The introduction of Universal Transverse Mercator (UTM) grid on military maps: a sixty year retrospect

Mike Nolan

In presentations by survey officers on the Falkland Islands, Balkans or Iraq Wars, or wherever, it is still not uncommon to hear mention of the problems caused by the UTM grid zone junction occurring in that theatre. There is, of course, no problem with the UTM grid zone junction. It is simply a fact of life resulting from the decision to adopt the UTM grid and to supersede the multiplicity of British grids formerly in use. These had a plethora of grid zone junctions between areas often mapped on a variety of projections. The UTM grid zone junction occurs at intervals of six degrees east or west of the first zone commencing at 180 degrees west of the Greenwich meridian and commonly occur where British troops have served or may serve, Hong Kong, Brunei and Oman being examples of areas in which junctions occur.

In the case of the Falkland Islands war, the Directorate of Overseas Surveys, who had produced the original 1:50,000 series, had ignored the grid zone junction and had, for local convenience, extended one grid zone to cover the whole colony. This series had been adopted for military use and stocked in map depots without modification. The operational maps and aeronautical charts at 1:250,000 scale, Series 1501 and Series 1501 Air correctly showed the standard grid zones and their junctions and were thus out of kilter with the 1:50,000 scale maps. The urgent remedial action that had to be taken to re-grid the 1:50,000 series to conform with the grids on the 1:250,000 series has been well documented.

The booklet *HQ 7714 Engineer Intelligence Group, US Army, Map Reading Kit* of 20 January 1952 provides a nice summary of the history:

> 'It was during the first World War that the French adopted a rectangular grid based on a conical projection, the Lambert Conformal Conic, known as the 'Nord de Guerre' grid. After the war the French extended the system with new Lambert Conformal grids named Lambert Zones I, II and III.
>
> At the end of the first World War the United States adopted a grid system based on a Polyconic projection named the US Polyconic grid. During the inter-war period the Portuguese adopted the Transverse Mercator as the basis for their national grid. Subsequently, both the Germans and Russians adopted the Transverse Mercator, the former in belts three degrees wide and the latter in belts six degrees wide. The world-wide nature of World War Two led to the adoption by the allies of British grids, where they existed. For other areas a new grid was adopted named the World Polyconic Grid, an awkward extension of the non-conformal US Polyconic Grid. At the end of the war the American Army Map Service reviewed the grids covering the world with the aim of instituting a simple, uniform, conformal system capable of application world-wide.

> The Transverse Mercator Projection with UTM grid was adopted as the official US Army map grid in 1947 for use in joint Army-Navy-Air operations involving close contact with the enemy.
>
> The ultimate advantages of the UTM grid meant that it came to be adopted by the UK and other NATO nations but the introduction of UTM also had additional benefits principally the opportunity to introduce more up to date French and German mapping than had been available during the war and the introduction of bilingual or multi-lingual versions. Captured German trigonometrical data in German Gauss-Krueger co-ordinates could also be incorporated in the new mapping. By 1952 there was also available a newly computed Central European Adjustment Net of ground control based on geodetic data acquired by Germany during their early victories. Adoption of the UTM Grid was initially limited to maps on scales of 1:250,000 or greater, with certain exceptions, and was to be carried out in large area blocks.'

Conference of Commonwealth Survey Officers 1951, Paper 7 explains why the Lambert grid was not adopted:

> 'The UTM Grid was adopted by military surveyors primarily to make life easier for the gunner who required a system of plane rectangular co-ordinates on which to operate. It was introduced by the United States War Department in 1947 to replace the inadequate, non-conformal, Polyconic Projection which had been introduced for extensive areas where the conformal British Grid System was not available during World War Two. The other conformal projection considered was the Lambert conical conformal projection which would have required thirteen latitudinal zones of six degrees either side of the equator to preserve the scale accuracy required by the artillery up to a latitude of 78 degrees. Thus, in those days of manual computing 65 sets of projection tables would have been required for the five spheroids then commonly in use had the Lambert been adopted.'

The UTM grid was adopted by NATO in the early 1950s and with effect from 27 March 1952 superseded existing map grids in the Priority I area (*figure 1*)**.** This area of approximately 400,000 square miles contained over 10,000 separate sheets of which 9,000 were at 1:25,000 and 1:50,000 scales. The reproduction task this represented was nearly 90,000,000 copies.

On 27 March 1952, all maps at scales of 1:250,000 or larger of that area bearing the old grids were made obsolete and all position referencing became UTM grid based. The UK, on the National Grid, was an exception to this policy. At the time it was stated that an indirect benefit of this change was that the reprinting of stocks of all the maps in the area concerned provided the opportunity to incorporate the latest revision information but how far this ancillary aim was met is not known.

