H.Q.</u>	
II Corps	No. 3 Group	NANSEN FARM

	No. 1 Group	DIRTY BUCKET CORNER
XIX Corps	No. 12 Group	RENINGHELST
	No. 27 Group	MONT ROUGE
X Corps	No. 23 Group	WULVERGHEM
XV Corps	No. 6 Group	HALL FARM
	No. 7 Group	STEENWERCK ( near )

Towards the end of September preparations commenced for the Fourth and last battle of YPRES. These were for an attack to be carried out by the II Corps, with the Belgians, supported by a certain amount of British Artillery on its left. The final objective for the day was the PASSCHENDALE RIDGE about five miles distant. The following Groups etc. were likely to be concerned in this operation :-

No. 1, 3 and 27 Groups.  
S, I, and GG Sound Ranging Sections

In anticipation of such a considerable advance the Army was asked to provide additional transport for each of these units from the Army Auxiliary H.T. Seven G.S. wagons were thereupon placed at the disposal of the Northern Artillery Section

Special Plans were elaborated in conjunction with the II Corps R.A. to use the Groups for watching the situation and sending back reports. A C.W. wireless set was provided by Corps and placed at the disposal of the Northern Artillery Section.

The general plan was as follows :-

No. 27 Group was withdrawn from the line a few days before the attack and concentrated behind the line with all stores and cable packed ready to move forward directly after the Infantry. As soon as it reached a given line it was to deploy and get into action, using the wireless set to send back reports. The other Groups, No 1 and No. 3 were then to pack up and go forward, passing through No. 27 to a more distant line when No. 27 would pack up and stand by ready to go forward again if the advance continued. No. 1 Group was specially detailed to report on the Belgian advance. The wireless receiving set was placed in a central position in one of the existing survey posts ( STRAY FARM ) to which there ran a buried line from No. 3 Group H.Q. Arrangements were also made for co-operation with H.A. F.O.O.s, and for laying lines back to STRAY FARM as alternatives to the wireless set. On Sept. 29th. the attack was launched in a deluge of rain which continued for three hours after zero. It was completely successful and in spite of strenuous efforts no Group succeeded in keeping up with the Infantry, nor did they succeed in getting back any information worth mentioning. The reasons for this were :

- (a) The wireless set had only been handed over to the Group the previous day and there was no time to test it before starting. It could not be got to work for six hours after it was set up.
- (b) The ground proved to be impassable for wheeled vehicles.
- (c) The "bury" up to STRAY FARM was cut.
- (d) There was very little, if any, information to send. At the end of the day No. 1 Group had advanced nearly to PASSCHENDALE, No. 27 Group had got halfway to BROODSEINDE, and No. 3 Group had established O.P.s round POLYGON BUTTE and a H.Q. at FREEZENBERG.

Next day the Army frontages were changed and No. 1 Group had to be ordered to change front and was directed to BECELAERE, to go through between No. 27 and No. 3. Owing to the lack of roads this involved retiring first right back to YPRES and resulted in heavy marching which greatly exhausted the Group.

By the evening of the next day No. 27 Group were established with three posts on the BROODSEINDE RIDGE. No. 3 Group H.Q. at FREEZENBERG and three posts round POLYGON WOOD. No 1 Group had reached BECELAERE but had not deployed. Communications now became very difficult. The

only road was impassable, blocked by mud and traffic. The journey by cart from BROODSEINDE to YPRES took twenty four hours. The Army therefore halted over a week on this line and all groups were able gradually to reorganise and establish themselves properly. The country, however, was not very favourable for observation as the slopes were gentle and well wooded. Many single flashes could be seen but concentration of several posts, particularly if a long base was used, proved difficult and uncertain. This may have been partly due to the fact that time had not permitted of the laying of a separate line to each post, hence the Flash and Buzzer boards could not be used and concentration was effected by buzzer alone.

As a result of this attack the enemy withdrew his line all along the Army front, giving up the MESSINES RIDGE and ARMENTIERES. No. 12, No. 23 and No. 6 Groups established themselves without difficulty or delay on the high ground. No. 7 Group moved forward also, but had difficulty in finding suitable O.P.s in the flat country round ARMENTIERES and did not obtain many results. All groups however effected a certain number of locations.

The advance following subsequent attacks proved easier as the roads were good and most of the houses still standing. The groups had no difficulty in keeping up with the Heavy Artillery though unfavourable ground and weather prevented their effecting many locations.

All groups were well established overlooking the SCHELDT when the Armistice was signed.

The conclusions I formed from the experience of this advance were as follows :-

- (1) A group moving forward along a road can deploy and get into action on a ridge in 3 to 5 hours from the time it arrives at the point of deployment.
- (2) The number of results obtained depends largely on the nature of the country and of course the visibility. They can do little in flat, well wooded country for which "Tower" O.P.s are almost essential. Church spires, though giving good observation, are always heavily shelled and are little used as Survey Posts. High houses are almost always preferable.
- (3) Long bases are only advisable in open country or among hills from which a good all round view can be obtained.
- (4) The Group cannot lay or maintain communication backwards from its H.Q.
- (5) Separate detachments must be detailed for laying new wire and picking up the old. A group cannot, after getting into action, send back and pick up its old wire; nor should it be asked to reel in its wire before advancing. It should have sufficient wire for two complete bases and sufficient personnel to pick up one base simultaneously with laying out the next.
- (6) It should be able to send out locations by wireless as "NF" calls.
- (7) Command of the groups from the Army is impossible. Tactical instructions to the R.A. issue from the Corps. The group should receive its instructions from the same source.

With the conclusion of the Armistice the work of the Observation Groups came to an end. Preparations had however to be made for the advance into Germany. For this an Army of four Corps was organised, and one Group allotted to each Corps. The arrangements made for the attachment to Corps are explained under the heading of H.Q. Section.

Only one Group actually marched to Germany, No. 6 Group accompanying the Canadian Corps. The march involved heavy work for the men, as the Group accompanied the H.A. which being all horse or M.T. drawn covered the distance in very long daily marches. The Group transport proved altogether inadequate, and much kit and a few stores had to be dumped at various places en route. Shortly after entering Germany it was possible to allocate a lorry to the Group which enabled them to keep up satisfactorily from that time onwards.

The Group arrived at WAHN about the 18th December and went into billets in the German Observation School there. The other Groups came up by train, one arriving on January 8th, and the other two about a month later.

PART V.

OBSERVATION.

Section (a) The work of Observation Groups and the Calibration Section.

APPENDIX "A"

Copy of G.H.Q. Letter OB/1231 dated 10th February 1916.

Copy of G.H.Q. letter OB/1231 dated 10th February 1916.

All Armies.

In view of the expansion of the methods by which hostile batteries are located, due to the establishment of Observation Sections in each Army area, and the proposed allotment of a Sound Ranging Section to each Army, it has been found that the organization foreshadowed in paragraph 2 of G.H.Q. letter No OB/1137 of the 13th December, in which it was proposed that the Topographical Sections should undertake the task of co-ordinating the results obtained by observation parties, is impracticable. It has been decided, therefore, to introduce a new unit, to be known as a Field Survey Company, to co-ordinate and control all work in connection with the topographical preparation of maps and the fixation of hostile objectives.

One Field Survey Company will be allotted to each Army.

This Company will work under the immediate direction of the General Staff, the latter remaining responsible for the acquisition of information, the collation of information obtained from all sources, and its dissemination to those concerned.

The Field Survey Companies will consist of three separate units, namely the Topographical and Map Sections, which now exist, the Observation Sections and the Sound Ranging Sections. In addition each Field Survey Company will furnish a Compiling Section from within its own establishment. A memorandum with diagram is attached showing in detail the organisation and duties of the Field Survey Coy., together with those of its component Sections. (a). Tables are also attached showing the establishment of the Field Survey Company and of a Sound Ranging Section. The establishment of an Observation Section was forwarded with G.H.Q. letter No. OB/1137 of the 30th January. (b).

( Signed ) Major-General

G.H.Q.

Deputy C.G.S.

- (a) A copy of the minute dealing with the Observation Section is attached, together with the diagram.
- (b) See Appendix A to Part I (Headquarters Section ).

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Observing Section.

The Section consists of a series of squads formed into Groups.

The squads are responsible for the close observation of the enemy's line and of the ground in their front, and for fixing, by instrumental observation, hostile batteries and other targets. Group Commanders will be responsible for the supervision and administration of the squads forming their group. Normally all reports of observations will be sent direct to the Compilation Section. On certain occasions, however, it may be advisable for the Group Commander to communicate direct with the Artillery, if and when he is able to locate the objective observed without previous reference to the Compiling Section. On such occasions the report will be repeated to the Compiling Section for verification.

The number of squads composing a group, and the number of groups formed, must depend on local considerations. Establishments must, however, be kept to a minimum.

Sound Ranging Section.

This Section will consist, for the present, of two independent detachments. Each detachment is entirely self-contained and mobile. Their duty is the fixing of hostile guns by the sound of their discharge. The reports of these detachments will be transmitted direct to the Compiling Section, who will discontinue the information as required.

To ensure good results being obtained from the work of the Observation and Sound Ranging Sections, it is essential that inter-communication throughout should be rapid. Good telephonic communication from the Survey Company Headquarters to the Observation Section Groups, and to the Sound Ranging Detachments, and inter-communication between these along the front, is therefore especially important.

FIELD SURVEY COMPANY - CHAIN OF RESPONSIBILITY.

General Staff ( Intelligence ).

Officer Commanding.

Adjutant  
Administration.

Compiling Section  
Compilation of results.

Topographical Section.

Map Section

Observation Section.

Sound Ranging Section.



Topo. work in the Field. Artillery Boards.	Topo. work in the Office. Printing. Map Supply.	Fixing targets by Observation			Fixing guns by sound.	
		Group	Group	Group	Detachment	Detachment
	Squad	Squad	Squad	Squad	Squad	Squad
		Squad	Squad			

PART V.

OBSERVATION.

Section (a) The work of Observation Groups and the Calibration Section.

APPENDIX "B"

Copy of Defensive Policy of Observation Groups and Sound Ranging Sections February 1918.

SECRET

COPY.

General Staff, Headquarters, 4th Army  
No. 161/10(G). 22-2-18.

II Corps.                   XXII Corps.  
VIII Corps.               Aust. Corps.  
X Corps.                   ) For  
4th. Field Survey Co. ) information.

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1. With reference to Fourth Army No. 161/9(G) of 20-2-18 ( issued personally to Corps Commanders.) Instructions are attached showing the Defensive Policy for Observation Groups and Sound Ranging Sections of the 4th. Field Survey Co.
2. These would come into effect in the event of orders being issued to carry out the operation in the above-quoted letter.
3. In order to prepare for the proposed changes in Observation Groups and Sound Ranging Sections, Corps will undertake to carry out, as soon as possible, the works laid down in paras. 2 and 4 of attached instructions.

H.Q. Fourth Army,  
22nd. February, 1918.

( Sgd. ) A.A. MONTGOMERY,  
Major-General.,  
General Staff, Fourth Army.

Copies to :- G.O.C., R.A.  
C.E.

SECRET

Fourth Army No. 161/10(G)

COPY.

DEFENSIVE POLICY FOR OBSERVATION GROUPS AND SOUND RANGING SECTIONS.

1. Observation Groups.

(a) The first effect of a small enemy advance would be to render certain advanced Survey Posts untenable. Alternative posts further back should be provided for, such posts to be occupied at the discretion of the O.C. Group when the existing posts become untenable.

The posts principally concerned are those at :-

D.23.c.1.8.  
J.10.a.7.7.

The alternative positions for these two posts should be forward positions for battle zone defence and they should be chosen with regard to the position of Corps "buries" and lines provided so that they can be put at once in telephonic communication with the Group H.Q.

