

4. 考 察

4-1. 基準点網の調整(3-2参照)

本地区には三角測量によって設置された既存の基準点が一部にあり、空中三角測量等のため必要な基準点を今回増設した。増設の手法としては以下の2方式を採用した。

- (1) 人工衛星観測方式……………アクセス、植生等の理由で従来の三角、多角方式では基準点の設置が困難な地域(BCGSが担当して実施した)
- (2) 多角測量方式……………(1)を除いた地域で、2級基準点の精度で基準点を設置

この結果、本地区には異なる3系列の基準点が混在することになった。これらの基準点について、単に空中三角測量に必要な標定点としてだけでなく、将来、各種測量の与点としても利用できるように、基準点網としての統一と調整を行った。

4-1-1 調整前の問題点とその処理

(問題点)

- (1) 三角法により設置された既設基準点を調査した結果、与点として利用可能な点は CHICO2, GAMMA, MASIPI 2 の3点しかなく、これらの点も測地の中央より北側に偏在していた。以上のことから網の調整の与点として使用するためには、次の検討が必要であった。
 - i) 既設基準点の精度の確認
 - ii) 測地が南北に細長く、既設基準点の数が少ない上に北方に偏在しているため、網のローテーションが起りやすい。この解決方法の検討。
- (2) 人工衛星観測方式により新設された基準点の精度の確認。
- (3) 多角測量によって新設された基準点の観測精度の確認と、この観測精度をできるだけ維持する平均方法の検討。

(問題点の検討と処理)

- (1-1) 既設点 CHICO2, GAMMA, MASIPI 2 の座標と、今回多角測量で観測された観測値を使用して、GAMMA → CHICO2 間及び GAMMA → MASIPI 2 間の座標計算を実施し閉合比を求めた結果、それぞれ $1/29,000$, $1/55,000$ を示し、2級基準点の精度 $1/75,000$ を満足していないことが確認された。
- (1-ii) 多角点 № 2, № 15, № 36 の各測点で北極星による方位角の観測を実施し、網の調整の際に方位の規正を行うことによって、ローテーションを防止する。
- (2) 人工衛星基準点をできるだけ測地網に結合させて座標の較差を算出し、おおよその精度

を推定した。実際には、人工衛星基準点と多角基準点とを併用した点が4点、測地網に取付け観測を実施したもの3点、合計7点を測地網に結合させた。おおよその精度は1点を除いて、平均二乗誤差で±5.65mであった。

- (3) 多角測量の精度の確認は、座標については、2等三角点 GAMMA 1点を与件として座標計算(概算)を行ない、閉合比によって精度のチェックを行った。また、標高については、測標水準点 №2, №15, №32を与件とし、比高の閉合差を求め精度を確認した。この結果、座標、標高とも2級基準点の精度内に充分入っていた。

4-1-2 測地網の調整

当初、網の平均計算の与点として考えていた2等三角点の精度が悪かったので、4-1-1で検討した結果を十分に考慮して、最終的な測地網の調整について日比で協議した結果、次の諸計算を実施し、最適な成果を採用することになった。

- (1) JMR №5 (GAMMA)* の座標及び№2, №15, №36 の3点で観測した天文方位角を与件として網平均計算を実施する。
- (2) (1)の計算で仮決定した、№9 (CHICO 2), MASIPI 2 及び JMR №5 (GAMMA) の座標を最小二乗法により調整し、その結果を与件とした基準点網の計算。
- (3) (1)の計算で仮決定した、JMR №8 (CAPA), JMR №9 (GON) 及び JMR №16 (CAG) の座標を最小二乗法により調整し、その結果を与件とした基準点網の計算。

4-1-3 調整の結果とその評価

(計算の結果)

4-1-2の(1)~(3)の計算結果は1方向の平均二乗誤差で

(1) ±1.43"

(2) ±1.05"

(3) ±1.03"

を示し、1級基準点の精度±1.5"を満している。この成果について日比で協議し(2)の成果を最終的に採用した。

また、4-1-2の(1)~(3)の計算結果から次の評価ができる。

- (1) 4-1-2の(1)~(3)の成果はどれを採用しても、後続の諸測量の与件として十分な精度を有しており、測地網の調整が良好であったことを示している。特に既設の三角網との結合方法が強く、網平均の結果、一方向の標準偏差も小さい(2)の成果を採用したことは妥当なことと思われる。

* …… JMR №5 (GAMMA) は2等三角点であり、人工衛星による観測は実施していない。

(2) 人工衛星による基準点の成果は、精密暦によって算出されており、一部の点を測地網に結合することによって、全体の点の精度をおおよそ推定できた。(結合した点数は7点で、その較差の標準偏差は± 5.65 mで、結合しなかった点の精度もおおよそこの程度と思われる。)この結果は、空中三角測量の与点として十分な精度を示している。また、4-1-2の(3)の計算から人工衛星基準点の間隔を充分に取る等の処置を行なえば、測地網の与点として採用できることも証明された。

今回のように系統(測量方式、精度)の異なる基準点の調整法は、今後、他の地域のプロジェクトにも充分に応用できるであろう。

4-2. 図式の特徴と問題点

4-2-1 図式の特徴

今回完成した 1/25,000 地形図の印刷図は、美観的にも、読図利用上も、きわめて優れたものになっている。これは、日比相互間の充分な協議により定められた図式が適用されたことと、それが(中縮尺の)地形図としては理想的ともいえる色設計になっていることによる。

この図式と、日本の 1/25,000 地形図のそれとを比較すると、次のとおりで、特に製図作業における版数(スクライプ版、マスク版等の数)の多いことが目立っている。

項	目	日 本	フィリピン
印刷の色数		3	5
製図の版数	植 生	1	15
	岩, 砂地, 泥地, 干潟等	1	5
	注記文字(数字以外)	1	2
	行政界	1	2
	計	7	平均 23
その他	線の太さの区分	4	5
	海部の等深線	なし	あり
	説明注記	ほとんどなし	若干あり

4-2-2 今後の問題

(1) この図式及び図式適用基準により、今後フィリピン国が整備を推進しようとする

1/25,000 地形図の Specification がほぼ確立された。今後、さらに必要に応じて、新た

な地物記号の追加、地物の分布状況に応じた図式適用基準の改正等を行い、より完全な図式及び図式適用規程を作成することが望ましい。

(2) この図式には説明的な注記がかなり多く含まれている。

(廃墟 Ruins , 渡船 Ferry , 渡渉場 Ford , 油タンク Oil , 煙突 , 塔 Tower , 共同墓地 Cem , 泥地 Mud , トンネル Tunnel 等)

完成された図式にするためには、このような普通名詞的な説明は、できるだけ記号化することが望ましいと考えられる。

(3) この図式は、4-2-1 に述べた特長をもつ反面、製図作業の工程、技術 (分版 , Registration , 検査等) を複雑なものとし、材料費等を含めて、作業量及び経費を大きくしている。将来、地形図の修正及び他地域におけるこの図式の地形図の作成を計画、実施する場合、このことが大きな負担となることも考えられる。

1/25,000 地形図の整備を推進する観点からは、暫定的に、版数を削減した実用図式を検討することもあり得るであろう。

4-3. Mapping 作業実施上の問題点

今後、1/25,000 地形図作成事業を計画的に実施していくためには、作業の能率化、標準化及び地形図の品質の確保等の観点から、次のことが望ましいと考えられる。

地形図編集までの工程については、

- (1) 正規の (製図の) 図式記号に対応する統一的な図化作業用の記号 (略記号) を定める。
- (2) 編集作業の基準 (表示事項の取舍選択、総描、転位等の原則) を定める。
- (3) 地形図に表示する事項のうち、居住地名、自然地名及び行政界等について、関係行政機関において統一を図り、信頼すべき資料を整備する。

地形図複製の工程については、特に製図作業の版数が多いことから、

- (1) 製図作業における刷り合わせ (Registration) を確保するため、使用する材料 (ポリエステルベース) の選定について、十分に検討する。
- (2) 製図の検査は多色校正焼 (サープリント) 上で行い、表示事項の誤り、脱落、各版相互の関係、刷り合わせ、隣接図葉との接合等を、十分に検査、校訂する。
- (3) 合同の作業で実施したように、製図成果から色ごとに合成ネガフィルムを作成し、これから製版する。
- (4) 印刷作業においては、用紙の伸縮による色ごとのズレを防ぐため、保管場所の温度、湿度の変化に注意する。

5. 成果の利用と提言

5-1. 1/25,000地形図の利用

5-1-1 1/25,000地形図の利用面

フィリピン国においては、その国土全域を覆うべく計画されている1/50,000地形図の改測と並行して、国土の約半を占める開発可能性の高い河川流域部（約10万km²）を対象として1/25,000地形図の整備が計画されているが、その端緒としての本事業により、その模範となるべき最初の印刷図が作成された。

1/25,000地形図は、国の基本図として最も詳細な高精度の多目的地形図として、各種開発計画の調査、検討に不可欠であるのみならず、研究、教育、観光、レジャー用あるいは行政管内図、1/50,000地形図等への編集図のための基図としても用いられ、その利用面はきわめて広い。

5-1-2 刊行サービス上の問題点

上述の1/25,000地形図の利用面のうち、調査、計画用、研究用、教育用の利用にあっては、多色の面的表現（Color Tint）よりも、書き込みに適する線画だけの地図（Line Map）の方が適する。この観点から、アミ点の表現を省いた線画だけの地図を、何等かの方法で複製し、利用の便に供することも考えられよう。

5-2. 1/10,000正射写真地図の利用

正射写真地図は、それぞれの地域における各種開発計画に際して、より大縮尺の基礎資料となるとともに、今後他の地域について正射写真地図を作成する場合の作業規程及び模範図としての役割りを果たすであろう。

5-3. 各種中間成果の利用

以上の最終成果のほか、中間過程における成果類も、今後それぞれ有効に利用することができるよう。以下、それらについて列記する。

5-3-1 空中写真

対象地区全域の縮尺1/30,000空中写真は、今後必要に応じて縮尺1/5,000程度までの空中写真測量（図化、正射写真地図、モザイク）及び各種専門領域での写真判読等、幅広い分野への利用が可能である。

5-3-2 基準点成果

対象地域全体を統一した座標系，精度で覆う基準点網が整備されたので，今後これらを基に細部基準点測量を行えば，大縮尺地形図作成や各種公共事業計画に役立てることができる。なお，基準点の成果表，点の記，埋標図の一部をサンプルとして巻末に付した。