The reprinting was a combined effort of all the NATO powers concerned but the Army Map Service carried out the greatest part of the task as shown in the following tables.

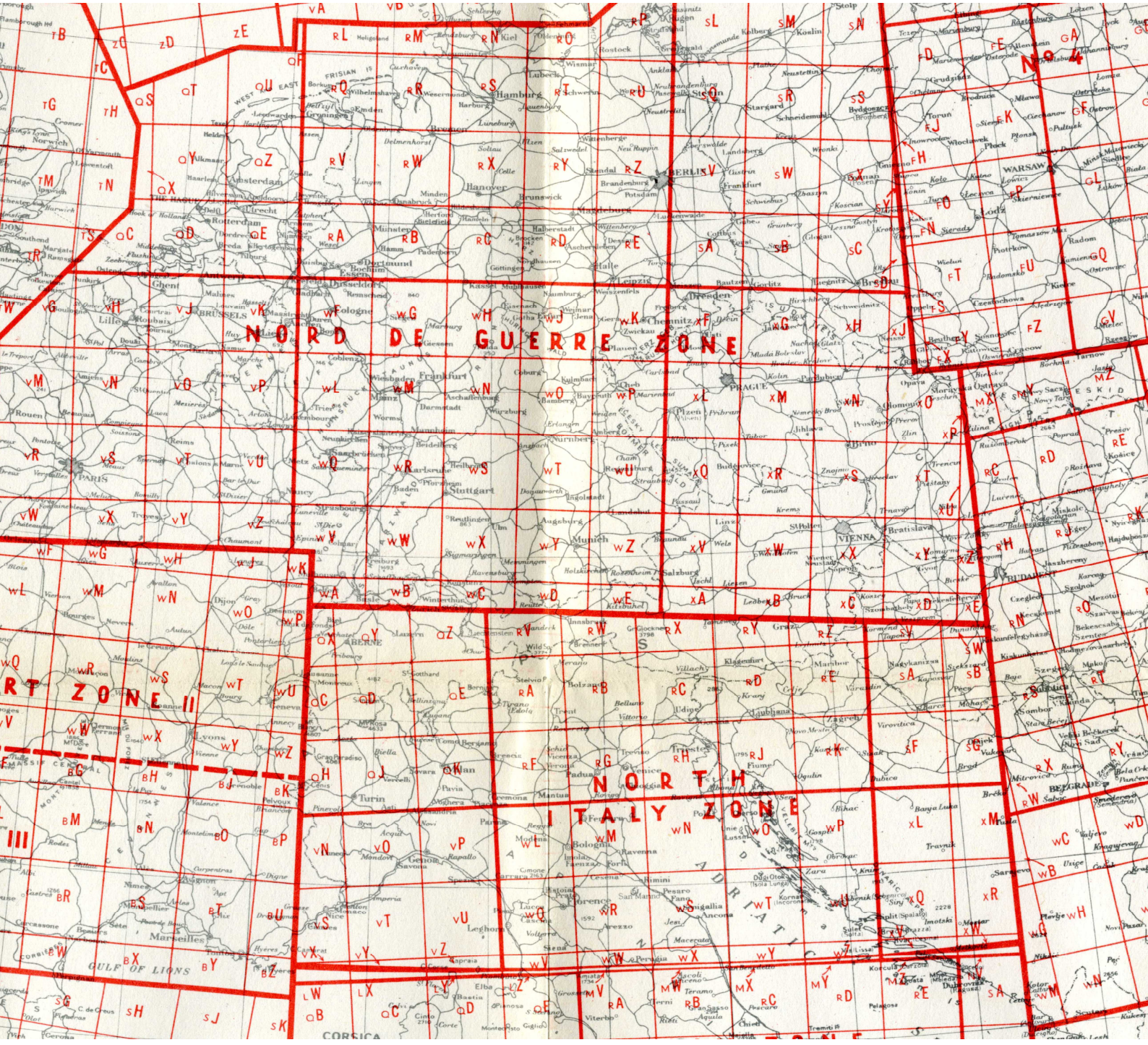
Separate sheets converted by US, GB, France, Netherlands and Belgium

Area of responsibility	*Number of separate sheets*				*Totals*
Scale 1:	**25,000**	**50,000**	**100,000**	**250,000**	
United States	5778	1421	412	95	7706
Great Britain	1475	138	28		1641
France	261	108		24	393
Netherlands	301	128			429
Belgium		72	10		82
Totals	7815	1867	450	119	**10,251**

Figure 1 (left) Diagram showing UTM Priority I area

Figure 2 (right) Part of the diagram showing the equivalent Pre-UTM British grid systems

These diagrams are taken from The UTM grid – notes for map users *issued by Survey Branch HQ BAOR in March 1952*



The grid systems defined on the full diagram are Irish, English National, Northern European zone III, Russian Belts, French Lambert zone, Nord de Guerre zone, Danube zone, Iberian Peninsula zone, North Italy zone, South Italy zone.