They should be selected by the O.C. Group in consultation with the Corps R.A. and Corps Signals, prepared by Corps and definitely allotted to the Group.

( No. 3 Group and XXII Corps ).  
( No. 23 Group and VIII Corps ).

(b) In the event of the occupation of the "Battle Zone", it will be necessary to provide Headquarters further back for No. 6 and No. 23 Groups.

The most suitable places are :-

No. 6 Group, Canal Bank in C.25.  
No. 23 Group, REIGERSBERG Chateau.

Protected telephone communication from these places should be provided to all survey posts, which should be considered in the scheme of Corps "buries". This includes existing posts and the alternative survey posts referred to above. It will not be necessary to move any other Group H.Q.

(c) In addition to the alternative posts referred to above, alternative posts should be provided for the following survey posts, protected telephone lines being provided from the Group H.Q. to the posts selected. ( vide para. 1 (b) above ).

No. 6 Group.

Post in U.20.c.  
Post in D.25.d.

No. 23 Group.

For the Battle Zone this Group will require "tower" or Tree Observation Posts in our present back area. ELVERDINGHE Mill is suggested as a suitable place for one.

Steel tower O.Ps. for the other two should be erected now so that they can be concealed as far as possible

These lattice steel towers will be provided on application to 4th. Field Survey Company. The following are suggested as suitable sites :-

H.5.d.  
H.30.c.

No. 3 Group.

Post at J.14.a.3.2.

As long as we hold the battle zone no other changes in Groups would be necessary.

2. Summing up the above, the following works should be taken in hand now, in the order stated :-

- ( 1. Provision of alternative Survey Posts in place of those at :-  
XXII ( D.23.c.1.8.  
Corps. ( J.10.a.7.7.  
( J.14.a.3.2.  
(  
( 2. Allocation of certain dugouts in the Canal bank to No. 6 Group and provision

II Corps. ( of protected telephone communication from this point to all posts of the Group, viz:  
( C.3c.2.8.  
( C.15.b. central  
( C.16.d.6.2.  
(  
( 3. Provision of an alternative post to the Survey Post at U.20.c. and D.25.d.3.6. and  
( protected telephone communication to them from the H.Q. in Canal Bank referred  
to ( above.

VIII ( Construction of tower or tree Observation Posts for No. 23 Group in H.5.d. and  
Corps. ( H.30.c. with arrangements for telephone communication from those points to the  
( H.Q. at REIGERSBERG Chateau. Also telephone communication from this H.Q.  
( to ELVERDINGHE Mill.

### 3. Sound Ranging Sections.

Most of the Sections are now fairly far back from the front and as long as we occupy the “ Forward Zone” no change should be necessary. Occupation of the “Battle Zone” would necessitate, however, the withdrawal of “S”, “BB” and “FF” Sections to positions further back.

The sites suggested are :-

“S” Section... to its present rear H.Q. in ELVERDINGHE Mill...with base line extending from S.18.central to B.28.b.9.5.

“BB” Section ... to its present rear H.Q. in Canal Bank, C.25, with base line extending from B.12.a.3.9. to I.16.b.6.0.

“FF” Section ... to vicinity of CAFE BELGE (H.29.b.) ... with Base line extending from C.25.c.0.8. to N.12.d.9.8.

These lines will be surveyed and marked out on the ground. Each Corps should keep a reserve of at least 25 miles of “S.11” cable per Section.

4. The following work will be required with reference to para 3.

By II Corps. Provision of a suitable forward Observation Post for “S” Section. Any existing dug-outs in the vicinity of ZUYDSCHOOTE and BOESINGHE, would be suitable.

By VIII Corps. Provision of forward Observation Posts for “BB” Section. Existing H.Q. of “BB” Section would be suitable for one. Any existing dug-out in I.5.b. would be suitable for the second.

By XXII Corps. (a) Provision of strongly protected accommodation for the instrument, splinter proof accommodation for the detachment in the vicinity of CAFE BELGE ( Note: the old S.R. H.Q. now occupied by a Balloon Company would be suitable.).

(b) Provision of suitable forward Observation Posts. “FF” Section’s existing H.Q. would be suitable for one and the other should be about I.27.d. Protected telephone communication should be provided between these forward Observation Posts and the H.Q. suggested.

22-2-18

PART V.

OBSERVATION.

Section (a). The work of Observation Groups and the Calibration Section.

APPENDIX "C"

HISTORY OF NO. 6 OBSERVATION GROUP.

#### No. 6 OBSERVATION GROUP.

This Group assembled at COMBLES as No. 3 Group 4th Field Survey Company in December 1916 on our taking over the Northern portion of the French line at the conclusion of the SOMME battle. The personnel were untrained with the exception of seven N.C.O.'s and men drawn from No. 2 Group 4th Field Survey Company. The frontage allotted to the Group was approximately from MORVAL, to Hill 150 - about 6000 yards, and O.P. sites were selected at MORVAL, RANCOURT and HILL 150. The two latter O.P.'s were prepared entirely by Corps and in the case of MORVAL two existing German tunnels were connected by the tunnelling company to form a dug-out - the remainder of the work of driving a tunnel and making an O.P. under the ruins of the village shrine was undertaken by the Group in order to expedite getting into action.

During the time the O.P.'s were being built the untrained personnel were given an intensive course of instruction under two N.C.O.'s, the more promising men being put into an advanced class and given every facility to qualify as efficient observers. Before the completion of these three O.P.'s the Group was required to side slip to the South and cover the front from RANCOURT to PERONNE. This necessitated a move of Group H.Q., the employment of two O.P.'s farther South and the giving up of the O.P. at MORVAL. Two O.P.'s with very good command but rather far back for the prevailing visibility, were taken over from the French, one at SUMMIT COPSE and one South of the SOMME, on the high ground 1000 yards East of MEREEAUCOURT WOOD. A new Group H.Q. was established in dug-outs prepared by Corps, East of MAUREPAS and the Group got into action with three O.P.'s about the end of January.

The heavy and persistent shelling of HILL 150 at this period led to its abandonment as an O.P. Work was carried out with three O.P.'s and a few results were obtained. In the meantime a fourth O.P. site had been reconnoitred, the vicinity selected being the high ground on the West bank of the SOMME at the river bend North of PERONNE. An excellent close range view of the enemy trenches on the opposite bank of the river was obtained from this position and also a good general view of his whole front line system for about a mile to the North. This O.P. was built by the detachment which subsequently manned it, in less than a week. Four O.Ps. were now working and a reconnaissance was undertaken to find better positions for the two which were further back. One new site was selected on the heights overlooking PERONNE about 1500 yards South of the existing Southern Post, but the enemy retired towards the HINDENBURG LINE on the following day ( 18th March, 1917 ) and work was not started on this position.

The Group had now been in action about seven weeks and the personnel had settled down to their work. It was now possible to fill up the vacancies for N.C.O's, with the best men, and this was done. The value of O.Ps. with a good trench view and continuous observation was proved during this period. During the two or three weeks that the O.P. overlooking the trenches East of CLERY-SUR-SOMME was in action it was noticed that large quantities of material were being carried out of the trenches and practically nothing brought in to replace it. It could also be seen that the trenches were lightly held. These facts pointed to a retirement. Previous to retiring the enemy lighted a large number of fires in PERONNE and adjoining villages.. On occasions men could be seen moving about near fires and the location of such fires was given to a Field Battery close to the Southern O.P. The battery usually replied with thirty rounds at rapid rate.

The post at RANCOURT was also very useful for trench intelligence and was able on many occasions to point out targets to F.O.O's in the vicinity. An enemy working-party which had been working for some days at the same spot in their reserve line was effectively disposed of as the result of information from this O.P. A heavy battery registered close to the spot where they had been working and then asked to be informed when the party was seen again. From ten to twelve men were seen next morning at the same spot working as usual, and the battery was informed. Fire was opened and two men were seen to be blown into the air and as they were all working close together it is probable that all of them were casualties. They were not seen again.

The system of a staff of N.C.O's and men in complete charge of the technical work in the Office to ensure that work was carried on vigorously during the whole of the twenty four hours was tried and proved successful.

The building of O.P's and H.Q's by Corps was a slow and unsatisfactory process. The delay was not felt very keenly by the Group at this time, as the men were being trained; but it was realised that if the Group was to get into action quickly in the future this work would have to be done by the Group. To this end all the N.C.O's at posts and as many men as possible were instructed practically in the selection, construction and concealment of posts and the N.C.O's were informed that they would have to be prepared to perform these duties if necessary.

As soon as it became clear that the enemy had retired from his trenches, patrols were sent out from the flank posts to get information as to the situation and to report on the condition of roads, bridges, etc., likely to be used for moving forward. A study of the country from the O.P's in conjunction with the map showed that a Group move was of little use until we had possession of the high ground from NURLU to the South. The reasons for this were two, viz., (a) An effective three post base could not have been established short of this line, (b) It was not possible to lay and maintain fresh telephone lines for sending information back, and this high ground offered facilities for visual signalling to the existing O.P's, one of which was retained for use as a transmitting station - from here the information was passed on by telephone as required.

A reconnaissance on the 20th March enabled an advanced H.Q. to be selected at AIZECOURT-LE-HAUT and on the following day this was occupied by reduced detachments for three O.P's and H.Q. Two O.P's were established in trees and wired laterally to H.Q., on the 22nd March - the Northern O.P. being on the Eastern edge of EPINETTE WOOD, then held by our outposts and giving view of LIERAMONT, which was in the enemy's hands and used as an observation point. The Southern O.P. was on the NURLU-PERONNE Road, about 1,500 yards South of EPINETTE WOOD. A third O.P. was established two days later in TINCOURT WOOD. No actual locations were obtained by these



three posts, but a number of flashes were seen and a fairly accurate estimate of the nature and disposition of the enemy's artillery was obtained. Daily reports were sent through each evening, by visual signalling and telephone, to Company H.Q. The personnel of the Group benefited greatly from their first experience of getting into action without any outside assistance and were very keen for their next tasks.

A further move of the Group would have been of little use until we had cleared the villages just West of LEMPIERE-GOUZEAUCOURT RIDGE, which was the next observation base. Touch was kept with the situation and the village of VILLERS-FAUCON ( two miles West of EPEHY ), having been cleared of the enemy, was occupied as H.Q. on the 1st of April. The village of EPEHY was cleared of the enemy on the 4th of April and held as an outpost. On the night of the 6th of April a detachment set out for EPEHY to establish an O.P. but lost their way, and encountered a considerable amount of shell-fire. They set out again next night and succeeding in establishing an O.P. despite the fact that they were harassed by shell-fire intermittently during the night. The telephone line was laid on the way out from Group H.Q. and the post was able to start work straight away. A second post was established next night without incident about 1000 yards North of EPEHY, in an exposed position. Both of these posts were in close range view of the enemy who was only from 400 to 600 yards away. A third post was started at MALASSISE FARM 1500 yards South of EPEHY on the 9th of April. A staging was to be erected against one of the walls and a slot cut in the wall. Before this could be completed the wall was knocked down by shell-fire. Another wall was selected for the O.P. and the approach was to be by tunnel from an existing cellar. The detachment had almost completed the tunnel when heavy shelling by a 6 inch Gun again started and lasted for several hours. This knocked down the second wall and did considerable damage to the Farm, blowing in an unoccupied cellar, adjacent to the one in which the detachment were sheltering. When the shelling ceased the N.C.O. in charge went out in search of the end of his telephone line and reported what had happened. He suggested the withdrawal of the detachment for the night owing to their trying experience. This was done. Next morning the same N.C.O. asked for permission to reconnoitre for a new O.P. and having found a place he set off the same evening with his detachment and established an O.P. in open country within 500 yards of the enemy and in front of our own outposts.