5-3-3 基準点刺針成果

また，基準点の刺針作業の成果は，基準点の利用や維持管理に際して有用な資料となる。なお，刺針点明細簿の一部をサンプルとして巻末に付した。

5-3-4 補助水準点成果

既設水準路線と併せて，補助水準網が整備されたので，将来の大縮尺地図作成や各種公共事業計画にこれらを利用することができる。なお，水準測量の成果表，点の記，埋石図の一部をサンプルとして巻末に付した。また，水準点の刺針作業の成果は，水準点の利用に際して有用な資料となる。なお，刺針の成果は，空中写真（密着写真及び2倍伸し写真）に表示してある。

5-3-5 空中三角測量成果

空中三角測量を対象地区全域について行った結果，今回地形図を作成しなかった地域についても，地形図，正射写真地図等の追加作成が可能である。

5-3-6 技術管理記録

技術管理の実施記録は，今後の作業における計画的，かつ適正な作業の管理のみならず，さらに他の分野の測量作業にも応用することができる。

参 考 資 料

基準点成果表

水準点成果表

刺針点明細表

基準点々の記

水準点々の記

基準点埋石標

水準点埋石標

**LIST OF RESULT FINAL
TRIG. INDEX CARD**

P.T.M. Projection (III)

Name of Station	Latitude	Longitude	N	E	H
	° / "	° / "	m	m	m
No. 1	18 24 31.4805	121 26 50.8347	2 036 056.93	547 275.95	34.455
No. 1-1	18 19 15.9519	121 22 40.4465	2 026 339.89	539 947.44	65.36
No. 2	18 20 56.3222	121 38 31.5964	2 029 503.83	567 866.38	14.00
No. 2E	18 20 58.0703	121 38 32.8197	2 029 557.70	567 902.11	12.590
No. 3	18 17 39.4601	121 49 19.8846	2 023 527.88	586 927.78	5.079
No. 4	18 13 19.7420	121 48 21.3430	2 015 535.27	585 243.59	59.135
No. 4-1	18 14 42.5722	121 51 56.6331	2 018 110.74	591 557.31	44.94
No. 5	18 17 30.1972	121 35 29.1172	2 023 148.62	562 529.36	43.89
No. 6	18 12 52.9641	121 24 33.1100	2 014 572.89	543 282.04	77.862
No. 7	18 09 30.3897	121 32 17.2648	2 008 380.37	556 938.10	116.54
No. 8	18 07 08.3196	121 41 49.7968	2 004 069.15	573 782.51	103.415
No. 9 (CHICO-2)	17 58 12.6154	121 34 59.3248	1 987 558.16	561 767.09	178.69
No. 9-1	17 53 47.7871	121 35 48.2536	1 979 421.25	563 232.84	125.59
No. 10	17 56 19.4678	121 40 26.5158	1 984 112.26	571 406.77	207.17
No. 11	17 48 17.0165	121 37 05.4919	1 969 259.98	565 540.02	22.195
No. 12 (JMR No.7)	17 47 27.6544	121 45 12.0831	1 967 794.90	579 876.69	74.268

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P.T.M. Projection (III)

Name of Station	Latitude	Longitude	N	E	H
	° ' "	° ' "	m	m	m
No. 13	17 48 41.6413	121 30 25.5370	1 969 981.62	553 759.15	122.00
No. 14	17 43 54.3275	121 25 26.2415	1 961 127.31	544 965.18	118.94
No. 15	17 39 30.5350	121 45 29.4429	1 953 129.02	580 447.09	75.948
No. 16	17 37 00.0938	121 33 16.3901	1 948 429.15	558 854.14	119.61
No. 17	17 36 28.4164	121 27 48.6037	1 947 429.38	549 193.10	323.98
No. 18	17 31 51.3769	121 26 23.2743	1 938 906.98	546 697.14	135.370
No. 19	17 30 29.9383	121 39 59.9958	1 936 473.49	570 795.06	181.456
No. 20	17 28 43.4620	121 44 53.7314	1 933 232.39	579 472.91	60.481
No. 21	17 28 25.2942	121 33 06.2866	1 932 602.77	558 602.22	402.73
No. 22	17 25 24.3048	121 49 17.2322	1 927 141.84	587 273.70	92.00
No. 22-i	17 27 05.4754	121 39 25.7686	1 930 184.50	569 807.05	128.674
No. 23	17 24 00.2304	121 27 12.5610	1 924 427.12	548 185.24	264.37
No. 24	17 21 08.7437	121 34 30.3730	1 919 190.18	561 123.43	222.391
No. 25	17 18 06.1279	121 45 03.8459	1 913 640.87	579 848.10	30.848
No. 26	17 16 00.7691	121 52 15.7822	1 909 840.79	592 621.91	145.92
No. 27	17 12 26.7637	121 35 56.3264	1 903 152.01	563 710.93	57.369

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P.T.M. Projection (III)

Name of Station	Latitude	Longitude	N	E	H
	° ' "	° ' "	m	m	m
No. 28	17 11 30.0442	121 41 52.8363	1 901 443.68	574 251.07	122.028
No. 29	17 06 54.1028	121 46 30.6753	1 892 992.15	582 495.11	63.12
No. 30	17 07 18.9451	121 53 09.5861	1 893 806.16	594 284.56	116.73
No. 31	17 06 35.7199	121 33 57.7553	1 892 350.39	560 238.98	100.447
No. 31-1	17 03 54.7042	121 34 52.9852	1 887 405.61	561 886.46	90.82
No. 32	17 01 59.8448	121 51 10.6706	1 883 980.89	590 812.07	81.070
No. 32-1	16 59 56.9341	121 50 56.8335	1 880 200.70	590 419.21	80.82
No. 33	16 59 53.2991	121 43 04.1697	1 880 033.05	576 437.86	47.77
No. 34 (JMR. 3)	16 59 06.6157	121 33 53.2615	1 878 544.70	560 146.03	156.971
No. 35	16 52 30.4385	121 51 16.2713	1 866 477.51	591 053.85	97.511
No. 36	16 52 13.3732	121 38 25.3004	1 865 866.51	568 234.83	72.783
No. 36-1	16 53 31.2089	121 41 53.6859	1 868 280.07	574 394.63	64.386
No. 37	16 52 09.9709	121 45 26.3092	1 865 806.03	580 697.28	63.192
No. 37-1	16 49 51.2729	121 46 24.1469	1 861 549.07	582 426.01	75.45
No. 38	16 49 23.2748	121 29 10.2932	1 860 591.03	551 819.59	156.514
No. 39	16 46 29.8707	121 42 56.5962	1 855 334.91	576 303.45	65.922

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P.T.M. Projection (III)

Name of Station	Latitude	Longitude	N	E	H
	° ' "	° ' "	m	m	m
No. 40	16 45 00.5934	121 35 46.4705	1 852 548.53	563 573.50	754.85
No. 41	16 43 33.9010	121 27 38.3621	1 849 845.33	549 122.72	1150.93
No. 42	16 39 10.6668	121 37 28.6288	1 841 801.47	566 632.99	106.976
No. 43	16 36 11.5899	121 29 51.2381	1 836 258.95	553 092.62	180.598
No. 44	16 34 16.2258	121 41 31.2961	1 832 774.34	573 855.42	130.749
No. 45	16 31 16.9208	121 36 47.1237	1 827 235.42	565 447.53	153.888
JMR. 1	16 29 06.7581	121 29 53.4266	1 823 200.69	553 189.82	424.50
JMR. 5 (GAMMA)	17 42 01.4833	121 37 18.7714	1 957 716.61	565 969.32	193.43
JMR. 9 (GON)	18 14 54.3858	122 00 07.3018	2 018 547.53	605 970.80	164.43
JMR. 16 (TUGUE GARAO)	17 37 08.9333	121 43 30.5817	1 948 762.10	576 960.34	42.12
MASIPI -2	17 24 31.6073	121 50 43.9228	1 925 532.94	589 839.41	190.88
J 8-1	18 20 23.0404	121 22 57.2443	2 028 403.42	540 436.36	10.36

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P.T.M. Projection (III)

Name of Station	Latitude ° ' "	Longitude ° ' "	N m	E m	H m
JMR. 2					
JMR. 4					
JMR. 6					
JMR. 8 (CAPA)					
JMR. 10 (PALA)					
JMR. 11					
JMR. 12 (CASI)					
JMR. 13 (SMAC)					
JMR. 14 (DIBA)					

RESULT FINAL OF B.M.

Name of Station	Elevation	Remarks	Name of Station	Elevation	Remarks
BM. No. 1	m 6.484		BM. No. 11	m 55.625	
2	19.239		12	216.017	
3	13.121		13	122.814	
4	80.105		14	58.570	
5	26.363		15	121.980	
6	31.534		16	57.913	
7	35.504		17	70.242	
8	61.009		18	71.650	
9	53.807		19	86.492	
10	87.446		20	103.053	