Series breakdown of sheets converted by the Army Map Service

AMS series	*Equivalent GSGS series*	*Scale 1:*	*AMS series name*	*No of sheets*
M402	4722	300,000	Austria & N Yugoslavia road maps	6
M506	4413	250,000	The Balkans	14
M508	4346	250,000	Central Europe	40
M591	4230	250,000	Italy	27
M592	4729	200,000	Italy road maps	14
M603	4336	100,000	Belgium & NE France	15
M607	4396	100,000	Yugoslavia	69
M631	2541	100,000	Holland	7
M641	4416	100,000	Germany	106
M651	4416	100,000	Poland	2
M661	4249	100,000	France	23
M671	4416	100,000	Middle Danube	40
M691	4164	100,000	Italy	150
M702	4734	50,000	Yugoslavia	186
M703	4040	50,000	France & Belgium	46
M741	4507	50,000	Germany	155
M742	4492	50,000	Bavaria	177
M761	4471	50,000	France	172
M771	4529	50,000	Austria	186
M773	4728	50,000	Hungary	73
M791	4229	50,000	Italy	517
M832	4414	25,000	Eastern Holland	123
M841	4414	25,000	Germany	1040
M842	4414	25,000	Bavaria	432
M863	4041	25,000	France & Belgium	23
M864	4411	25,000	France	823
M871	4528	25,000	Austria	128
M872	4725	25,000	Czechoslovakia	747
M873	4741	25,000	Czechoslovakia	117
M891	4228	25,000	Italy	1862
M895	4732	25,000	Switzerland	443
M941	4480	various	Germany city plans	3
M971	4483	various	Austria city plans	33
Totals				7799

Plastic relief models

Alongside the paper map production task, it is believed that about 1,000 copies of each of 54 plastic relief models at 1:250,000 scale were included in the Priority 1 area programme.

Trig lists

In parallel with the production of the re-gridded maps new trig lists were also required. The preparation and publication of trig lists for the Priority 1 area was complete by May 1952 except for a small part of France:

Country	*Number of books*	*No. of stations*
Germany	690	184,900
France	167 of 291	incomplete *
Italy	129	25,313
Czechoslovakia	102	56,570
Belgium	71	13,420
Yugoslavia	62	10,140
Austria	59	19,518
Netherlands	45	9,834
Hungary	24	14,560
Poland	12	2,360
Switzerland	1	64
Totals	1362	Excluding France 336,679

* Of the 291 books in France, 167 completed by 1 May 1952, remaining 124 in work

Total reproduction carried out by USA, GB, France, Italy, Netherlands and Belgium *(Scale breakdown as at 1 March 1952)*

Scale 1:	*Sheets*	*Copies*
25,000	9,527	52,959,913
50,000	2,021	26,722,150
100,000	581	5,033,100
200,000	42	1,558,200
250,000	83	2,303,400
300,000	6	50,400
Various city plans	21	36,000
Totals	12,281	88,663,163

Army Map Service reproduction as of 1 March 1952

Series name	*Series*	*Scale 1:*	*Sheets*	*Copies*	*Impressions*
Austria	M871	25,000	126	616,500	1,886,650
Austria	M771	50,000	186	1,012,800	2,886,675
Austria city plans	M971	Various	19	31,200	211,875
Austria/Yugo road	M402	300,000	6	50,400	194,250
Czechoslovakia	M872	25,000	747	895,800	1,014,800
Czechoslovakia	M873	25,000	117	142,400	238,100
Switzerland	M895	25,000	444	847,200	1,343,100
France	M864	25,000	816	3,452,618	5,834,690
France	M761	50,000	133	2,592,300	6,482,750
France	M661	100,000	22	440,000	1,430,000
France & Belgium	M863	25,000	23	66,700	110,690
France & Belgium	M703	50,000	46	1,020,000	2,184,000
Belgium & NE France	M603	100,000	15	300,000	840,000
Germany	M841	25,000	1472	26,363,670	20,194,210
Germany	M741	50,000	155	4,090,400	13,165,620
Bavaria	M742	50,000	177	4,385,450	3,027,750
Germany	M641	100,000	106	1,841,600	6,636,250
Germany city plans	M941	12,500	3	4,800	29,100
Italy	M891	25,000	1858	3,962,225	7,262,000
Italy	M791	50,000	512	1,633,100	4,221,575
Italy	M691	100,000	150	517,800	1,773,275
Italy	M592	200,000	14	96,600	737,450
Italy	M509	250,000	27	91,800	262,000
Balkans	M506	250,000	15	55,900	169,750
Central Europe	M508	250,000	41	2,155,700	6,576,500
Holland	M832	25,000	123	455,800	709,525
Holland	M631	100,000	7	140,000	525,000
Hungary	M773	50,000	73	147,800	579,795
Poland	M651	100,000	2	40,000	110,000
Middle Danube	M671	100,000	40	823,000	2,159,975
Yugoslavia	M702	50,000	186	47,100	1.099,000
Yugoslavia	M691	100,000	69	230,700	998,500
Germany	M741	50,000	60	1,409,000	2,831,700
France & Belgium	M863	25,000	50	145,000	279,000
Totals			7,840	60,105,363	98,005,655