Three O.P.'s were now working, and it became necessary to get the remaining men and stores up from the rear H.Q. before a fourth O.P. could be established.

During these moves one Officer and a considerable number of men had to be left behind to look after heavy stores and ensure that rations and water were sent up to the front. The transport available was five Maltese Carts. As soon as the extra personnel and stores had been brought up a fourth post was established on the high ground West of VILLERS-GUISLAIN, towards the end of April.

Enemy artillery activity at this period consisted chiefly of night harassing fire by H.V. Guns on communications and bursts of Field Gun fire on forward areas. A number of these guns were located. The personnel of the three Southern Posts lived at group H.Q. and reliefs for 12 or 24 hours duty were sent up to the posts in rotation. The fourth Post's detachment lived in a bivouac near their post. These Posts could not be approached by day without being seen, and all reliefs took place before dawn or after dusk.

After the fourth post had been established the Group was required to cover an additional frontage of 3000 to 4000 yards to the North. This was done by moving the post just north of EPEHY on to the high ground 500 yards South of GOUZEAUCOURT, and establishing a fifth post on the end of the spur running North from GOUZEAUCOURT. This gave a five post base of about 10,000 yards with the posts practically in a straight line.

The Group H.Q. moved to GENIL-WELL COPSE, about 600 yards behind the centre O.P. and the transport lines into a sunken road about three quarters of a mile to the South of the Copse.

The enemy retreat had now come to a standstill and the conditions behind our own front improved. Roads were repaired and supplies of water and rations became easier to obtain. During the enemy retirement all telephone lines to O.P.'s were of single cable with earth return, for reasons of mobility.

D III phones were used both at H.Q. and posts and synchronisation was effected by a system of short buzzes. In the office two phones were used; one was connected to three O.P.'s and the other to two O.P.'s necessitating the employment of two telephonists in the office. Corps Signals gave no assistance in the way of labour or material until six weeks after the retirement had begun. They then relaid about half of the lines with twin cable and provided the cable for the remainder, which was laid by the Group.

The country hereabouts is undulating which, with a number of woods, provided battery positions with excellent flash cover by day; consequently a proportion of enemy batteries could not be located visually by day. This fact was apparently known to the enemy who rarely fired with these batteries by night, whilst keeping them busy by day. It was noticed that although these batteries could not be seen they could be heard quite clearly and a system of location by sound bearings with intervals was adopted to meet the case, approximate corrections being made for estimated wind and temperature. The method adopted was as follows:- On hearing a gun report the observer buzzed on his telephone and reported - "A" Post, "Rough sound bearing 60 degrees, probably a 15cm How." This bearing would be set off on the chart by "string" and the possible positions of the battery estimated from a layered map. The other posts were given bearings covering five to ten degrees of this area and each observer then set his instrument near the centre of the bearing - as given to him and kept the area under observation in addition to listening for the gun report. On seeing a flash or hearing a gun report from this direction the observer sent a buzz to Group H.Q. The times at which buzzes were sent from O.P.'s were recorded in the Group office and 30 seconds after the first buzz all posts were asked for their bearings, as with a 10,000 yards base any given sound must reach all posts within 30 seconds of the time it reached the first post. The bearings were classified by the observers as rough sound bearings or otherwise and were laid off by strings on the chart. After a little practice it could be seen at once whether all the posts had heard the same gun or not. The first rough location usually placed the gun in a 1500 yards square. Two or three more locations were obtained, the observers improving their bearings on each occasion if possible and reclassifying them accordingly. In the case of howitzers many locations were obtained within 200 yards of the battery position and there were very few more than 500 yards in error. With guns, due to "onde-de-choc"; the errors were much larger and varied from 500 to 2000 yards and the error was always minus. The location was usually in the line of fire- ascertained from the area shelled and location obtained - and a careful study of the ground from 1000 to 20000 yards along this line enabled a fairly accurate estimate of the actual position to be made. As a check the time intervals between the various buzzes should be proportional to the differences in range between the various O.P.'s and the target. If not, the location would not be accepted as reliable.

The construction of O.P.'s could not be carried out by day and experiments were made to see if O.P.'s could be constructed in one night. The type of O.P. experimented with was "L" shaped and consisted of a short trench about twelve feet long at right angles to the line of fire with an opening at one end about four feet square for the observer. A completely closed-in box of 1 inch or 1½ inch timber about 3½ feet square and seven feet high with a door in one side and an observing slot, was prepared at Group H.Q. The whole of this material could be carried on two Maltese Carts, and was taken to the site for the O.P. at dusk. The O.P. detachment marked out the ground for digging and a border of canvas was put down all round this to prevent discoloration of the ground. Improvised stretchers were employed to remove the excavated earth and these were laid on the ground close to the men digging so that the earth could be shovelled direct on to the stretchers and carried away. The amount of earth excavated was about 370 cubic feet and by employing the men in reliefs (two digging at a time) this could usually be excavated in seven hours. The O.P. box was then lifted into position and the revetting of the trench proceeded with. This operation - with all the timber prepared - could usually be completed in from 2 to 3 hours. The canvas protecting the ground in the vicinity of the O.P. was removed and the grass brushed up. Camouflage was now placed over the O.P. which only required the instrument, telephone etc; to be ready for use. Three of the five O.P.'s were established in this manner each in one night.

At the end of June 1917 a detachment of fifteen N.C.O.'s and men was sent to NIEUPORT to form the nucleus of a new Group. A Group H.Q. was selected about mid-way between NIEUPORT and WULPEN in a brick factory on the main road, and O.P.'s were established at GROOT NORDHOF FARM, RAMSCAPPELLE chimney, and at Group H.Q. Personnel to complete establishment arrived gradually from other Field Survey Battalions and the Depot Field Survey Company. The Group started work about the fourth of July with three O.P.'s and about 30 men. On the evening of the 9th July one new long range gun, about 28 cm was located which registered on the village of WULPEN and a previously unlocated 13 cm gun registered on Group H.Q. These registrations were explained on the

following morning when the enemy opened out a most intense bombardment which lasted about eleven hours, sixteen new batteries were located although each O.P. and the Group H.Q. were shelled at one time or another during the day. Telephonic communication with Counter-Battery was maintained until mid-day when the lines were cut; afterwards information of importance was sent by D.R. No locations were obtained from other sources during this battle. About this time additional personnel became available and the number of O.P.'s increased to five, the Southern O.P. being on the NIEUPORT-PERVYSE ROAD about a mile north of the latter town. Enemy artillery continued very active for some time after the YSER battle and an average of about 25 different batteries were located each day, a large proportion of these batteries was located four or five times during the twenty-four hours.

Excellent facilities existed for ranging our own batteries. To take advantage of these without interfering with battery locating a second observation instrument and telephone were installed at four of the O.P.'s and duplicate telephone lines laid, which were connected to a second flash and buzzer board at Group H.Q. The personnel required for ranging consisted of two observers per instrument, one office telephonist and one N.C.O. for plotting. This arrangement proved satisfactory and a large number of calibrations, registrations and destructive shoots were carried out by the Siege Artillery with three or four line observation by the Group. During periods of enemy activity when ranging was not being carried out, the ranging instruments were used for battery locating and on many occasions two enemy batteries were located simultaneously. Two of the O.P.'s and Group H.Q. were subjected to periodical shelling - one of these O.P.'s was destroyed on two occasions and on each occasion a new O.P. was established in the same building within twenty four hours by the detachment. The casualties during four months were six men wounded and were very light compared with the volume of shell-fire. During this period the Corps H.A. formed a ranging group of three O.P.'s on similar lines to the Group, the personnel being attached to the Group for a short period of instruction. Covering the four months July to October the average number of locations was fourteen per day. In clear weather the average was twenty per day and in misty weather about six. On no occasion was there a Nil report.

About the month of August 1917 all Groups were re-numbered and the Group changed from No. 2 Group 4th Field Survey Company to No. 6 Observation Group. In November the Group supplied a detachment of one officer and six other ranks as a nucleus for an Experimental Ranging Section on Salisbury Plain. This section was successful and the personnel re-joined the Group in March 1918.

The Group moved into 2nd Army area towards the end of 1917 and went into action in the YPRES Salient between FREZENBERG and PILKEM, with the Group H.Q. at MOUSETRAP FARM. The prevailing misty weather and comparative inactivity of the enemy's artillery resulted in few locations being obtained. The Group remained here during our withdrawal from PASSCHENDAELE consequent on the German offensive on the LYS, only withdrawing the post at FREZENBERG which was well outside the new line to be held by us.

About the 20th of April the Group was ordered to the HAZEBROUCK front where the German LYS offensive had come to a standstill at METEREN and STRAZEELE. A Group H.Q. was established at BORRE and O.P.'s in NIEPPE FORREST, BORRE, N.W. of PRADELLES, CAESTRE MILL and COQ-DE-PAILLE. This was fresh country for enemy batteries and no locations had been obtained when the Group arrived neither were photographs available. Locations were obtained from the outset and the positions for the greater part of the enemy's batteries were soon available for the information of the Heavy Artillery. The majority of these locations were subsequently confirmed when Sound Rangers got into action and photographs became available. Due to persistent gas shelling, the O.P. in NIEPPE FOREST had to be abandoned, the detachment suffering heavily in morale in addition to two gas casualties. It was deemed advisable not to withdraw the post detachment without making an effort to shew them that the post could be manned by a determined detachment and one or two changes were made in the personnel to this end. The new N.C.O. i/c established a new O.P. a short distance from the old one and manned it. His personal example of cheerfulness, energy and courage had the desired effect and in a very short time the detachment had recovered their morale. The O.P. had not as good a view as was desirable and it was subsequently moved to GRAND-SEC-BOIS where it was successful.

The command of the Group was changed twice about this time ( May 1918 ) and about 25 N.C.O.'s and men transferred to other Groups.

A continuation of the German offensive towards HAZEBROUCK appeared imminent in June 1918 and the post at GRAND-SEC-BOIS and Group H.Q. were moved to S. HAZEBROUCK Church and the vicinity of ST. SYLVESTRE CAPPEL respectively. The post near PRADELLES was transferred to MONT-DES-CATS. The Group remained in action here until the end of August when the Germans began their withdrawal. The Group was at once organised on a mobile basis and followed up the withdrawal. The stand made by the Germans at ARMENTIERES in September enabled the Group to get into action with O.P's on KEMMEL, NEUVE EGLISE, CRUCIFIX CORNER and MONT-DE-LILLE with Group H.Q. near RAVELSBERG and a considerable number of locations were obtained. The Germans then moved rapidly towards the SCHELDT about the 15th of October and were again followed up, the Group finally getting into action about 1 mile West of BOTTIGNIES, with four O.P's from COYGHEM to ST. LEGER and remaining in action here until the signing of the Armistice. They were then affiliated to the Canadian Corps and marched to the Rhine with the Army of Occupation arriving at WAHN about the 17th of December. The total casualties were one man killed and about twelve men wounded.

The following principles were observed in the Group, and were found to be beneficial:-

1. Group HQ was established as near the centre of the base as possible. This reduced the amount of cable required to a minimum and made line maintenance easy.
2. NCO's and men were brought to Group HQ in rotation for instruction and testing. This was of value as the OC got to know every man's ability and the men improved as observers. Promising men were selected for training in the Group Office.
3. OP's, especially those in exposed positions, were visited regularly and frequently and every thing possible done to ensure that the men were clean and comfortable.
4. With the exception of the first Group HQ and two OP's the whole of the work of establishing H.Q. and O.P's was done by the personnel of the Group. Experience shewed that a large amount of material could be had for the salving if moves were made rapidly. A great saving of time was effected by adopting this policy.
5. All the NCO's and men employed in the office were taught how to prepare charts for plotting purposes. Most of the charts use by the Group were prepared by the Office N.C.O.'s. This rendered the Group independent of the Battalion Artillery Board Section.