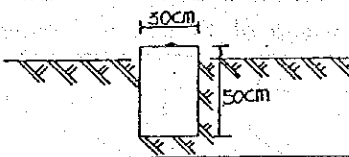
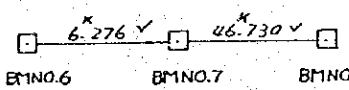
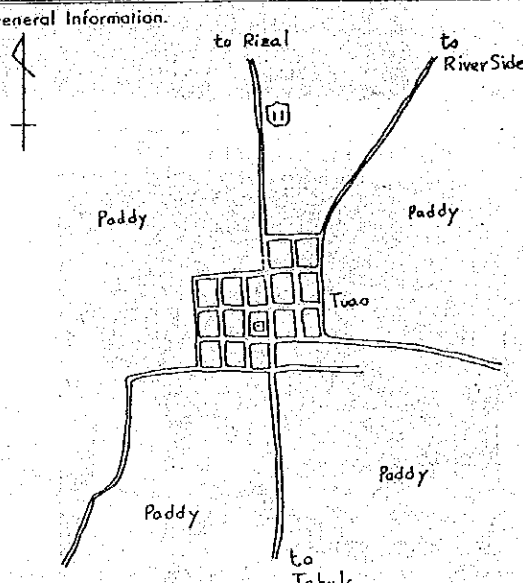
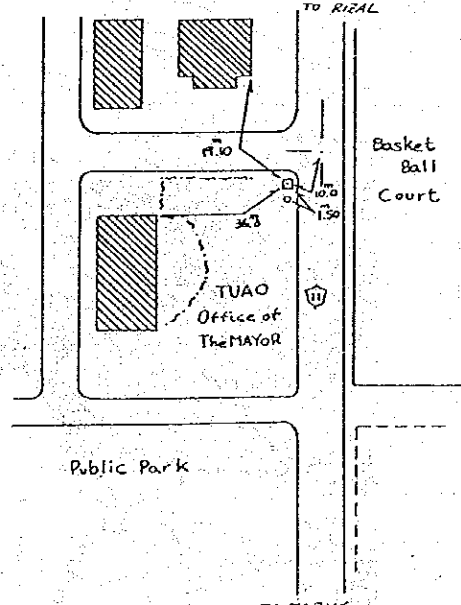
TRIG. INDEX CARD				III
Name of Station	No. of Station	Order	Projection	
	No.15	2	P.T.M.	
Location CAGAYAN		Map Ref. ILAGAN 2506 1/250,000		
Abstract No.	T. C. No.	Comps. No.		
Latitude & Longitude		Co-Ordinate	Scale Factor	
Lat. =	17 39 30.5350	✓ N = 1 953 129.02 ✓	1.000 030 ✓	
Long. =	121 45 29.4429	✓ E = 580 447.09 ✓		
Conv. =	- 0 13 48.00	✓ H = 75.948 ✓		
To Station	Azimuth	Distance	Remarks	
20	182 48 07.04	✓ 19 919.88 ✓		
JMR.No.16	218 36 19.11	✓ 5 588.00 ✓		
JMR.No.5	287 34 55.81	✓ 15 186.98 ✓		
12	357 46 24.75	✓ 14 676.54 ✓		
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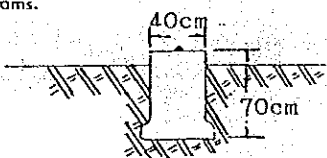
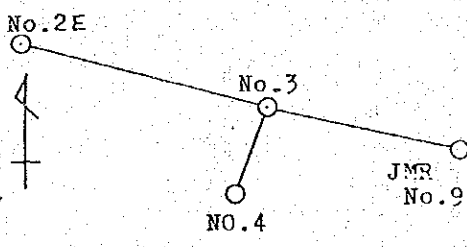
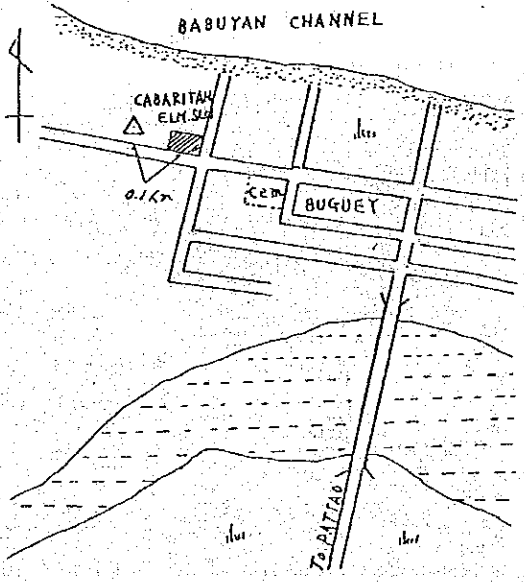
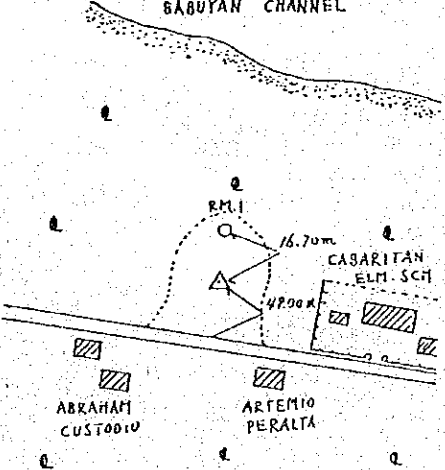
TRIG INDEX CARD				III
Name of Station	No. of Station	Order	Projection	
CAG 172	JMR.No.16	2	P.T.M.	
Location CAGAYAN		Map Ref. ILAGAN 2506 1/250,000		
Abstract No.	T. C. No.	Comps. No.		
Latitude & Longitude		Co-Ordinate	Scale Factor	
Lat. =	17 37 08.9333	✓ N = 1 948 762.10 ✓	1.000 023 ✓	
Long. =	121 43 30.5817	✓ E = 576 960.34 ✓		
Conv. =	- 0 13 10.23	✓ H = 42.12 42.10 ✓		
To Station	Azimuth	Distance	Remarks	
15	38 36 20.86	✓ 5 588.00 ✓		
19	206 38 33.22	✓ 13 748.23 ✓		
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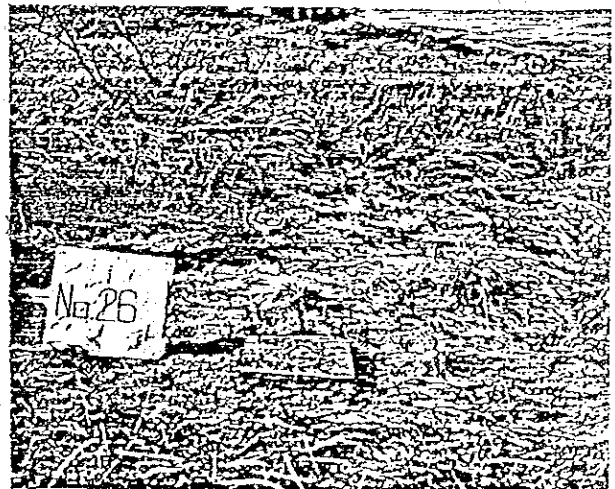
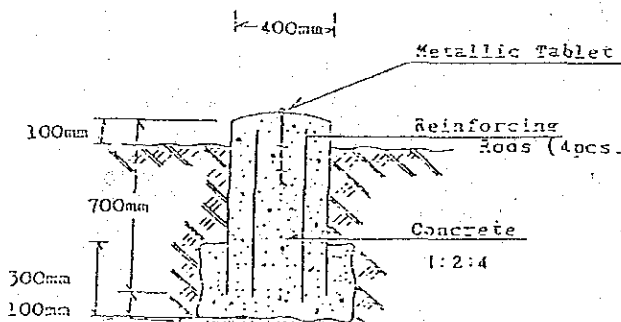
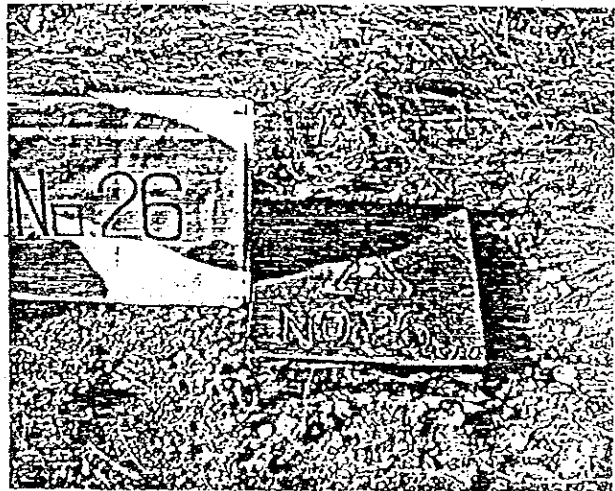
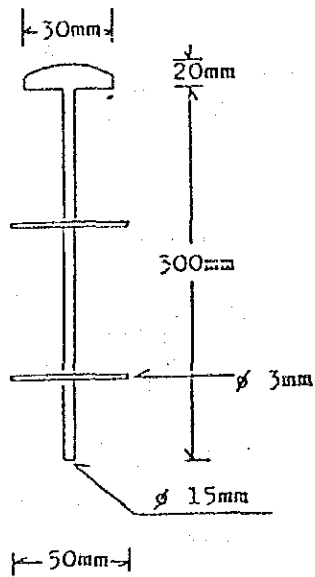
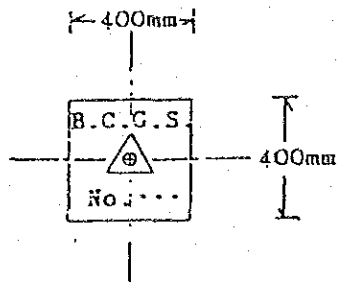
DESCRIPTION OF CONTROL POINT

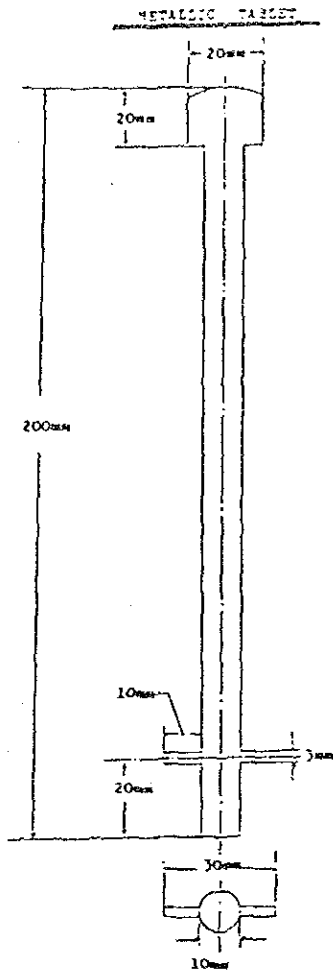
37

Station No.				Operated by	<i>Y. Katamine</i>
No 32				Checked by	<i>C. Misawa</i>
				Date	Apr 11 '80
Zone No.	Coordinates of Station				
III	N	E	H		
Main Point	<i>+ 1 823 980.89</i>	<i>+ 590 812.07</i>	<i>81.07</i>		
Pricking Point P ₁	<i>+ 1 823 968.58</i>	<i>+ 590 812.30</i>	<i>80.42</i>		
Supplementary Point	--	--	T.H		<i>82.62</i>
Sketch-map of Station and Neighborhood			Photograph of Station		
<div style="display: flex; justify-content: space-between; align-items: center;"> C4A No. 49 NORTH ↑ EAST C4A No. 50 </div>					