Reproduction carried out by GB, France, Italy, Holland and Belgium

Nation	*Area*	*Scale 1:*	*Sheets*	*Copies*
GB	Germany	25,000	902	5,317,000
	France & Belgium	25,000	477	2,022,800
	Germany	50,000	78	2,048,000
	France & Belgium	50,000	72	1,740,000
	Belgium & NE France	100,000	10	200,000
Totals			1539	11,327,800
France	Germany	25,000	259	3,804,000
	France	50,000	216	4,056,200
	France	200,000	28	1,461,600
Totals			503	9,321,800
Italy	Italy	25,000	1862	3,724,000
	Italy	100,000	150	300,000
Totals			2,012	4,024,000
Holland	Holland	25,000	249	1,144,200
	Holland	50,000	112	2,240,000
Totals			361	3,384,200
Belgium	France & Belgium	50,000	15	300,000
	Belgium & NE France	100,000	10	200,000
Totals			25	500,000
Overall			4,440	28,557,800

The above tables have been taken from the AMS Summation of UTM Grid Conversion Programme Report *by Jacob Skop given at the International Topographic Mapping Conference in May 1952, see PRO WO 402/364*

It was presumably from that date that "UTM GRID" appeared prominently in the northern margin of maps and doubtless there was a Directorate of Military Survey Technical Instruction on the subject.

Grid ticks of the obsolete grids such as the common French Nord-de-Guerre grid were retained around the edges of maps to enable references in terms of the obsolete grids to be identified still. On British maps these ticks and values were inconspicuous and in sloping type. On many of the 1:250,000 and 1:100,000 scale maps printed by the American Army Map Service these were shown as prominently as the new UTM grid numbers, though in a different colour. In some cases the grid lines of the obsolete grid were also retained. Near grid zone junctions the grid ticks of the adjacent grid zone were also shown to allow the adjacent grid to be extended into the sheet if necessary. Apparently, on some maps outside the British Zone of Germany an additional grid, commonly Nord-de-Guerre or German civil Gauss Kruger was also shown.

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ARMY COUNCIL INSTRUCTIONS

16th January 1952

Distribution—*See* A.C.I. Quarterly Index

GENERAL STAFF

41. Military Maps of Europe.—Introduction of Universal Transverse Mercator Grid.

1. *Introduction.*

As a result of a N.A.T.O. decision the Universal Transverse Mercator (U.T.M.) grid is to be brought into use on military maps of Europe (excluding the British Isles) at scales 1/250,000 and larger in place of existing grids. The U.T.M. grid is of world wide application and consists of Transverse Mercator belts with junctions every 6° of longitude from Greenwich. The introduction of this grid on the maps of Europe will have the effect of reducing the number of grid junctions in Europe from about thirty to seven. In converting triangulation data from existing grids to U.T.M. advantage has been taken of the recently completed adjustment of European national triangulations.

The implementation of this N.A.T.O. decision requires a very considerable map production and distribution effort, and is being undertaken by areas as and when all the maps and triangulation data of the area have been converted to U.T.M.

The first area to be converted to U.T.M. is that at present covered by the Nord de Guerre grid (south of 51° north and west of 12° east), the North European Zone III grid (south of 55° north) and the North Italy Zone grid. This area is indicated on the diagram at Appendix A to this A.C.I.

The change-over in this first area from maps with existing grid to maps with the U.T.M. grid is planned to take place in February 1952. The exact date of change over will be announced later.

The method of giving a map reference from the grid is materially the same in the new system as it is in the old.