## PART V.

### OBSERVATION

#### Section (a). Work of Observation Groups and Calibration Section

### APPENDIX "D"

COPIES OF ORDERS ISSUED TO GROUPS AND SECTIONS by O.C., 4th FIELD SURVEY  
BATTALION, R.E.

NOTES ON THE OBJECTS TO BE ATTAINED BY OBSERVATION GROUPS AND SOUND  
RANGING SECTIONS AND GENERAL PRINCIPLES ON WHICH WORK SHOULD BE  
CARRIED OUT.

1. The principle duty of the Survey Observation Section is the location and reporting of targets for our artillery.

3. The increasing strength of Artillery is forcing and will continue to force Counter-Bombardment work more and more into prominence and as a consequence that portion of the work which deals with this, that is the location of Hostile Batteries and direction of fire onto them, is assuming greater and greater importance, and our organisation must consequently be framed primarily to deal with this problem.

3. The various means of location available are four in number :

- (i) The R.F.C. and Balloon Observer.
- (ii) The air photograph.
- (iii) Flash intersection.
- (iv) Sound Ranging.

The best results will naturally be attained when there is close and intimate co-operation between these four agencies.

4. In each Corps there is an Officer, the C.B.S.O., specially charged with the work of engaging hostile artillery; he is assisted by an Intelligence Officer, whose duty is to collect information, from all

available sources, as to the number and position, etc., of hostile batteries. The engaging of hostile artillery takes three forms

- (a) Destructive shoots designed to destroy "material".
- (b) Neutralizing fire, intended to temporarily check the hostile fire.
- (c) Sudden short concentrations, or "Crashes".

(a) is usually carried out by means of observed pre-arranged shoots, with H.E. shell from a Heavy Howitzer.

(b) will normally be carried out either to put a stop to hostile fire which is inflicting damage on us, while a particular operation is in progress. It may be carried out with either H.E., Shrapnel, or Gas Shell.

(c) is usually unobserved fire, shooting by map alone, to destroy personnel.

5. A little consideration will show that the requirements of the R.A. to enable them to carry out these duties are different in each case.

For (a), it is sufficient that the position of the guns is exactly located, and established with certitude. We have to aim at ensuring that we know for certain that the target is at a certain point, so that our shells may be directed on that point till it is destroyed. Accuracy of location and certainty, rather than speed, are of prime importance.

For (b), if we assume that our knowledge of the hostile artillery dispositions is reasonably good, the majority of the fire directed on our lines will come from "known" positions, and their speedy identification becomes the prime factor.

For (c), since the shells will be spread over a certain area, certainty of occupation is more important than precise location.

6. A consideration of the above indicates that we have three objects in view :-

- (i) The accurate location of enemy batteries as soon as they open fire in a new position.
- (ii) Repeated location or identification of enemy batteries in known positions to enable us to keep records of which of many known positions are occupied and in use.
- (iii) The speedy identification and reporting of positions when the guns in them are firing.

7. To consider now the application of the agencies enumerated in para 3 to these ends.

The R.F.C. Observer is always faced with the difficulty of accurately transferring, without any instruments the position of a flash, as seen on the ground, to the map. He therefore cannot greatly assist in (i). He is useful, however, for (ii) and (iii) when visibility conditions permit of his working.

The air photograph is particularly good for (i), but is of little use for (ii), and no use at all for (iii).

Flash Observation groups are useful for all three when visibility permits.

Sound Ranging Sections are particularly good for (ii), but for (i) and (iii) they suffer from the disability that the record takes a certain time to compute, and that the order of accuracy of the result is commonly low, and it requires supplementing.

The order of importance of neutralizing or destructive shoots cannot be laid down. Accurate location must naturally be the basis of all work, but as soon as the majority of enemy positions has been satisfactorily located, it is probably better to direct our activities to speed in identifying and reporting known batteries first, and then to spend time in searching for and locating new positions.

9. I consider that on most of the front we can claim that this state of affairs should exist. If it does not, a short spell of weather favourable for Sound Ranging and photography will quickly show it up, and Groups and Sections should therefore pay special attention to speed in obtaining and reporting results.

The following system has been found in the past to give good results, and will be followed as closely as circumstances permit.

All photographs, as soon as possible after they are taken, are sent to the Field Survey Company H.Q., and there examined by the Compilation Officer, who measures the co-ordinates of all suspected positions seen on them. These are compared with positions known or already reported by the various agencies, and such as are definitely established as occupied are incorporated in battery lists and maps.

Other suspected positions will be notified in the daily Company Summary.

Each Group should keep a chart or board showing the grid and the plotted positions of their Survey Posts, with an arc for each. These arcs should be drawn in different colour for each post. At the position of each post a pin should be carefully stuck into the chart, or a small hole drilled. Attached to, or passing through each, is a fine thread with a weight at the end for rapidly laying off bearings seen from the posts. On this board should be carefully plotted all the known or suspected enemy positions. This board should be renewed from time to time as the paper on it gets worn or dirty.

The concentration on a flash is carried out by means of the threads as follows :-

As soon as any Post sees a flash the Observer calls out "Flash", pressing his button. He should lay his instrument on it as accurately as possible, and call out the reading. The telephonist should send this to H.Q. at once. As soon as the Observer gets it in the glass, the angle is read again and telephoned to H.Q. The telephonist at H.Q., on seeing the lamp on the flash and buzzer light up, calls out "Flash" followed by the name, letter, or number of the Post. - "Flash Beer", for example.

The Officer or N.C.O. working the board at once lays out this angle with a fine thread or straight-edge - the former is probably quicker. He observes which, if any, of the known positions already plotted on the chart the ray intersects, and by means of other strings, or with the straight-edge, he measures the angle from other Posts to these positions.

If there are two possible positions, one of the other posts should be directed on to each. The angle should be given to the nearest degree or half degree, the instrument set at this, and the observer told to "look in the glass". The setting at exact degrees facilitates working out the exact angle, and speeds up accurate reporting.

The next round should indicate, by two lamps lighting together, whether one of the two is active. All Posts should then be concentrated on this, and after the next round the result reported. Subsequently one or two more rounds should be taken, and then information demanded from the posts as to the number of guns firing, exact angles, and the area shelled. One post should be detailed to report when fire has ceased. The cessation of fire should be reported to the C.B. Office.

It is evident for this to work well, that observers must be trained to read angles and set their instruments quickly.

The telephonist at H.Q. on the flash and buzzer should concentrate his attention on it, calling out as the lamps show - "Flash A, B, and C", or as the case may be.

The man working the board must be practised in manipulating the string quickly and giving his instructions clearly and concisely to the telephonist, thus : "A post, 27 degrees in the glass," "B post, 48 degrees in the glass", and so on.

After two rounds, if no post except the leader has seen the flash, the buzzer circuit must be switched in and each post given an arc of about 5 degrees to watch. The result, if any is obtained, will have to be plotted by means of the straight-edge. Angles to each piece firing must be obtained, care being taken that truly synchronous observations are plotted together, so that the bearing from one post to No. 1 gun is not co-ordinated with bearings from other posts to No. 2 gun, or any other, gun. These bearings should be plotted on the board by means of the straight-edge. When the position has been satisfactorily established, the position should be inked up and the rays rubbed out.

To work this system properly it will usually be necessary to have one Officer or man always on duty to work the board, and one man to work the telephone. In busy times, it will generally be necessary to have a third man to work the telephone to the C.B. Office.

The new establishment will, I hope, provide sufficient personnel for this : At least three trained N.C.Os for working the plotting board are required at H.Q. The concentration of posts on a flash should never be left to the telephonist alone. N.C.Os and promising men from posts should be brought to H.Q. in rotation and thoroughly trained in these methods.

Times should not be recorded in the post unless the flash and buzzer board fails: the observer, at each flash calls out "Flash 10 Left", "Flash 5 Right", etc. This is taken down by the telephonist on Form C \* and sent down to H.Q. as stated, and when asked for. Each Flash should be numbered both at post and H.Q. ( on Form D \*), since the third flash seen by one post may be the first seen by another , and it is important to be able to say which are synchronous. The telephonist on the post should work out the corrected bearings. These can be checked, if necessary, at H.Q.

As soon as the battery has been reported to the C.B. Office and the Centre, it should be entered up on the daily report for H.Q. Locations should be numbered serially.

Orders regarding Daily Reports to H.Q. have already been issued. The following records, etc., should be maintained in the Group:

- |       |   |               |
|-------|---|---------------|
| (i)   | Office copy of Daily Report of Hostile Battery locations: | Form A.       |
| (ii)  | Office copy of Daily Telephone Communication form         | Form B.       |
| (iii) | Company Daily Summaries.                                  |               |
| (iv)  | "Record of Observations" for the various posts and H.Q.   | Forms C and D |
| (v)   | Crime sheet of Hostile Batteries ( in book form )         | Form E        |

\* Specimens of these forms, partially filled in, are attached. The columns for "Round" are filled in at H.Q. as the lamps show.

The columns for "Graticule" and "Corrected Bearing" are filled in whenever time permits between rounds, or at the conclusion of the concentration.

Form A is made out from Form D of which it is an abstract, omitting the first part of the concentration". Only the bearings actually constituting the Intersection should be included on Form A.

As regards Sound Ranging Sections, efforts are being made, by formation of Wind Sections, use of automatic developers and increase of compiling staff , to improve both the speed and the accuracy of the results. In any case, however, considerable time may often have to be spent on working out films before results are sent in, and it will hardly be practicable to always rely on S.R. identifications for neutralizing purposes. Sound Ranging is particularly valuable for the location of new positions. The accuracy of the result obtained by Sound, however, can seldom be guaranteed within the limits required, and it is important therefore, to confirm the result as soon as possible, either by photo or by flash intersection.

Speaking generally, it is desirable to obtain simultaneous locations by Flash and Sound whenever atmospheric conditions permit. When a Sound Ranging Section gets a location on a new position a rough co-ordinate should be sent through as soon as possible to the Group for verification.

S.R. Sections should have the positions of all posts overlooking the area they deal with plotted on their boards, and should make a practice of always attempting to get visual confirmation of their results. A single visual ray co-ordinated with results from sound may give valuable information as to the cause of error in a doubtful location.

Observation groups should invariably give all the assistance they can in this way. Survey Post observers should gradually be trained whenever possible to act as S.R. A.P.Os. Sound Ranging Sections and Observation Groups should generally make themselves acquainted with each other's work and pay great attention to mutual co-operation.



12th January 1918

4th Field Survey Company, R.E.

PART V.

OBSERVATION.

Section (b) Sound Ranging.

## SOUND RANGING

### 4th Field Survey Battalion R.E.

The first Sound Ranging Sections allotted to the 4th Field Survey Battalion were "S" and "R" Sections. These were equipped with Bull apparatus in a specially fitted lorry, and Driencourt microphones. The first section to arrive was "S" Section under the command of Lieut. (now Major) A.H. Atkins, R.G.A. This section arrived in March 1916; "R" Section under Lieut. T.G. Hodgkinson, R.F.A. shortly afterwards.

The frontage to be covered by each Section was selected by the R.A. 4th Army. After consultation with them arrangements were made to install "S" Section on the South side of the LA BOISELLE-FRICOURT Salient and a base was surveyed between BILLON WOOD and the BRAY-ALBERT road about 1500 yards from the enemy front line.