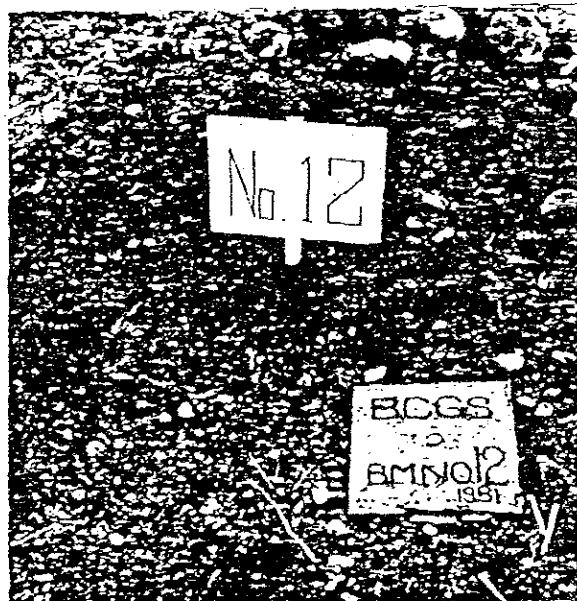
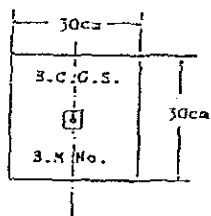
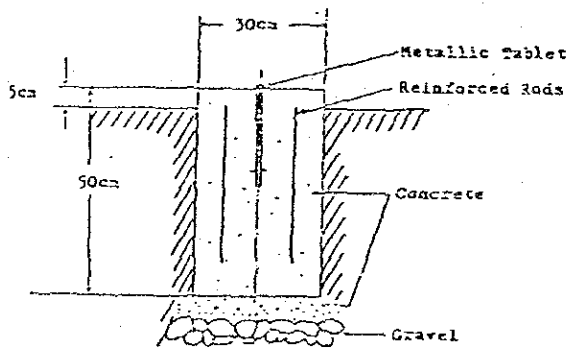
STATION RECORD SHEET.			Station:
Latitude			BM. No. 7
Longitude			For Office Use 7
E.			
N.	Elevation 35.504 ✓		
located on photo no.	Run.	Film.	
Record prepared by.	S. TOMINAGA	Date. 8.JAN'81	
Station established by.	S. TCMINAGA	Date. 8.JAN'81	
Revisited by.	Date.	Remarks.	
Description of Mark.			Diagrams.
			
location and Access.			
<p>The station is in the town proper of Tuao, Cagayan. It is on the NE corner of the municipal building lot and is 1.50 m N of post with name: PNB, 10.00 m SW of the center of road junction, 36.00 m ENE of the NE corner of the Office of the Mayor's building and 19.10 m SE of the SE corner of Court of First Instance Building.</p>			
General Information.			
			

STATION RECORD SHEET.			Station: No. 3
Latitude	18 17 39.4601 ✓	For Office Use	
Longitude	121 49 19.8846 ✓		
E.	586 927.78 ✓		
N.	2 023 527.88 ✓		
Elevation	5.079 ✓		
Located on photo no.	Run.	Film.	5
Record prepared by.	T. MASUDA	Date. Mar 30, 1980	
Station established by.	T. MASUDA	Date. Mar 30, 1980	
Revisited by.	Date.	Remarks.	
Description of Mark. The station mark is a cross cut rod 30mm. in diameter embedded at the center of a square concrete monnment 40 x 40 x 70 cm. protruding above the surface of the ground about 10.0 cm. The station is inscribed \triangle No. 3 BCGS 1980.		Diagrams. 	
Location and Access. The station is in Centro, Buguey, Cagayan. It is on the lot of Natalio V. Mendoza, a resident of the same place. It is approximately 120.0 m. west of Cabaritan Elementary School. A 23.0 meters steel tower was built over the station to avoid cocomt plantations obstruction and to see the visibility of other stations. To reach the station proceed to Centro, Buguey, Cagayan where the station is located. It is on the northern side of the road and about 400.0 m. NW of a cemetery.			
General Information. 			



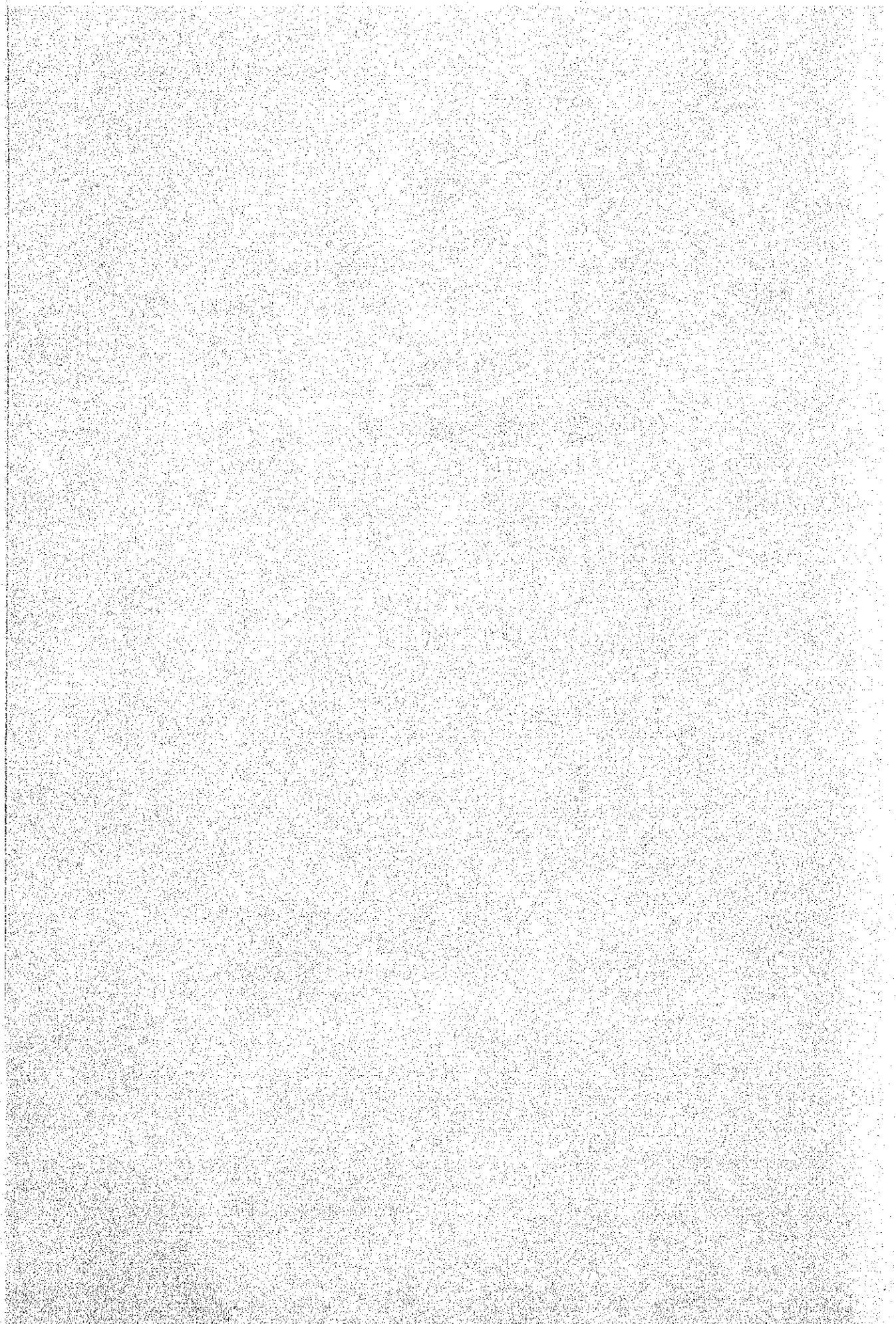


BENCH MARK



作業計画書・議事録等集録

作業計画書



IMPLEMENTING ARRANGEMENT OF THE TECHNICAL COOPERATION
BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND THE BUREAU OF COAST AND GEODETIC SURVEY
FOR THE TOPOGRAPHIC MAPPING SURVEY
OF THE CAGAYAN VALLEY

AGREED BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
BUREAU OF COAST AND GEODETIC SURVEY
DATED: 21ST FEBRUARY 1979

FOR JAPAN INTERNATIONAL
COOPERATION AGENCY:

Takeshi Hirai

TAKESHI HIRAI
Head, Planning Coordination
Division, Planning Department
Geographical Survey Institute
Ministry of Construction

FOR THE BUREAU OF COAST AND
GEODETIC SURVEY:

Antonio P. Ventura

ANTONIO P. VENTURA,
Commodore, BCGS
Director

IMPLEMENTING ARRANGEMENT ON THE TECHNICAL COOPERATION
BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND THE BUREAU OF COST AND GEODETIC SURVEY
FOR THE TOPOGRAPHIC MAPPING PROJECT
OF THE CAGAYAN VALLEY

I. INTRODUCTION

In response to the request of the Government of the Republic of the Philippines, the Government of Japan dispatched a survey team to the Philippines in January 1978 for the purpose of the preliminary study of a Mapping Project (hereinafter (to be) referred to as the "Mapping Project") to prepare topographic maps and orthophotomaps of the Cagayan Valley, located in the northern part of Luzon Island of the Philippines, which are prerequisites for the planning of various development projects in the areas.

Based on the report of the above survey team, the Government of Japan decided to undertake the Mapping Project in accordance with laws and regulations in force in Japan with regard to technical assistance programs, and the diplomatic notes on the Mapping Project which were exchanged between the Governments of Japan and the Republic of the Philippines up to February 1979.

II. MANAGEMENT AND ADMINISTRATION OF THE MAPPING PROJECT

1. The Japan International Cooperation Agency (hereinafter (to be) referred to as JICA), the official agency responsible for the implementation of technical

cooperation programs of the Government of Japan, will carry out the work necessary for the Mapping Project.

2. The Bureau of Coast and Geodetic Survey (hereinafter (to be) referred to as BCGS) shall act as counterpart to the Japanese survey teams and also as coordinating body to other concerned governmental and nongovernmental organizations, for the smooth implementation of the Mapping Project.
3. The BCGS shall assign counterparts consisting of a Project Coordinator and the necessary technical men who shall jointly manage the execution of the Mapping Project with the representatives of JICA.
4. A report will be presented to the Government of the Republic of the Philippines by JICA every fiscal year (from April to March).

III. IMPLEMENTATION OF THE PROJECT

The present document sets forth the Implementing Arrangement agreed between JICA and BCGS for the Mapping Project.

1. The JICA shall provide technical cooperation to the BCGS for the implementation of the Topographic Mapping Project of the Cagayan Valley, covering an area approximately 11,000 km².
2. The Mapping Project shall be implemented in accordance with the Work Plan, which is given in detail in the Scope of Work, which forms a part of this

Implementing Arrangement, in close coordination with other development projects in the Cagayan Valley and other projects for economic and technical cooperation in the region.