2. *Consequence of the Change-Over.*

As a result of this grid change, the map series listed at Appendix B to this A.C.I. will become obsolete and will be replaced by new series or editions.

On the date chosen, all copies of obsolete maps in use or in stock are to be withdrawn and disposed of in accordance with para. 4 below.

The change-over will necessitate the changing of grid references on operation instructions, intelligence reports, etc., and in order to simplify this as much as possible grid ticks for the old grids are given in the margins of the new maps. In some cases it may not be possible to convert all references to the new grid and old maps must be retained, but a record must be made on all old maps retained for this purpose, and in no circumstances will they be used for any other reason.

For technical reasons it has not been possible to remove the old grid when adding the U.T.M. grid in all cases. At the earliest opportunity the maps which carry both the U.T.M. and the old grid will be replaced by maps carrying only the U.T.M. grid. Until such maps can be replaced care will have to be taken to avoid using the obsolete grid.

3. *Distribution of New Maps.*

Stocks of the new maps will be distributed to all overseas commands concerned and will be issued to formations and units before the date fixed for the change-over. Detailed instructions will be issued by overseas command headquarters.

Home and overseas commands in which there is no survey representation, holding and requiring maps of the area concerned, will immediately place demands on the War Office (Survey 2 (*c*)) for replacement. These demands should give the series and sheet numbers of the old series and the quantities of each requiring replacement. As supplies of the new U.T.M. gridded maps are likely to be limited, demands should be kept to the minimum necessary to enable change-over to take place.

UTM grid was not introduced overnight. Army Council Instruction (ACI) 41 of 16 January 1952 (*left*) introduced the UTM grid over northern France, West Germany, Switzerland, Austria and parts of Hungary, Italy, Yugoslavia and Czechoslovakia. As a result about 50 existing map series were made obsolescent.

On 11 October 1952, ACI 639 introduced UTM grid over the former Nord de Guerre grid areas, Germany and Poland between 12 and 18 degrees east and north of 51 degrees, resulting in the obsolescence of another six map series.

On 28 January 1953, ACI 49 introduced UTM grid for the remaining part of France covered by the Lambert Grid, Zones I, II and III. As a result a further nine series were made obsolescent.

It is believed that ACIs were discontinued in 1963 and superseded by DCIs, Defence Council Instructions. On completion of the NATO Priority Areas a programme of conversion was continued for other areas of the world.

A quick review of ACIs archived at the National Archives (TNA) reveals at least the following introductions between 1954 and 1963. However, not all annual sets of ACIs consulted included indexes so it is possible that some were missed.

ACI 246/1954	Norway and parts of Sweden and Finland
ACI 293/1954	Russian Zone Grid 4 and 5
ACI 336/1954	Indo-China
ACI 413/1954	Remainder of Sweden and Finland
ACI 222/1955	Malta and Gozo
ACI 117/1956	Area B1 - Yugoslavia, Albania and Islands
ACI 134/1956	Nigeria
ACI 356/1956	Bermuda
ACI 403/1956	SE Arabia
ACI 49/1957	Turkey
ACI 332/1957	Faeroe Islands
ACI 404/1957	Mauritius and Rodriguez
ACI 3/1958	South Arabia
ACI 404/1958	Hong Kong and The New Territories
ACI 189/1958	Uganda
ACI 29/1959	Northern Syria and Parts of Southern Turkey
ACI 89/1959	Corsica
ACI 288/1959	Gibraltar
ACI 65/1960	Tanganyika, Rhodesia and Nyasaland
ACI 306/1960	Egypt, Israel, Jordan, Lebanon and parts of Syria, Arabia, Libya and Sudan
ACI 62/1962	Syria and Iraq
ACI 392/1962	Parts of Thailand and Burma
ACI 156/1963	Malaya and Singapore (RSO Grid, not UTM)
ACI 219/1963	Libya Part I
ACI 242/1963	Iraq-Iran Phase II
ACI 335/1963	Libya Part II
ACI 336/1963	Kenya

The programme must have continued and if there is anyone who has further information on this programme the writer would be pleased to hear of it. Defence Council Instructions about introduction of UTM grid were still being issued in the 1970s

The little booklet *The UTM (Universal Transverse Mercator) grid – notes for map users* provides much of the above information including figures 1 and 2. It was issued by Survey Branch HQ BAOR in March 1952 and, in its sample appendices showing the grid layouts and reference boxes for various scales of maps, it might be considered a forerunner of the excellent, much later, and much more comprehensive, *Manual of Graticules and Grids on Military maps and air charts* published by Directorate of Military Survey in 1973.