The microphone lines were laid by the 4th Army Signals, bare copper airline being used, after which all maintenance was done by the section. The surveys and lines took about two months to complete and the section was not in action till May. "R" Section was installed with H.Q. at COURCELLES AU BOIS, and a microphone line facing due East was laid out and surveyed by Lieut. Hodgkinson just behind COLINCAMPS SUCRERIE. On these Bases both sections located a number of batteries previous to the commencement of the Somme Battle.

After the preliminary bombardment for the battle commenced no locations were possible owing to the impossibility of maintaining the lines and the continual noise. As soon as the advance permitted, "S"

Section moved up to MANSELL COPSE, and two bases were laid down from this H.Q. though for the same reasons no results were obtained.

“R” Section was transferred to 5th Army on the 19th of July on formation of the 5th Field Survey Company.

In October 1916, “S” Section moved from MANSELL COPSE up to BAZENTIN LE GRAND into a dug-out built for it by the R.E., the apparatus being removed from the lorry and set up in the dug-out. The base laid out extended from MARTINPUICH to GINCHY TELEGRAPH. On this base, thanks to Tucker Microphone which had now been introduced, a large number of locations were obtained, in spite of the considerable difficulty which was experienced in maintaining the line and the frequent interruptions.

In November 1916, other sections were formed, and three new sections “G” “H” and “K” were posted to the 4th Field Survey Company “H” Section was installed at BAZENTIN with a view to relieving “S” Section which was ordered to move to the MAUREPAS-SOMME front, while “G” and “K” Sections were detailed to work South of the SOMME. Great difficulty was experienced in obtaining H.Q. for all these sections. All buildings were destroyed and no labour could be obtained to build dug-outs or huts, and it was not till February that “S” Section could be moved. They then took up a H.Q. at LE FORET but before the base had been completed the enemy commenced his retreat to the Hindenburg Line.

“K” Section arrived in January and commenced to build a H.Q. at DOMPIERRE: this was just completed when the enemy commenced to retreat.

No attempt was made immediately to follow up our advance. All sections collected their wire and stood fast “K” Section carried out a small amount of “Screen Calibration” for the 1st Division.

As soon as the German resistance stiffened in front of the Hindenburg Line all sections moved forward and took up H.Q. as follows :-

“S” Section near GOUZEACOURT with a base from HAVRINCOURT WOOD to VILLERS GUISLAN.

“K” Section between ROISEL and HARGICOURT with a base from EPEHY to LE VERGUIER.

“G” Section at MARTEVILLE with a base from LE VERGUIER to HOLNON.

All sections were installed by the beginning of May and succeeded in making a number of locations. In May the front south of the OMIGNON was taken over by the French and “G” Section H.Q. was moved to MONTIGNY FARM, its base being moved slightly northwards.

In July 1917 when the Fourth Army was moved to the coast, “S” Section accompanied the 4th Field Survey Company its base being taken over by “P” Section ( Capt. Peach ) the other two sections were left “in situ” and handed over to Third Army. “S” Section came into action behind NIEUPORT. On this occasion all lines were laid by the section, using S.11 cable. To assist in laying and maintenance about 20 linesmen were permanently attached to the section by the XV Corps H.A. and but for this assistance it would have been impossible in this much-shelled sector to keep the section in action. Thanks to this assistance the section was only out of action during the heaviest bombardments and effected a great number of locations, as many as 60 being obtained within 24 hours.

Much useful work was also done in establishing “shelling connections” and calibres of hostile pieces.

In December 1917 the section followed the Fourth Army to the YPRES Sector relieving “R” Section behind LANGEMARCK.

In November 1917 the Fourth Army took over the front held by the Fifth and Second Armies and the 4th Field Survey Company took command of “A”, “B”, “Q”, “I”, “W” and “M” Sections while “R” Section was relieved by “S”. Three new sections were formed - “BB”, “FF”, and “GG”, nuclei being furnished by sections in the line. “B” Section was transferred to another Army early in December and “A” and “Q” Sections were relieved by “FF” and “BB” Sections respectively shortly afterwards.

“GG” Section was formed in January as a Wind Section. “A” and “Q” Sections were transferred to other Armies.

The front was a very active one and all sections were compelled to fix their bases at a considerable distance from the line. An attempt to establish “Q” Section east of the STEENBECK was unsuccessful in obtaining any locations and it was withdrawn. The sections were finally installed for the winter as follows :-

“S” Section	H.Q. Balls Farm.	Base from BIXSCHOOTE to ST. JULIEN.
“BB” Section	H.Q. Mouse Trap Farm.	Base from LANGEMARCK to FREZENBERG.
“I” Section	H.Q. Woodcote House.	Base from WIELTZE to ST. ELOI.
“FF” Section	H.Q. Ecole.	Base from WESTHOEK to ST. ELOI.
“W” Section	H.Q. SPANBROCKMOLEN.	Base MESSINES RIDGE.
“M” Section	H.Q. near LE ROMARIN.	Base from HILL 63 to ARMENTIERES.

All sections obtained many results from these bases throughout the Winter but the accuracy was often poor. During the Winter all sections were gradually brought into regular bases - usually 4.5seconds - 25 seconds radius.

The Wind Section was installed at POPERINGHE using a single line of Micros on a 240 degree arc of 9000 yards radius.

Early in 1918 orders were issued from the Army introducing a defensive policy and each section was allotted a reserve H.Q. and a reserve base covering the main Army Line of resistance.

In April 1918 the Lys Battle opened and “M” and “W” Sections at once had to retreat. Both sections were withdrawn forthwith to back areas where they were kept concentrated till the line stabilized.

The other sections went out of action successively and “FF” Section was broken up and used as reinforcements for other sections. Owing to the fact that none of the prearranged defensive lines were held, the reserve bases were of little use, but the earmarking of H.Q. in advance proved useful, as the greatest delay in getting a section into action was always caused by the difficulty in finding a H.Q.

“S” Section remained in action on various bases throughout the battle: all other sections were gradually withdrawn and re-instated as the line stabilised. All sections were able to get into action within three days of their getting into their H.Q. By May “S”, “I”, “BB”, “W” and “M” Sections were all in action again. “GG” Section was later installed in the Belgium area as an ordinary S.R. Section, special arrangements being made with Meteor for determining the Sound Ranging wind.

Sound Ranging bases of all sections were frequently changed, slight alterations in position and orientation being made from time to time so as to deal with particular groups of hostile artillery according to the tactical situation.

In September the enemy commenced to retreat from the LYS Salient and two (“M” and “W”) Sections went out of action. Both were installed again facing the enemy’s new line in front of MESSINES - ARMENTIERES.

On September 28th, the 4th battle of YPRES opened. Arrangements had to be made for two sections to move forward and get into action should the attack succeed. In point of fact the attack succeeded so well, and the depth of the advance was so great, that it was not possible in the condition of the roads to follow up at once. Each S.R. section on the battle front had been provided with two G.S. wagons from the Auxiliary H.T., and as soon as conditions permitted “S”, “BB” and “W” Sections were moved forward, “I”, “GG” and “M” being kept concentrated ready to relieve or “go through” these sections as required. Some difficulty was experienced in the surveys, and further assistance had to be given by H.A. in the matter of transport but all sections succeeded in locating a number of batteries and in at least one instance enabled the corps to carry out a comprehensive and effective neutralization programme during the course of the next attack. The same policy was followed up to the conclusion of the Armistice, i.e. no attempt was made to follow up an advance at once. After a successful attack each section reeled in its wire and sent forward an advance party to mark down a new H.Q. As soon as the enemy halted the section was moved forward and got into action 3000-5000 yards from his line. Regular bases 5 sec. 35 sec. radius being invariably used. Much useful work was done.

The following points connected with organisation etc. are worthy of record:-

In August 1917 "S" Section was provided with an R.F.C. wireless receiving set. The object of this was to enable hostile aeroplane wireless to be picked up and "shelling connections" and other information about his guns obtained. Some useful results were obtained in this way, but the greatest use of the set proved to be in picking up our own signals and verifying NF calls.

In this sector the ground was much cut up by shell fires and it was difficult, particularly in the Dune area for a plane to accurately "pin point" a flash. Attempts were therefore made to develop this co-operation between the plane and the S.R. section which was having difficulty in maintaining the line to the forward O.P. The plane on seeing a flash was directed to send by wireless a special call known as a "KK" call which was used by the S.R. Section in a similar way to the signal from its forward observer. A number of results were obtained in this way.

Attention was also devoted to developing the co-operation between the Group and the S.R. section. A direct line was laid between No. 6 Group and "S" Section and a man from the section was kept on duty in front of the flash and buzzer board. This man had a key working a relay in the section H.Q. so that as soon as a lamp showed on the board he could turn on the apparatus, ( conditions being favourable ). This was particularly useful for checking S.R. results and locating H.V. guns firing at long and irregular intervals.

A similar arrangement was made for co-operation with the Kite Balloons, from which useful results were also obtained.

As a result of these arrangements, when the Coy moved to the Ypres front all S.R. sections were provided with wireless sets and special attention was devoted to co-operation between groups and sections with the idea of obtaining simultaneous location by flash and sound. The results were not as good as might have been hoped but the necessity of working this up was fully established by an examination of the captured positions after 28th September, when strong evidence was obtained that the enemy had been successful in deceiving the groups with dummy flashes.

Few results were obtained from "KK" calls from aeroplanes, principally owing to the difficulty in getting pilots to send down the calls in a suitable way. "KK" calls were however, often successfully sent from balloons.

The section wireless was particularly valuable when the wind section was abolished. The special Meteor results were then sent out from A.H.Q. by wireless and picked up by all sections who thus received their results with the minimum delay.

As regards tactical employment : In November 1917 it was ruled by G.H.Q. that the tactical employment of Field Survey Battalion Observation Sections should be directed by the R.A. and the G.O.C., R.A. Fourth Army delegated his authority to G.O.C., R.A. of Corps. Orders were issued by the Army affiliating groups and sections to particular Corps.

Two artillery section commanders were appointed who lived close to the front and supervised the actual working of the units under them. These officers were invaluable during active operations when the line was in movement; they also greatly improved the co-operation between all units and the R.A.

Ranging was done occasionally by sound but there was considerable reluctance on the part of the R.A. to exploit this means to its full extent for fear of interfering with location work. Results however, when it was used, were very satisfactory.

In September 1918 to enable more ranging to be done a second base was laid out for "S" Section. This threw considerable strain on the linesmen of the section but good results were obtained and the section showed that on a quiet front at least it was possible to maintain two bases, using for work that which was most suitably oriented with regard to the wind at the time.

Some statistics of the results obtained by Observation Groups and Sound Ranging Sections of the 4th Field Survey Battalion. are given below :-

	Locations by Observation Groups. ( 6 Groups)	Locations by Sound Ranging Sections. (6 Sections)	Hours spent In observing shoots
December 1917	800	1500	
January 1918	342	1047	
February 1918	441	991	
March 1918	1017	2125	
April 1918	417	747	
May 1918	680	1094*	
June 1918	808	1005	163
July 1918	803	1112	348
August 1918	1002	1260	389
September 1918 ( enemy retirement )	1230	434	62
Totals	7540	11315	

\* No “approximate” locations of which there were many, are included in this figure.

The above figures give the total number of batteries located by Groups and Sections and not total locations: i.e., should a Group or Section obtain three locations on one battery during 24 hours, for statistical purposes, it is counted as one location only.

## PART V.

### OBSERVATION

#### Section (b) Sound Ranging.

### APPENDIX “A”

## STATISTICS OF RESULTS OBTAINED BY OBSERVATION GROUPS AND SOUND RANGING SECTIONS

OF THE  
FOURTH FIELD SURVEY BATTALION R.E.