3. The Mapping Project shall be undertaken in accordance with the Time Schedule which was formulated on the basis of the Work Plan referred to in III-2 above.
4. Technical Details shall be in accordance with those agreed upon by JICA and BCGS, as shown in APPENDIX V.
5. During the execution of the Mapping Project, changes can be made in the text of the Scope of Work by mutual agreement considered useful by JICA and BCGS in facilitating the work to be performed.

IV. DISPATCH OF JAPANESE MAPPING SURVEY TEAMS

The JICA shall, at its own expense, dispatch Japanese mapping survey teams in accordance with the schedule mutually agreed upon by JICA and BCGS.

V. PROVISION OF MACHINERY, EQUIPMENT, AND OTHER MATERIALS

The JICA shall, at its own expense, provide such machineries, equipment, and other materials, as listed in APPENDIX IV, necessary for the implementation of the Mapping Project.

VI. ON-THE-JOB TRAINING OF PHILIPPINE COUNTERPARTS IN JAPAN

The JICA shall, at its own expense, receive BCGS personnel connected with the Mapping Project for technical training or observation, as trainees in special subjects like aerial triangulation, stereoplotting and map compilation, in Japan in accordance with the normal procedures under the Colombo Plan Technical Cooperation Scheme.

VII. MEASURES TO BE TAKEN BY THE BCGS

1. The BCGS shall, at its own expense, provide the following:
 - a. Additional primary geodetic control points to be established by JMR Doppler Survey Set, and the recovery/re-establishment of 1st order leveling bench marks.
Results of above-mentioned surveys will be submitted to the Japanese Survey Team not later than June 30, 1980.
 - b. Available data and information related to the Mapping Project.
 - c. Counterparts consisting of a Project Coordinator and technical men as found necessary.
 - d. Suitable office room in the BCGS office in Manila.
2. The BCGS shall make the necessary arrangements for the following:
 - a. Suitable office space with appurtenant facilities, storage facilities and garage in the Project Area.

- The cost of rental shall be chargeable against JICA funds allotted for the Mapping Project.
- b. Secure flight permission for aerial photography related to the Mapping Project.
 - c. Secure permission for the use of radio communication facilities, including transceivers and electromagnetic distance-measuring instruments.
 - d. Secure permission for entry into private properties and restricted areas and the felling of trees when necessary.
 - e. Hiring of laborers as needed, but wages shall be chargeable against JICA funds allotted for the Mapping Project.
 - f. Availability of medical facilities when needed, but medical expenses shall be chargeable against JICA funds allotted for the Mapping Project.

VIII. SECURITY ARRANGEMENTS

- 1. The following security arrangement will be taken in the implementation of the Mapping Project.
 - a. The Government of Japan, will submit to the Government of the Republic of the Philippines all materials acquired in the Philippines for the implementation of the Mapping Project, including those enumerated in the APPENDIX III and all products thereof. The Government of Japan, wishes to receive two copies of 1/25,000 Topographic

Maps from the Government of the Republic of the Philippines, one copy to be kept in the Ministry of Foreign Affairs of Japan and the other to be kept in JICA, as the record of the said Project. The copy thus received by the Ministry of Foreign Affairs will be treated as confidential.

The standing orders of the JICA provide that all products of the surveys conducted by the JICA shall be kept confidential. The contract between the JICA and private contractor for the Mapping Project prohibits the latter from revealing any confidential knowledge acquired through implementation of the Mapping Project.

- b. The Government of Japan will take necessary measures for JICA to accept two security officers. The two security officers will be responsible at all times for the processing, handling, reproduction, safekeeping and final disposition of all aerial photographs and reproducible mapping materials in accordance with relevant laws and regulations of the Philippines.
- c. The JICA shall submit detailed background information on the aerial survey group and all its personnel who shall be working on the Mapping Project in the Philippines and the key personnel who shall be working on each stage of the work in Japan, to the Ministry of National Defense, through

the Ministry of Foreign Affairs, Republic of the Philippines, for purposes of accreditation/ clearance prior to the start of the Mapping Project.

2. The Government of the Philippines, shall take the following necessary measures:
 - a. To ensure the safety of the survey teams while working in dangerous or critical areas, the BCGS shall arrange with proper authorities for necessary security details.
 - b. To issue proper ID cards or Credentials to Japanese personnel who shall be working on the Mapping Project.
 - c. To effect the smooth transfer of data and materials, including aerial photographic films from the Philippines to Japan or vice versa, for the purpose of executing the Mapping Project.
3. Provisions for the reception by the JICA of Philippine security officers as JICA trainees:

The JICA shall receive two security officers, who shall have basic knowledge of photogrammetry, to Japan as JICA trainees, who at the same time will have custody of the aerial negatives or diapositives during the work to be undertaken in Japan and will jointly supervise, with their Japanese counterparts, the actual compilation work to be done thereon.

Note: This Implementing Arrangement shall come into force on the date of the exchange of Diplomatic Notes between the Government of Japan and the Government of the Republic of the Philippines.

SCOPE OF WORK AND REQUIREMENTS FOR THE
AERIAL PHOTOGRAPHY OF CAGAYAN VALLEY, PHILIPPINES

1. SCOPE OF WORK:

Aerial photography shall be carried out by the CONTRACTOR for the photographic mapping project of the Cagayan Valley, of which the survey and mapping have been entrusted to the International Engineering Consultants Association (IECA) by Japan International Cooperation Agency (JICA)

2. AREA:

The area to be photographed is outlined on attached Flight Map marked as Encl. 1, and covers approximately 15,000 sq. km.

3. COMMENCEMENT OF THE WORK:

All arrangement for the personnel of high-skill, materials, facilities and/or equipment necessary for this work shall be prepared quickly by the CONTRACTOR so that the flying can be commenced from the Tuguegarao Airport or Cauayan Airport, within fifteen (15) days after receipt of the notice of commencement from the International Engineering Consultants Association (IECA). IECA will make every effort to give the CONTRACTOR preliminary notice to start mobilization as far in advance of the notice of commencement as possible. CONTRACTOR should, afterwards, stand-by on site so as to fly when IECA requires.

The whole work, shall be completed within ninety (90) calendar days after receipt of the notice to start the work.

4. REPRESENTATIVE OF IECA ON SITE:

IECA will dispatch its personnel in the Philippines as its representative in order to supervise and check the photo-flights of the CONTRACTOR.

Detail indication and minor modification of the specification as set forth below, within the extent of not affecting contract amount as mutually agreed by both parties will be ordered on site by the IECA representative.

5. EQUIPMENT TO BE UTILIZED:

5.1 Aircraft

The survey aircraft to be used in the performance of the contract work shall have a Civil Aeronautics Administration airworthiness certificate. It shall be equipped with all the essential navigational and photographic instruments. It must have the requisite photographic cruising speed and operating range, a high rate of climb, good stability while in flight, good field of view for visual navigation and a service ceiling at full load equal to or higher than the highest altitude required for the project. The design of the aircraft shall be such that there shall be an unobstructed field of view for the total image area of the camera, shielded from exhaust gases, oil and turbulence of airflow caused by propellers.

No window of glass, plastic or other materials shall be interposed between the camera and the ground to be photographed.

5.2 Aerial Camera

Aerial camera to be used for the photography shall be a modern aerial survey camera such as ZEISS RMK A15/23, or WILD RC-8, RC-10 type with wide angle lens (6 inches focal length), which has a calibration report indicating it has been tested within two years.

The calibration report should include:

- a) The maker's serial number of the camera and the serial number of the lens.
- b) The coordinates of the principal point with reference to the fiducial marks.
- c) The radial distortions of the image, with reference to the principal point as origin.
- d) The calibrated focal length at which these distortions apply.
- e) The certificate as by whom and when the camera was calibrated.

5.3 All equipment and copies of the last calibration certificate of the above equipment should be agreed on and submitted to IECA before commencement of the work.

5.4 Laboratory

The contractor's laboratory shall be spacious enough

to meet the expected operational requirements and shall be adequately equipped and staffed with sufficient qualified personnel to facilitate high quality production in such a volume as the contract may require.

6. PERSONNEL TO BE EMPLOYED:

CONTRACTOR should employ or hire skilled and welltrained personnel for this kind of work, and submit to IECA their experience previously for the acceptance of IECA.

IECA shall have the right to reject and direct the replacement of CONTRACTOR's personnel who is judged "unqualified" by IECA for the execution of the work.

7. SPECIFICATION:

7.1 Flight Plan

The flight plan is attached as Encl. 1 and was prepared was prepared on a topographical map of the area at scale 1:250,000. The flight plan shows the lines to be flown and the required coverage beyond the boundaries of the area to be mapped. The directions of the flight lines are shown as such on the flight plan. Flight line No. C1-C15 are planned to fly over the center of the Philippines standard medium scale in Zone III. Easting of the flight lines are $612,500m - (n \times 5,000m)$.

where: N = No. of the flight line

Therefore the spacing between adjacent flight lines are exactly 5,000 meters.

Flight of the north-east and north-west shore line area (line No. C16-C19) and control flight (line No. BCl-BC5) are not followed in this condition.

7.2 Photo Scale and Altitude

The aerial photography shall be taken at average scale of 1/30,000.

Flying altitudes for each lines are shown on the list of flight line marked as Encl. 2.

7.3 Aerial Films

- a) The aerial film to be used shall be with a fine grain freshly coated emulsion and the base shall have minimum differential distortion.
- b) Negatives shall be clear and sharp in details and of uniform density. They shall be free from clouds, smoke, haze, light streaks, shadows, tears, scratches and other blemishes.
- c) To ensure dimensional stability, the film shall not be stretched or otherwise deformed in any way. Special care shall be exercised to ensure proper development and thorough fixing and washing of all films; and to avoid rolling of film tightly on drums during processing and drying. About one meter at each end of a roll shall remain unexposed.

7.4 Flying Requirements

- a) The photography will be undertaken so as to provide complete stereoscopic coverage over the specified area.

- b) The area will be covered with straight strips of photographs having overlap of about 60 ± 7 percent.

The sidelap (overlap of parallel strips of photography) shall average 27.5 percent. In no case shall the sidelap be less than 10 percent on the area to be mapped. In the event of considerable variations in ground level, a reasonable increase in the specified overlaps will be accepted.