LOCATIONS OF HOSTILE BATTERIES EFFECTED  
BY OBSERVATION GROUPS AND SOUND RANGING SECTIONS  
OF THE 4TH FIELD SURVEY BATTALION R.E.  
IN  
JANUARY, FEBRUARY AND MARCH 1918.

CONDITIONS.

Weather. Misty and unfavourable for visual, variable, average conditions for sound.  
Terrain. Unfavourable for four Groups ( YPRES Sector , Nos. 1,3,6, and 23 ).  
Average for one Group ( HOUTHULST Sector, No. 12 ).  
Favourable for two Groups ( MESINES Sector, Nos. 2 and 4 ).

Observation Groups.

	DEC.		JAN.				FEB.				MARCH			TOTALS
Week ending	31	7	14	21	28	4	11	18	25	4	11	18	25	
No. 1 Group	7	7	12	13	12	2	22	6	18	39	46	84	77	345
No. 2 Group	36	26	38	28	17	4	41	12	24	49	44	99	79	497
No. 3 Group	1	-	7	8	6	1	5	4	29	23	15	28	22	149
No. 4 Group	11	11	27	28	15	1	29	13	27	26	31	28	16	263
No. 6 Group	14	9	22	17	2	-	22	11	6	20	13	22	20	178
No. 12 Group	7	8	18	13	3	-	16	9	9	13	16	6	18	136
No. 23 Group *											8	14	22	
Totals weekly	76	61	124	107	55	8	135	55	113	170	165	275	246	1590
	76		347				311				856			

\* Came into action 16-3-1918.

Sound Ranging Sections

	DEC.		JAN.		FEB.		MARCH		TOTAL					
Week ending	31	7	14	21	28	4	11	18	25	4	11	18	25	
A. Section	17	27	-	2	30	37	5	106	8*	38	116	164	47	597
BB. Section	52	62	26	9	22	42	1	93	23	54	62	73	101	620
I. Section	117	108	5	33	91	166	18	141	11	62	151	194	111	1208
M. Section	68	51	6	19	24	26	8	45	26	13	95	88	56	525
S. Section	117	130	59	12	21	41	-	68	44	38	75	121	252	978
W. Section	98	72	6	28	29	71	9	86	22	35	70	86	86	698
Totals weekly	469	450	102	103	217	383	41	539	134	240	569	726	653	4626
	469		872				1097				2188			

- "A" Section relieved by "FF" Section.
- 

	DEC.		JAN.		FEB.		MARCH		TOT					
Total locations by	31	7	14	21	28	4	11	18	25	4	11	18	25	
Field Survey	545	511	226	210	272	391	176	594	247	410	734	100	899	6216
Battalion.												1		
Observation. Sects.	545		1219				1408				3044			

NOTE :- Locations claimed on "Single" bearings are not included in above figures.

The Commanding Officer  
4<sup>th</sup>. Field Survey Battalion, R.E.

BATTERY LOCATION STATISTICS FOR THE MONTH OF AUGUST, 1918 - 2<sup>ND</sup> ARMY.

<u>Observation</u>		<u>Sound Ranging</u>	
No 1 Group	104	S Section	440
No 3 Group	107	BB Section	566
No 6 Group	269	GG Section	210
No 7 Group	208	W Section	361
No 12 Group	127	I Section	192
No 23 Group	351	M Section	325
No 27 Group	18		
<u>Total</u>	<u>1184</u>	<u>Total</u>	<u>2094</u>

GRAND TOTALS

4th Field Survey Battalion	3278
Kite Balloon Sections	194
Royal Air Force	836

For the purposes of the above list, any report in which a co-ordinate is given, is regarded as a location.



In the consideration of these figures the following points are of significance :-

- (1). The month of August was one in which Stationary Warfare obtained. Visibility was fair. Conditions for Sound Ranging Sections were variable. Winds from the South-West were prevalent.
- (2). In the case of Sound Ranging, a location often represents the "mean" value of many findings.
- (3). In the case of Flash Spotting, results at a co-ordinate previously obtained on the same day, are reported as "again active" and do not, therefore, count as a location.
- (4). The majority of R.A.F. results are given in first figure co-ordinates only.
- (5). During the month a period of 389 hours was spent in ranging our artillery

1st., October, 1918

"G.A.G." Sergeant, R.E.,  
for Compilation Officer,  
"MAPS" Second Army.

NORTHERN AREA.

Nos. 1, 3, 12 Groups. I, BB, S Sections.

Date	Locations Flash	Locations Sound	Flash & Sound. Co-operation between	S.R. Sections.	Groups.
1-7-18	14	64	7	6	--
3-7-18	15	25	2	3	4
5-7-18	2	76	1	3	--
13-7-18	8	51	--	--	--
16-7-18	6	43	1	3	--
17-7-18	9	54	--	4	1
18-7-18	5	31	1	5	1
20-7-18	5	26	1	5	--
3-8-18	14	67	--	8	--
Totals	78	440	13	37	6

"GG" results not included but three results were obtained with this Section and No. 12 Group.

SOUTHERN AREA.

Nos. 6, 7, 23 Groups. M, W Sections.

1-7-18	16	8	2	--	2
3-7-18	15	5	--	--	6
5-7-18	14	7	1	--	--
13-7-18	61	5	1	--	6
16-7-18	13	10	2	--	5
17-7-18	17	9	1	--	1
18-7-18	34	14	1	--	2
20-7-18	34	2	1	--	6
3-8-18	21	23	2	1	1
<u>Totals</u>	<u>225</u>	<u>83</u>	<u>11</u>	<u>1</u>	<u>29</u>

PART V.

OBSERVATION

Section (c) Compilation of Results obtained.

COMPILATION SECTION.

4th. Field Survey Battalion R.E.

Period Feb. 1916 - March 1917.

Previous to the formation of the 4th F.S.C. plans for the system of compiling adopted by us had been devised and put into action by the Third Army. These may be briefly described thus. The preparation of numerous independent lists of hostile battery positions by independent and unqualified authorities had led to confusion and uncertainty in our information about hostile artillery dispositions and it was decided to make the F.S.C. the final authority.

All information about hostile artillery was to be collected, examined, and collated by it. When the O.C., F.S.C. was satisfied that a position was satisfactorily established, its exact position was determined and published in a periodical "Active Hostile Battery" List issued over the signature of the M.G.G.S. On this list were placed only those batteries which were considered to be satisfactorily located.

As well as this "Active Hostile Battery" List the Third Army published a list of all "Positions Determined" whether believed occupied or not.

On formation of the Fourth Army the system was continued with the exception that publication of a "Positions Determined" as a separate list was discontinued, the "Active Hostile Battery" List being divided into two parts, (1) Positions believed active (2) Positions believed unoccupied.

This list was published fortnightly and was discussed at a Counter Battery Conference at which representatives of the R.A., R.F.C. and F.S.C. took part.

To prepare this list and keep it up to date orders were issued that all information relating to hostile artillery should be sent to the F.S.C. A daily report was accordingly sent by the R.F.C. giving all

flashes seen during the day and arrangements were made for a daily written report to be sent by the F.S.C. Observation Section: these two being the principle sources of information. The Group reports gave the times and observed angles to any flashes seen and the co-ordinates of any intersections obtained.

These were re-plotted at H.Q. and compared against R.F.C. reports and against all available photos.

All this time photos were not issued in large numbers and copies were not available for batteries or for Corps H.A. In order therefore to keep the H.A. abreast of the times between publication of the A.H.B. Lists a daily summary was prepared by the F.S.C. embodying the results of the day's work.

This was divided into two parts :-

- (a) Batteries seen in action.
- (b) Positions or suspected positions seen on photos.

The summary gave as far as possible the co-ordinates, source of information, order of accuracy, time, date, calibre, area shelled and the reference of the latest photos.

Shortly before the commencement of the SOMME Battle the first Corps C.B. office was formed, Major Haig being appointed C.B.S.O. X Corps. This officer took up his H.Q. next door to No. 2 Observation Group, the old H.Q. of the Observation Section, and from the first made great use of the information supplied by it. Other Corps C.B. offices were established shortly afterwards and Counter Battery Meetings were held fortnightly at which the A.H.B. List was criticised. At one of these meetings one of the C.B.S. officers drew attention to the fact that the A.H.B. List was now so large that plotting each position by its co-ordinates took a great deal of time and suggested that it should be supplemented by a map. This led to publication of the first "Battery Map" shortly after the commencement of the SOMME Battle, each pit located being shown by a green dot. This map was prepared in the F.S.C. Compiling Office and printed on a hand press.

For sometime after its introduction the C.B. office had no means of plotting the positions of batteries from photos and the Field Survey Company was the only authority for the exact position of any located. The latter also did the interpretation of the photo as well; the results of their labours were incorporated in the periodical printed lists and in addition, as stated above, up to the end of 1916, the Compiling Section examined all photos as soon as they came in and published as an annex to the daily summary the co-ordinates of all suspected positions.

Throughout the greater part of the SOMME Battle facilities for observation were very poor, it being impossible to see over POZIERES Ridge from any part of our lines and the S.R. equipment was unable in those days to give locations during a battle. The majority of hostile batteries were therefore located in the first instance by the photo. When the Corps C.B. Offices were fully established one of their first actions was to take up the question of the interpretation of air photos and all were soon afterwards provided with proportional compasses to enable them to plot the positions seen on them. This was done not from any dissatisfaction with F.S.C. information but with a view to saving time lost by having to await the F.S.C. reports, and also to enable them to check forthwith any "NF" or other calls sent down from the air.

The rapid increase in the amount of air photography which occurred in 1916 would in any case have made it impossible for the F.S.C. to deal sufficiently quickly with the large number of photos received without a large increase of staff. It was obviously desirable therefore to assist the Corps to do this work themselves. All possible help was therefore given to the C.B.S.O.s many of whom modelled their system of indexing and compiling on the methods evolved by us. By the end of 1916 the Corps C.B. office was accepted as the final authority on "interpretation" of the photo, the F.S.C. the authority on the "plotting" from it.

This division of responsibility requires perhaps some further explanation. At this period camouflage of battery positions was in its infancy and it was almost always possible to detect them on photos as soon as they came into action. Till the battery was actually seen in action however ( as it was known that alternative positions were being constructed ) it was always doubtful if the guns were in position and it was a matter of judgement and opinion to say whether it was worth engaging as a target. Again after the position had been located and seen active it might be abandoned, so that the Artillery Intelligence divided itself into two distinct branches (a) The initial location of battery positions. (b) The inquiry into their occupation and continued activity after they had once been located. This second aspect (b)

was that which the C.B. Office took up from the start as they insisted on being the deciding authority as to whether the position should be engaged or not. Subsequently they gradually extended their activities to (a) also and are now the deciding authorities in both cases.

In addition to the above work the F.S.C. prepared up till about the middle of 1917 a fortnightly summary of Hostile Artillery activity for incorporation in the Army Intelligence Summary. From July 1917 onwards this was written by the Reconnaissance Officer R.A.

The Period March 1917 - July 1917 presented no special features beyond alteration in the symbols used on the battery map. The Zone Call System devised by the 5<sup>th</sup>. Army was adopted by G.H.Q. and the symbols used to distinguish heavy and field batteries standardized for use by all Armies. Compiling work ceased during the actual period of the German retreat, being resumed as soon as the HINDENBURG Line was reached.

Period July 1917 - Nov 1917.

This period calls for no special comment as no alterations were made in the system. The conditions for observation on the coast were specially good and our information in consequence more than usually complete. Owing to there being only one Corps in the line it was possible to maintain specially close relations with the C.B.S.O.

Period Nov. 1917 - April 1918.

In November 1917 the Fourth Army took over the YPRES Front and the number of Groups and Sections rose from 2 and 1 to 7 and 6 respectively. This large increase involved some modifications of the compilation procedure. Reports from the Groups which had hitherto been collected by our own transport had to be sent in by D.R.L.S. This involved serious delays and in December the Compiling Section was sent forward to LOCRE where the Second Army Observation Centre had been established. The practice of replottting all group observations was discontinued and only such locations as showed discrepancies "inter se" were thus treated. The annex to the daily summary was also discontinued. Increase in the volume of work necessitated a special typewriter being allocated to the Compiling Section.

Period April 1918 - September 1918.

The German attack on the LYS caused the Compiling Section to be moved back to CASSEL, where they occupied the former Battalion H.Q. No changes were made in the system.

September 1918 - Armistice.

This period saw the German retreat. Little or no compiling work was done, though the opportunity was taken to check some of the German Battery positions as found on the ground against the locations obtained.

Time did not permit of a very systematic check but a careful examination was carried out by the C.B.S.O. XV Corps of that Corps C.B. Area in the LYS Salient and the results embodied in a comprehensive report.

An examination on the same lines had been carried out after the first German retreat on the SOMME. Both examinations showed that in each case the great bulk of the hostile artillery had been accurately located. Copies of these reports are attached.

PART V.

OBSERVATION.

Section (c) Compilation of Results obtained.

APPENDIX "A".

Report by C.B.S.O., XV Corps on Examination of Positions on the LYS.

EXAMINATION OF HOSTILE BATTERY POSITIONS IN THE EVACUATED AREA ON THE  
LYS BY THE XV CORPS COUNTER BATTERY OFFICE, SEPTEMBER 1918.

In the four months that elapsed between the checking of the enemy's offensive on the Lys in April and the capture of the OUTERSTEENE ridge in the middle of August, the grouping of his battery positions, though always showing a steady backward tendency in detail, nevertheless covered more or less the same area continuously. During the interval between the taking of the ridge and the withdrawal at the end of the month a complete new set of positions appeared, against which, though probably many of them had been prepared as reserve positions considerably earlier, little or no previous activity had been recorded, and which had hitherto been well out of range to our guns. Our knowledge of these positions was naturally considerably less than of the older positions: and as they were active only for so short a time comparatively little destructive work upon them was possible.

There are therefore two more or less distinct sets of positions to be considered in the area; which fact complicates any detailed attempt to sum up our work.

But in addition to this complication the gradual but steady backward tendency of active battery positions already mentioned, which was probably due in the first instance to our destructive fire, assisted later by the steady advance of our line, involves a further difficulty. Broadly speaking, the development of our destructive fire during May denied the enemy the choice of any position for an active battery within approximately 4,000 yards of the front line; and thereafter each advance of our line necessitated a corresponding withdrawal of batteries to approximately the 4,000 yards line on his part. This process, apart from producing continuously a series of active positions beyond the reach of our fire, renders a detailed analysis impossible for two reasons; the older and more forward positions have in many cases been so long abandoned and so repeatedly destroyed as to be unrecognisable: and positions further back, which were originally occupied by heavy calibres, were later, as the line fell back, adopted ( in some cases with modifications ) by field pieces.

During this period of four and a half months no less than 532 different positions, nine-tenths of which were located active, were numbered by us in the Corps area. In addition about 100 positions have been reckoned as possible silent batteries and in many cases have been shot at for reconnoitring purposes, mainly with a view to the expected enemy attacks in June and July.

It was clearly impossible to examine in detail the whole of the ground and to test the accuracy of every location. Nor would it be possible, even if this were done, to produce a satisfactory analysis of the results, for the reasons given above. A total of 222 positions have been examined, covering the whole

area in which active batteries existed throughout the period of four and a half months; the older positions ( those occupied during May and June ) less thoroughly than the newer, as they were found to produce less evidence owing to the completeness of their destruction; but each period is well represented in the following tables.

The classifications given below are necessarily approximate only. The evidence is of course incomplete; in many cases where pits have been hit, it may be that the position had long been disused or was temporarily unoccupied; and it is not intended to indicate any definite conclusions regarding guns damaged or personnel affected, which can only be matters of opinion. Where a position has been literally shot to pieces it has not been possible to say whether the pits were correctly located and therefore whether they were hit; in some cases it is not possible to say whether the position ever existed; but every effort has been made to allow the enemy the benefit of the doubt.

1. ANALYSIS OF C.B. MAP ACCURACY

Total positions examined.	Pits correct in detail.	Position correct.	Position approx.	Doubtful	Wrong
222	59	94	8	25	36
	153				

In order to arrive at percentages, it is necessary first to deduct the doubtful positions from the total; this gives the following results :-

Correct in detail.	Position correct.	Position approximate.	Wrong.
30%	48%	4%	18%
78%			

NOTE : The classification is as follows :-

Positions are reckoned as correct in detail when the pits on the ground agree with what was at one time or another shown on the C.B. map. As will be seen later, owing to the enemy's method of constructing positions, this proportion is necessarily not very large.

Positions are reckoned as correct when it is clear that the guns fired from a point within the area indicated on the map.

Positions are reckoned as approximate when one or more guns of a battery fired from within the area shown on the map, but the whole battery was not correctly shown.

It is therefore the case that of the information shown on the C.B. map, 80% was at one time or another correct. It has already been noted ( in Part I ) that, in an individual case, the proportion of positions existing on a given date correctly shown was roughly 60%, and it would therefore not be unreasonable to infer that at least 50% of the positions engaged for destruction were actually occupied by batteries at the time when they were engaged. In view of the frequent moves of enemy batteries and the skilful and energetic ruses employed in order to mislead us, this conclusion may be regarded as satisfactory.



It is impossible to give any figures for the proportion of occupied positions which were altogether missed by us. In the course of visiting the 200 odd positions analysed above, not more than 20 positions, many of which were single pits only, have been discovered which were never shown on our maps. There must at one time or another have been a much larger proportion in the forward areas, but the destruction there is so complete and there is so much ammunition lying everywhere that it is hopeless to attempt an estimate.

## 2. RESULT OF OUR FIRE.

NOTE :- In compiling this table the 36 wrong positions have been ignored and the doubtful positions have been included.

Total posns examined	Number engaged for destruction	Positions with pit hit	Positions well engaged	Positions neutralised	Positions untouched
186	132	65	66	23	32
		-----			
		131			

These figures, which include details of a large number of the more distant and therefore less accessible positions, and so unquestionably represent the damage at its lowest, give the following percentages :-

Engaged for destruction.	Pits hit.	Well engaged.	Neutralised	Untouched
70%	35%	35%	13%	17%
	-----			
	70%			

NOTE :- The classification is as follows :-

Pits hit have been claimed only where there is evidence of a definite pit.

Positions classed as well engaged from those totally obliterated to those in which the pits are well bracketed, although intact

Positions are reckoned neutralised where there are shell holes in the position.

In 56 positions or 30% there is evidence of explosions of ammunition in the positions.

In less than a dozen cases what are probably portions of the gun or carriage have been found; but this small total was to be expected.

On the 132 positions engaged for destruction, 324 shoots were fired involving 51,541 rounds of ammunition.

The total number of rounds fired in C.B. destructive shoots from May to August inclusive was 117,000

## 3. ANALYSIS OF WRONG POSITIONS FROM TABLE 1.

Of the 36 wrong positions given in Table 1, 16 on examination proved to be dugouts only; in 11 cases there was no sign ( mainly owing to the effects of shell fire ); and in the remaining cases such objects as a small pioneer dump, gaps in a hedge, short pieces of trench work, or ammunition stacked in a hedge, had been mis-interpreted on photographs, in two cases at least over-subtly had been exercised ( both times in order to account for locations falling slightly away from a known position ) in the one, flash spotting locations falling all round a single 15 cm. gun were for a time credited to eight imaginary pits placed under a row of trees with a track beneath; the variation of the locations being due apparently to the fact that the gun generally fired at night. In the other case, a broken and withered tree which

produced an unusual shadow was mistaken for camouflage; and a position correctly shown was on the strength of this moved to a wrong place to account for one flash-spotting trisection.

Twelve of the above wrong positions have been analysed in detail, two were taken up on purely photographic evidence and never reported active; against the remaining ten activity had been recorded. Owing to the fact that the enemy both uses roving guns to a large degree and also employs for field guns temporary positions for which no platform is necessary and of which all traces quickly disappear, it is not possible to tabulate details satisfactorily. In six cases however, it is probable that an inaccurate location of a neighbouring position or a single gun firing on one occasion only was the cause: suspicious objects being found on the photograph - generally dug-outs - which agreed closely with the locations. In five cases it seems probable that the flash of a neighbouring battery not at the time shown on the C.B. map was credited to a wrong position by the R.A.F.; and in general it may be said that all the evidence goes to show that to use a C.B. map in the air is contrary to the interests of accuracy. In two cases only the amount of activity recorded and the agreement of co-ordinates given is not explicable, and it is clear that there must for a time have been guns somewhere in the immediate neighbourhood of what was shown on the map

In the absence of the facts necessary to complete a detailed analysis of the sources of error, it is only possible to set down as a matter of experience a summary of what has occurred in particular cases.

First it is clear that too much has been attempted in the way of accounting for every location received. Flash-spotting locations have been invaluable, and as a rule extraordinarily accurate; sound ranging locations have in the majority of cases proved to be under-valued, and for this very reason regarded too lightly. There are nevertheless two main causes of error which cause an unnecessary multiplication of positions. In the first place flashes at night tend to produce a multiplication of pin-points which give a false impression. Secondly, very small map errors, which involve a discrepancy between the location obtained from flash-spotting and the co-ordinate of the pit visible on a photograph, often lead to an undesirable multiplication of pits, and occasionally of positions, on the map. In both cases this is perhaps unavoidable, but on the whole it would seem that in fairly open country the photograph is the safest guide and that only in exceptional cases should it be necessary to extend a position on the map beyond the limits indicated on the photographs in order to account for locations.

It is not easy to classify R.A.F. locations. The practice of obtaining photographs marked by pilots after sending NF calls has been invaluable, and has in several cases cleared up positions in sheds, ruins, etc, which would otherwise have been approximate only. On the other hand an examination of the activity recorded against positions shows that either the practice of taking up a C.B. map into the air is a source of error so that the enemy is using dummy flashes on a large scale. As regards the co-ordinates sent down, their value clearly depends solely on the accuracy of the map used; and in the present case where the map has been re-drawn in April and the detail was on the whole very good, the co-ordinates sent down were unusually satisfactory.

In this sector owing to the excellent facilities for observation it was not necessary to show on the map positions taken purely from photographs unless they looked exceptionally promising, and the majority of those originally numbered on photographic evidence only ultimately became active. Two general statements may be safely made, first that in the great majority of cases it is not possible to identify battery positions with any certainty from photographic evidence only; secondly that in the summer at least, when photographs are plentiful, repeated locations can almost be accounted for accurately on photographs. It follows therefore that to look for silent positions as such on photographs is misleading; a more comprehensive study of all signs of activity under trees, behind hedges, in houses etc. and a complete system of registering and dealing with all such targets, without particularising, is obviously desirable.

#### 4. ANALYSIS OF LOCATIONS.

In order to arrive at some definite conclusion regarding the sources of information available for locating active batteries, the records of 46 positions included in Table 1 have been analysed in detail. The following tables are an attempt to summarize the results from both sides; but it is difficult to standardize them satisfactorily.