- c) Crab shall not exceed 10° or be such that stereoscopic gaps in the photography result from it.
- d) Tip and tilt should not exceed 4°
- e) The centers of the first one and the last one photograph shall fall outside the required area boundary.
- f) Exposure of photography should be so that even in the shadows caused by topographic relief, satisfactory identification of details is possible.
- g) Where breaks in a flight strip are necessary the minimum overlap between segments of the strip shall be at least three (3) exposures.

Any segment of a flight strip resulting from necessary breaks shall consist of no fewer than eight (8) exposures.

- h) Reasonable effort will be made to obtain cloud free photographs and five percent of clouds appearing in each photograph may be considered as tolerable.

In no case, however, shall clouds fall on control points and principal points.

- i) All flight strips shall be centered as close as possible over flight lines plotted. No flight strip or segment of a flight strip shall depart from its plotted position on the flight map by more than forty (40) percent of the specified mean side lap distance. Failure of any flight strip or section thereof to meet these requirements may be a cause for rejection.
- j) Attention of the CONTRACTOR is directed to all existing regulations concerning restrictions and procedures on photography of classified installations and/or reproducing, publishing or selling photographs of such installations. The CONTRACTOR shall meet the Ministry of National Defense security requirements before taking photographs of classified areas or installations.
- k) A flight report has to be delivered for each film containing the following information (see Encl. 3):
 - 1) The name of the contract
 - 2) The name of contractor
 - 3) The number of the film
 - 4) The time of the first and last exposure for each run
 - 5) The date exposed
 - 6) The serial number of the camera, magazine and the lens

- 7) The calibrated focal length given in the calibration report
- 8) Lens aperture, filter, shutter speed
- 9) Type of film
- 10) Aircraft number
- 11) Height above sea level
- 12) Weather conditions, etc.

7.5 Indexing and numbering of films shall conform to the specifications of the Bureau of Coast and Geodetic Survey (BCGS), the Philippines. Each film and each aerial negative shall be marked clearly of the block type lettering approximately one sixth (1/6) inch high and positioned so that each group will not be less than 1/8" or more than 1/4" from the related image edge of the negatives.

a) Filmmarkings - Each negative roll shall be numbered consecutively starting with No. 001. Each end of each roll shall be clearly marked with:

1. Contract Number or Project Designation:

CAGAYAN VALLEY

2. The name of the island: LUZON

3. Roll Number.

4. Dates on which exposed, together with relevant negative numbers.

5. Serial number of camera optical unit and the principal distance as shown in the calibration certificate.

6. Corrected height (not indicated height) above mean sea level at which exposed, together with relevant negative numbers. When a roll is exposed at more than one height, all heights should be shown against the relevant numbers;

e.g.:

011-075 flown at 25,000 ft above m.s.l.

076-110 flown at 24,000 ft above m.s.l.

111-200 flown at 19,000 ft above m.s.l.

b) Negative Numbering

Negative numbering will be instructed later.

7.6 Contact Prints

- a) Contact prints from the negatives of the aerial photography shall be made on double weight semi-matte standard commercial grade photographic paper and shall be trimmed with a margin of approximately one-fourth (1/4) inch outside of the photographic image including the space necessary to show the registering instrument clearly.
- b) Special care shall be exercised to ensure the proper development and the thoroughly fixing of contact prints. All prints shall be clean and free from stains, blemishes, uneven spots, light fog, and finger marks, and shall be thoroughly washed to completely eliminate the hypo or any other chemicals which would impair their permanency.

7.7 Photo Index

A photo coverage index of the project shall be prepared to check for overlaps and placement of flight strips against the approved flight plan. The coverage index shall be a line index which shall be prepared on the master reproducible 1:250,000 flight plan sheet. The master sheet will be supplied to CONTRACTOR by the representative of IECA.

8. PROCESSING AND INSPECTION:

8.1 The CONTRACTOR shall process aerial films and make contact prints immediately after the every photographic flight are completed in order to make preliminary inspection of the result and instruct re-flight if it is needed.

8.2 Quality Control Sheet, to be used for record of the result (see Encl. 4) will be inspected by the representative of IECA.

8.3 The CONTRACTOR shall follow any reasonable instructions or technical advices given by the representative of IECA.

9. FINAL MATERIALS TO BE DELIVERED:

9.1 Negatives, Prints and Reports

The following photographic materials and reports shall be delivered or supplied by the Contractor:

- a) All original aerial negatives exposed during the aerial photography under this contract.

The films are to be on metal spools in metal containers properly labelled. The labels shall be one of durable materials and contain the following information:

Contract Number or Project Designation

Name of Contractor

Date Exposed

Roll Number

Numbers of First and Last Negatives

- b) One contact print from every negative of the photography for evaluation.
- c) One contact print from every negative of all accepted photography.
- d) One set of line index in reproducible materials.
- e) All reports required by the specifications.

9.2 Shipment of photographic materials.

All films shall be thoroughly cleaned, placed on spools and original metal containers, and sealed with emulsion facing the core of the roll and the outside edge secured to prevent unrolling. Contact prints shall be arranged and bound by flight strip and shall be identified by flight strip number, and relevant roll and negative numbers. Photo index negatives and prints shall be delivered in flat position.

10. DELIVERY POINT:

All finished products and materials to be completed by the CONTRACTOR and required under this contract, and all records, drawings and other technical data used by the CONTRACTOR's expense to the BCGS, Manila, Attn.:
IECA Representative.

JOINT MEMORANDUM COVERING THE TOPOGRAPHIC MAPPING
PROJECT OF THE CAGAYAN VALLEY UNDER THE
TECHNICAL COOPERATION BETWEEN BCGS AND JICA

In response to the request of the Government of the Republic of the Philippines, the Government of Japan despatched a preliminary survey team to the Philippines from January to March, 1978.

As a result of the discussions, the Bureau of Coast and Geodetic Survey and the preliminary survey team from Japan International Cooperation Agency hereby mutually agree that the topographic mapping project of the Cagayan Valley shall be carried out based on the Draft of the Scope of Work which is attached hereto.

The following small particulars related to the implementation of the project, which are not mentioned in the Draft of the Scope of Work, are mutually agreed upon by both parties:

I. General

1. The Bureau of Coast and Geodetic Survey, Department of National Defense, hereinafter referred to as BCGS, the central agency responsible for the national mapping program in the Republic of the Philippines, hereinafter referred to as R.P. shall act as counterpart to the Japanese survey teams and also as coordinating body to other concerned governmental & non-governmental organizations of R.P. for the smooth implemen-

tation of the project.

2. The members of the Japanese survey teams who will work in the Philippines on this project possess official passports issued by the government of Japan.

3. To ensure the safety of the survey teams while working in dangerous or critical areas, the BCGS shall arrange with proper authorities for necessary security detail.

4. The cost of establishment of additional geodetic control points using JMR Doppler Survey sets, and the recovery and/or re-establishment of 1st order leveling bench marks, including the salary and incidental expenses of counterparts shall be charged to the account of the BCGS.

5. Aside from the two (2) trainees provided in Item No. II-2 below, JICA shall accept several technical men of the BCGS as trainees on special subjects like aerial triangulation, stereo plotting and map compilation.

6. All maps produced under this project shall bear at the lower margin the following:

THIS MAP WAS PRODUCED UNDER A JOINT UNDERTAKING
BETWEEN THE GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES
AND THE GOVERNMENT OF JAPAN.

II. Security

1. The Government of Japan shall take all necessary measures to avoid leakage of confidential information obtained in the implementation of this project.

2. To ensure the safety and security of RP aerial photographs and other by-products while under processing in Japan, two security personnel shall be sent to Japan as JICA trainees, with expenses provided by JICA at standard JICA rates.

3. The trainees chosen by the R.P. as security officers as provided in Item 2 above should preferably possess basic knowledge of photogrammetry.

4. During periods when the aerial photographs and other by-products are not being used by the contractor of Japan the safekeeping of materials will be worked out between the two (2) agencies.

5. Aerial photography and photo-processing of the project are subject to the security regulations of the R.P.

6. The Government of Japan shall furnish to R.P. the bio data of Japanese personnel who shall be working in the Philippines for this project before the start of the operations.

7. The R.P. shall issue proper ID cards or credentials to Japanese personnel who shall be working in R.P. for this project.

8. The Government of Japan shall submit to the R.P. the bio-data of key personnel in each stage of work who shall be working in Japan for this project.

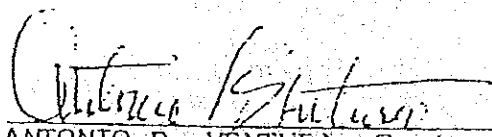
III. Aerial Photography

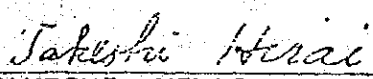
1. The aerial photography of this project in the Philippines shall be performed by a Philippine surveying company under the supervision of Japanese contractor within the budget allocation for the aerial photography.

IV. Technical Details

1. Technical details worked out between BCGS and JICA shall be a part of this Joint Memorandum.

Manila, March 8, 1978


ANTONIO P. VENTURA, Capt., BCGS
Director
Bureau of Coast & Geodetic
Survey
Department of National Defense


TAKESHI HIRAI
Leader
Preliminary Survey Team
of Japan International
Cooperation Agency (JICA)

TECHNICAL DETAILS

I. SPECIFICATIONS

Major specifications of this project are:

- i) Ground control point survey:
Specifications for 2nd order control point survey in the Technical Manual of Overseas Surveying of JICA (hereinafter referred to as TM of JICA),
- ii) Levelling survey for minor height control point:
Specifications for 3rd order levelling survey in TM of JICA.
- iii) Monument: Subject to the specification of BCGS.
- iv) Mapping:
B class mapping specifications for planimetry;
A class mapping specifications for height
- v) Reference Ellipsoid: Clarke Spheroid of 1866
- vi) Vertical Datum: Mean Sea Level (Manila Tidal Station)
Horizontal Datum: Luzon Datum
- vii) Projection: Universal Transverse Mercator for
1:25,000 Topo Map; Philippine Plane
Coordinate System for 1:10,000 Ortho-
Photo Map
- viii) Contour Lines: 10-meter contour intervals (5-meter supplementary contour and 2.5 meter auxiliary contour will be added in case it is needed.)

- ix) Format: 7-1/2' x 7-1/2' for Topographic Map;
5000 m x 5000 m for Orthophoto Map

II. ACCURACY (Standard deviation)

Accuracy of above-mentioned surveys shall be:

- i) Horizontal control survey

$$\frac{\sqrt{\Delta x^2 + \Delta y^2}}{S} = \frac{1}{75,000}$$

- ii) Vertical Control Survey

$$10^{\text{mm}} \sqrt{S} \quad S: \text{distance in km}$$

- iii) Mapping

Planimetry: $\pm 1^{\text{mm}}$ on the map

height $\frac{\Delta h}{3}$, Δh : contour interval

contour $\frac{\Delta h}{2}$

III. WORK TO BE CARRIED OUT BY BCGS:

1. BCGS will establish Doppler Stations in the project area. (See attached drawing). Positioning and signalization of the station will be done prior to the aerial photographic work. Results of this survey will be submitted to the Japanese Survey Team not later than March 31, 1979.
2. BCGS will recover or re-establish 1st order levelling within the project area.

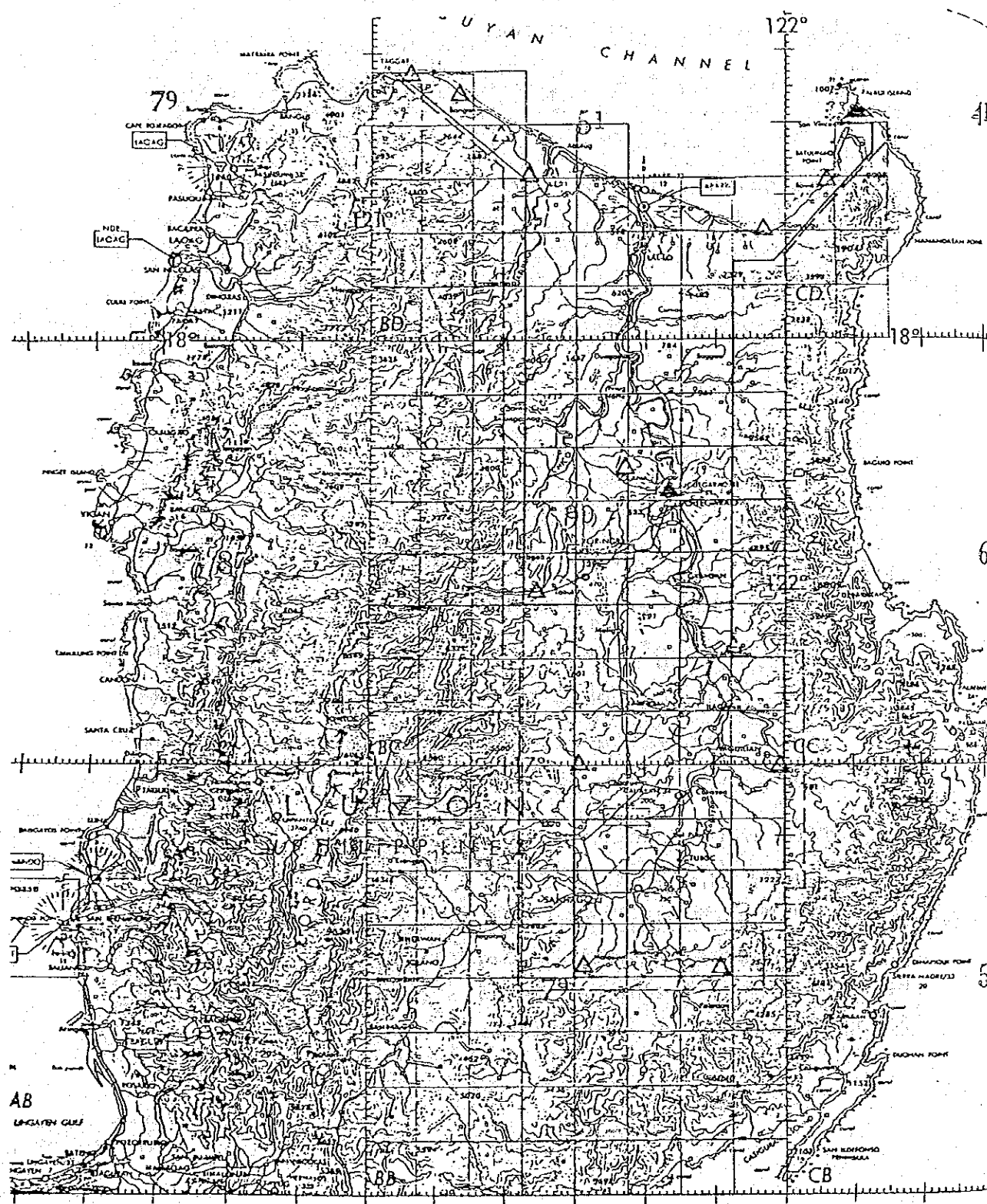
IV. MODIFICATION OF THE TECHNICAL DETAILS

During the execution of the Project, changes may be made in the Technical details by mutual agreement as found necessary by both parties.

DRAWING FOR ITEM III-1 OF MEMORANDUM



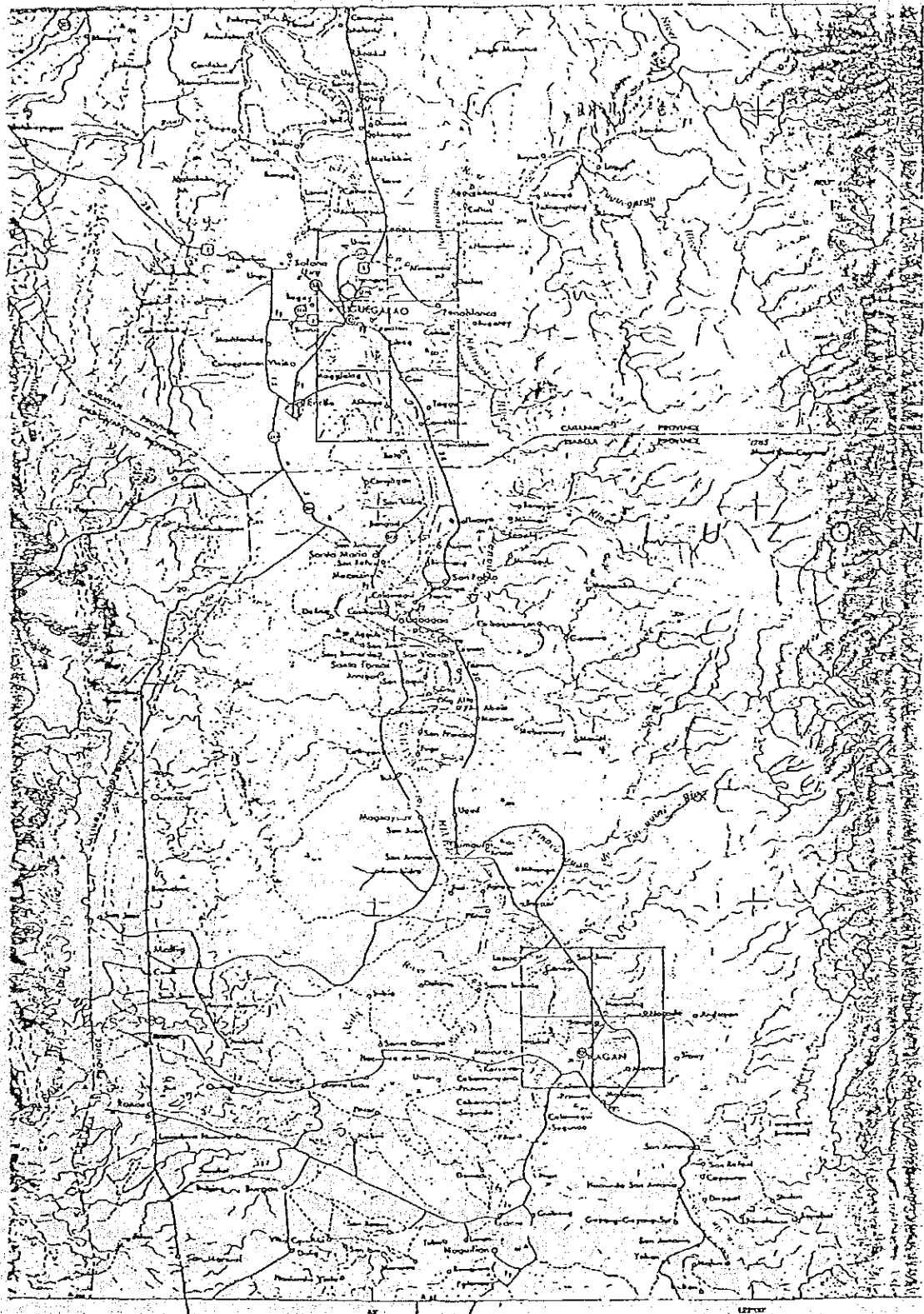
- 1:25,000 TOPOGRAPHIC MAPPING COVERAGE
- 1:30,000 PHOTOGRAPHIC COVERAGE
- ▲ EXISTING DOPPLER STATION
- △ DOPPLER STATION TO BE ESTABLISHED





BUYAN CHANNEL





SCOPE OF WORK
FOR
TOPOGRAPHIC MAPPING PROJECT OF THE CAGAYAN VALLEY,
THE REPUBLIC OF THE PHILIPPINES

I. Introduction

In response to the request of the Government of the Republic of the Philippines, the Government of Japan despatched a survey team to the Philippines in January, 1978 for the purpose of the preliminary study of a mapping project (hereinafter to be referred to as "The Project") to prepare topographic maps and orthophotomaps of the Cagayan Valley, northern part of Luzon Island of the Philippines, which are prerequisite for the planning of various development projects in this area.

Based on the report of the above survey team, the Government of Japan decided to undertake the Project in accordance with laws and regulations in force in Japan with regard to the technical assistance programs. The Japan International Cooperation Agency (hereinafter to be referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will carry out the works necessary for the Project.

II. Working Plan

The Project will be composed of the following works:

Aerial photography (1/30,000) covering the area approximately 15,000Km²;

Topographic mapping (1/25,000, contoured) covering the area of approximately 11,000Km²; and orthophotomap production (1/10,000) covering the area of approximately 300Km² (See Appendix I).

The entire work shall be carried out under a 4 year program starting from the year of 1978 and shall consist of the following phases:

Phase 1. Aerial Photography.

Phase 2. Ground Control Point Survey (Satellite Geodesy, Triangulation, Traversing, and Leveling) and Field Identification.

Phase 3. Aerial Triangulation, Stereo-plotting and Field Completion.

Phase 4. Orthophotomap Production.