Located by                      Total Locations by

	Taken up from photo only, never located		Taken up from photo and afterwards located		O	S	A	B	O	S	A	B	Average life of posns in weeks	Calibre correct by S
Posns. correct in detail	15	3	3		11	5	11	-	54	15	30	-	5	3
Posns. correct	25	2	1		18	13	19	7	77	32	56	8	5	9
Posns. doubtful	6	-	4		5	1	6	3	14	1	7	5	7	2
Totals	46	5	8		34	19	36	10	45	49	93	13	6	14
Percentages		11	17		74	41	80	22						74

(NB. O = Obs Section, S = Sound Ranging Section, A = Aeroplane, B = Balloon)

The salient features of this table are as follows :-

1. The high percentage of observations made by aeroplane and by Obs. sections, which have confirmed one another to a remarkable extent.
2. The high percentage of accuracy in sound ranging estimates of calibre, as shown by the ammunition found in positions.
3. As regards the average life of positions, this has been reckoned from the date of first location to the last report. In the majority of cases it is clear that there were intervals of silence during which another position was probably occupied, but it is not possible to find a formula on which to calculate the average duration of each period. Further the majority of these positions were rather far back and so less liable to disturbance. In general it has been found that the average period of activity at one time is less than a fortnight.
4. The high total of Observation Section locations ( each position being located on the average more than 4 times ) shows the practical value of this source of information.

Points brought out in compiling the above tables are :-

1. The comparative worthlessness of all estimates of calibre except those given by sound ranging. In no cases have the latter been definitely proved wrong; and in the great majority of the cases they alone have given the right calibre. It is clear that much more attention should have been given to their reports, particularly in the case of 21 cm. howitzers. In future it would be desirable that the Obs. Sections written report should state whether in each particular case the estimated calibre given is based on the size of the flash, or of the burst; except in the case of 13 cm. guns or larger, no value attaches to the former. In addition a great deal more should be done in the way of identifying fragments of shell after a shoot.
2. The great accuracy of balloon locations. In four cases out of the 10 obtained, the co-ordinate agrees exactly with that obtained from photographs: in the remainder the error is very slight.

##### 5. ANALYSIS OF CALIBRES FROM AMMUNITION LEFT IN EVACUATED POSITIONS.

Of the 222 positions examined, 163 contained ammunition or empty cases sufficient to identify calibres. The following table gives details.

<u>77 gun</u>	<u>10.5 H.</u>	<u>15 H.</u>	<u>21 H.</u>	<u>10 G.</u>	<u>13 G.</u>	<u>15 G.</u>
56	42	47	28	25	3	2

In 34 cases more than one kind of ammunition was found.

The points here are :-

(1) The surprising amount of 21 cm. howitzer ammunition. No doubt this may be accounted for partly by the presence of roving sections reported in July by a prisoner. But from the dumps to be found in VIEUX BERQUIN, BAILLEUL, close to METEREN etc. it is clear that this weapon was intended to take a predominant part in the opening barrage of the great attack. There was never any ground for suspecting anything of this sort, though not enough attention was paid to sound rangers' reports of this calibre.

(2) The presence of mixed positions has been established, not only by the mixture of ammunition, which is explicable by other means, but also by the finding in a few cases of different sized pits obviously constructed for different natures of guns in the same position.

#### GENERAL.

There can be no question that, so far as concealment goes, the enemy places himself at a great disadvantage by having the majority of the dugouts for personnel actually among the gun pits and in many cases opening out from them. No pits with overhead cover have been discovered and it is clear that the ordinary type of lightly constructed pit camouflaged over is not distinguishable on a photograph from the ordinary dugout which indeed was hardly ever more than weatherproof, if that. Further it is clear that the commonest error of judgement in fixing positions from photographs has been to go for a hedge with signs of activity behind it in preference to anything else: whereas in several cases the dugouts and ammunition have been found in the hedge and the actual gunpits under trees ( fairly well scattered, particularly in orchards ) a few yards away. Even in these cases however the dugouts are so near the pits that for purposes of destruction the difference is hardly worth considering. But the earth thrown up in constructing dugouts and the slots in which ammunition was kept has given away innumerable positions.

A further mistake of the enemy's appears probable, though the inference here may be wrong. It seems to be taught as a principle that before constructing anything in the open it is safer to cut away growing crops than to leave them to be trodden down. The result in two particularly noticeable positions was to produce on the photograph a broad white strip in which both the pits and the smallest piles of ammunition could be readily detected. In two cases it appears to have been thought wise ( presumably to minimise blast mark ) to cut a patch of growing corn the shape of the blast mark in front of each pit: this produced an effect so brilliant that the positions were at first believed to be dummies. When however one of them was located the effect was supposed to be a blast mark due to abnormal activity, and continued activity was at one time credited by the French to this position, though in fact it was intended apparently as a reserve position and has never been much used.

The examination of camouflage in positions still existing confirms what has been suspected from photographs, that in most cases it was singularly unsuccessful in concealing the pits, and often achieved the opposite result. One case has been discovered in which it was completely successful - four pits in the open in a cornfield, of which no trace can be found on photographs. Other pits apparently exactly similar in construction in the same field are exceptionally conspicuous, but for some inexplicable reason this position was successful. It is certain that in the open, where the ground is at all badly cut up, a gun standing in a pit not covered over is infinitely harder to discover than the neat smooth surfaces of the camouflage netting. In a few cases, where straw has been worked into wire netting, dugouts have been well concealed but the flat and marshy ground made it impossible to sink gun pits deep enough to avoid raising camouflage above the ground level.

Although ( as appears from Part I ) the principle of the "working gun" placed away from the main position has been in force on this front, it is clear in most cases this gun would be placed in a position containing several pits, though in one case, the notice "Arbeits-Geschintz" ( working gun ) has been found besides a single isolated pit. As has been shewn, the number of positions was so great, and frequent change so necessary, that every suitable position was prepared sooner or later as a battery position. Although on the whole our map inclines to credit most positions with rather more pits than

they contained - owing to the impossibility of deciding between pits and dug-outs - it is clear that the number of pits in occupied positions was often greater than the number of guns in occupation. In conjunction with this it may be noted that 60% of the positions visited contained ammunition and while much of this may have been merely abandoned, it seems likely that, in the event of an attack, the bulk of the older positions and spare pits would have been utilised. In other words, it would have been possible for the enemy to find three or four hundred positions more or less prepared, without new construction, at any time during the last three months or so.

Common features of a great number of positions are : Tree O.P's actually in the Battery: a good deal of T.M. ammunition; and two or three open boxes of hand grenades.

A few cases of pits in houses have been discovered, but in every case the house has been knocked down over the pit; and as all the houses are more or less isolated ( except of course in BAILLEUL ) they were probably avoided as a rule. Many of the ruins however contain ammunition. The slope between BAILLEUL Square and the station was certainly prepared for battery positions in the event of an enemy attack: and a few locations were obtained here at one time or another: but no evidence of regular activity has been found here, presumably owing to the severity of our harassing fire.

### CONCLUSIONS.

In an area so effectively devastated it may seem presumptuous to claim any successes of detail. Even upon the vexed question as to the real value of destructive shoots not much evidence is available. It is clear from an examination of positions that the number of pits hit bears no direct relation to the number of destructive shoots fired: on the other hand that at least five-sixths of the positions engaged for destruction had been severely punished: that immense quantities of ammunition and apparently most of the dugouts, were rendered useless, but obviously the enemy gunners were not the only sufferers from this and it may be that their frequent changes of position and other ruses enabled them to reduce losses of personnel and material to a minimum. For all arms inevitably the discomforts of this sector must have been unusually severe; and evidence is not lacking of the effects of our harassing and bombardment fire in the innumerable wagons destroyed, the dead horses, the cover, both natural and artificial, almost completely obliterated, the ploughed up roads, the flooded state of many gun-pits and dug-outs ( due to the blocking of the natural channels ), the ammunition, wire and other stores scattered in every direction and obviously neglected. But the view is at least tenable that the greatest sufferers were the enemy gunners, and that their apparent inability to protect or support their infantry was not altogether according to plan.

### NOTES ON THE REPORT BY THE C.B.S.O. XV CORPS.

In considering this report in relation to the work of the F.S.B. only, it should be noted that many of the co-ordinates finally accepted for positions located, were decided by the C.B. Office, whose opinion in many cases did not agree with that of the Compiling Officer, the discrepancies being due to the "weight" given to different items of evidence when these did not agree inter se.

In many cases, the positions had been located from photos only, so that the conclusions derived from these have no bearing on F.S.B. methods.

The statement as to Sound Ranging results being "undervalued", means that owing to the comparative low order of accuracy claimed by the sections for their locations, the C.B. office did not give sufficient "weight" to the co-ordinates given.

In comparing balloon and R.A.F. results generally, the C.B.S.O. comments on the accuracy of Balloon locations. I think he has overlooked the fact that during this period, practically all Balloon reports

related to batteries seen in action which had already been located by other means. Very few new positions were located by the Balloons.

Attention should also be drawn to the fact that the figures give no indication of the total number of locations made by the various agencies. To exhibit this, a statistical table has been prepared of locations effected on the Army front in August. This month was very favourable for R.A.F. work; but included eighteen days when Sound Ranging was impossible. The figures given for aeroplanes include every location of whatever accuracy; a high proportion are "C" accuracy only.

The figures given for the F.S.Bn include only P, Q, and R accuracy locations, and omit a great number of approximate or "S" results. They do not include as separate locations a battery seen active twice or more times on the same day - an incident of common occurrence. The figures, therefore, are as favourable towards aerial observation as they can be made.

## PART V

### OBSERVATION

#### Section (c) Compilation of Results obtained

### APPENDIX "B"

Report by O. C., 4<sup>th</sup>. Field Survey Battalion on examination of Positions on the SOMME

REPORT FROM O.C., 4TH FIELD SURVEY BATTALION, R.E. TO GENERAL STAFF "I"  
FOURTH ARMY DATED 14TH APRIL, 1917 ON EXAMINATION OF HOSTILE BATTERY  
POSITIONS ON THE SOMME

Immediately after the German retreat in the middle of March, arrangements were made for a complete examination of the area occupied by hostile artillery with a view to forming some idea of the completeness and degree of accuracy of hostile battery locating in this Army, and of our estimates of the hostile artillery opposed to us. The examination was carried out as follows:-

The whole front was divided up into sectors and each group was allotted one sector and directed to carefully examine the whole of it and report on:

- a) Battery positions as reported on the latest battery maps, their correctness as to location, and whether our reports of activity were borne out by actual examination of the position.
- b) Any positions found on the ground which showed signs of use but were not marked on the map.
- c) Any other points of interest such as type of position constructed, accuracy of our own fire etc.

Reports have now come in of practically the whole area except a portion around BUS and ROCQUIGNY, which owing to traffic restrictions, was difficult to access. This area has, however, been longest under observation and is more open than further south, and I have not therefore thought it worth while to delay this report till information about it is received.

The deduction from this examination are as follows:-

Total number of positions, apparently recently active, found by actual examination of the ground.	230
Total number of the above correctly located and reported as active	183
Total number of the above correctly located but reported as inactive	16
Number of the above not located at all	31
<b>TOTAL</b>	<b>230</b>
Positions reported active of which no trace could be found on the ground	13

In other words, out of 212 positions shown as active, 183 or 86.3% were correct. Out of a total of 230 positions on the front examined, 31 positions or 13% were not located at all. Of these 13 could be subsequently identified on photographs and 18 could not be located by photo only.

In view of the fact that the location of batteries had been much hampered by mist and unfavourable weather conditions, it would appear that in similar open country it is to be expected that at least 75% of the enemy's artillery will be accurately located.

It is of interest to note that all reports agree that the construction of heavily protected emplacements was most exceptional. Deep dugouts were often constructed beside the gun pit, but in very many cases there appeared to be no heavy cover for the detachment, particularly in positions close to a village. Gun positions in woods were usually merely screened by branches, and in the open either covered with camouflage only or a light splinter-proof roof.

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