Phase 5. Colour Separation Drafting and Printing.

Phase 1. Aerial Photography

1-1 Aerial photographs shall be taken at the scale of approximately 1/30,000 to cover the Project area with a wide angle precision camera.

Phase 2. Ground Control Point Survey (Satellite Geodesy, Triangulation, Traversing, and Leveling) and Field Identification.

2-1 Satellite Geodesy

Additional primary geodetic controls shall be established by the method of artificial satellite Doppler system.

2-2 Triangulation and Traversing

Minor horizontal control points, necessary for aerial triangulation and mapping work, shall be established by triangulation or traversing.

Accuracy of observations and monumentation of control points shall conform to the specifications established by both parties.

Aerial signals shall be established prior to the aerial photography, whenever possible.

2-3 Levelling

Levelling shall be carried out to obtain vertical controls necessary for aerial triangulation and mapping work. The levelling consists of the 1st order and minor order levellings starting from the existing 1st or 2nd order bench marks. Accuracy of observations and monumentation of bench marks shall conform to the specifications established by both parties.

2-4 Field Identification

The topographic information related to land classification, vegetations, etc. shall be verified in the field using the aerial photographs. Style sheet and symbols shall be those adopted by the Bureau of Coast and Geodetic Survey (hereinafter referred to as BCGS).

Administrative boundaries and geographical names which should be expressed on the maps, shall be identified in the field and shall be shown on the aerial photographs by the staffs of BCGS.

Phase 3. Aerial Triangulation, Stereo-plotting and Field Completion.

3-1 Aerial Triangulation

Aerial Triangulation shall be carried out by an analytical method using stereo-comparators and electronic computer. Adjustment shall be carried out by a block adjustment method.

3-2 Stereo-plotting

The plotting shall be carried out using stereo-plotting instruments at the scale of $1/25,000$ with 10-meter contour intervals. The sheet line shall be $7'.5 \times 7'.5$.

3-3 Field Completion

Topographic features, vegetation, etc. which cannot be plotted shall be supplemented on the compiled sheet in the field. Administrative boundaries and geographical names shall be verified and supplemented, if necessary, on the paper copy of the compiled sheet by the Government of the Republic of the Philippines.

Phase 4. Orthophotomap Production

4-1 Orthophotomaps shall be produced using orthoprojectors at the scale of 1:10,000. The sheet line shall be 5Km x 5Km in the terrain.

Phase 5. Colour Separation Drafting and Printing.

5-1 Colour Separation Drafting.

Based on the compiled sheet, scribing shall be carried out on the stable polyester base for each of the five colour separation plate. Style sheet and symbols shall be those adopted in BCGS.

5-2 Printing

Plate-making shall be carried out using 1/25,000 scribed negatives, and printing shall be carried out by the off-set method.

III. Time Schedule

The whole work will be conducted in accordance with the time schedule. (See Appendix II)

IV. Report and Final Results

The report will be presented to the Government of the Republic of the Philippines by JICA every fiscal year (from April to March). The materials mentioned in Appendix III will be submitted to the Government of the Republic of the Philippines by JICA after having completed the whole work and they shall belong to the Government of the Republic of the Philippines.

It shall be mentioned on the printed maps to the effect that the maps are the result of the cooperation between the Government of the Republic of the Philippines and the Government of Japan.

V. Contribution to the Mapping Project

A. Japanese Contribution

JICA will contribute to the Project by:

- (a) Despatch of a Japanese survey team to carry out the project.
- (b) Preparation of necessary survey equipment and instruments as listed in Appendix IV and any other

necessary equipment and materials for the Project.

(c) Training of the Philippine counterparts.

B. Philippine Contribution

The Government of the Republic of the Philippines is to contribute to the Project by providing the Japanese survey team with the following conveniences, facilities and services for the smooth and effective implementation of the work:

(a) To establish additional primary geodetic control points by JMR Doppler Survey Sets.

(b) To exempt from custom duties, taxes and charges of any kind with respect to the equipment including vehicles, machinery, materials, personal effects and medical supplies necessary for the performance of the duties of the members of the survey team.

(c) To supply available data and information related to the Project.

(d) To arrange for smooth transfer of data and materials including aerial photo films to Japan and to the Philippines for the purpose of executing the Project.

(e) To arrange suitable office spaces with appurtenant facilities, storage facilities and garage in the Project area and one office room in BCGS in Manila.

- (f) To secure flight permission for aerial photography related to the Project.
- (g) To recommend local aerial survey enterprises related to aerial photography.
- (h) To secure permission for the use of communication facilities including tranceiver and electromagnetic wave distance measuring instruments.
- (i) To secure permission of entry into private properties and the restricted areas and felling of trees when necessary.
- (j) To secure the necessary arrangements for the safety of the survey team.
- (k) To arrange for the hiring labourers as needed.
- (l) To arrange for the availability of medical facilities when needed.
- (m) To arrange for no restrictions on funds introduced into the Philippines from external sources by the members of the survey team for the purpose of the Project.

Bank account opened in the Philippines by the survey team members shall remain at their exclusive disposal, and balance on such accounts shall be freely transferable into Japan in any other convertible currency.

- (n) To provide assigned counterparts of the Government of the Republic of the Philippines consisting of a project coordinator and technical men.
- (o) To provide credentials to the members of the survey team for the execution of their activities.

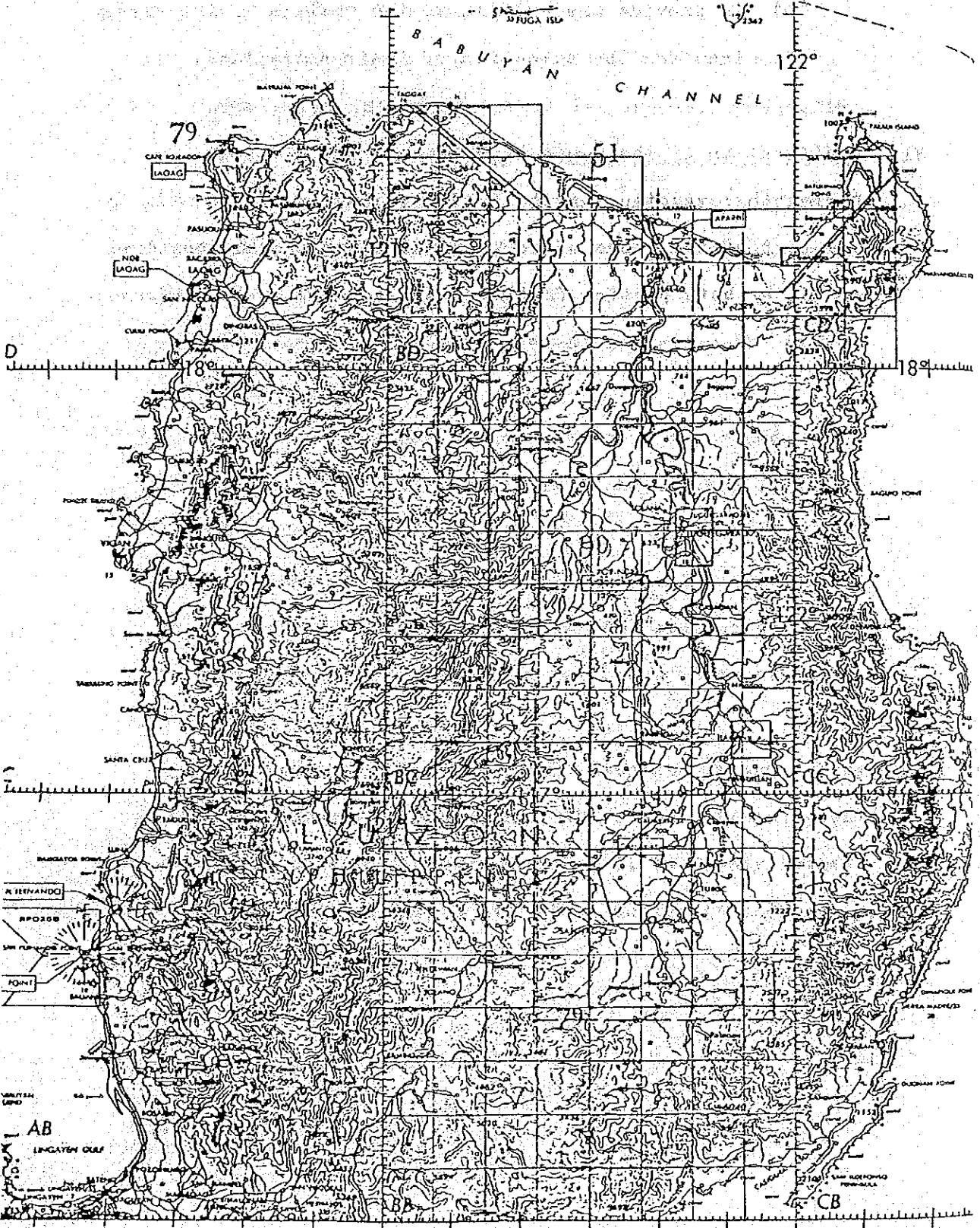
VI. Modification of the Scope of Work

During the execution of the Project, changes can be made in the text of the scope of work by mutual agreement considered useful by both parties facilitating the work to be performed.

APPENDIX I

BUAYAN

- 1:25,000 TOPOGRAPHIC MAPPING COVERAGE
- - - - 1:30,000 PHOTOGRAPHIC COVERAGE
- 1:10,000 ORTHOPHOTOMAP COVERAGE



APPENDIX II

TIME SCHEDULE

	1st year	2nd year	3rd year	4th year
	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3
Signalisation				
Geodetic Control Survey				
Aerial Photography				
Levelling				
Field Identification				
Aerial Triangulation				
Ortho-photo Mapping				
Stereo Plotting & Compilation				
Field Completion				
Colour Separation Drafting				
Printing				

Above mentioned schedules are subject to alteration.

APPENDIX III

Final results

- I. Aerial photography
 1. Original negatives
 2. Contact paper prints (one each)
 3. Photo index sheets

- II. Geodetic Control survey
 1. Horizontal control results
 2. Vertical control results
 3. Computation sheets
 4. Field notes
 5. Description of points

- III. Topographic mapping
 1. Aerial triangulation results
 2. Color separation scribed sheets
 3. 1/25000 Topographic maps (each 1000 copies)
 4. Pricked photos
 5. Original manuscripts
 6. Dia positives

- IV. Orthophoto mapping
 1. Original ortho-photo negatives
 2. Contour overlay
 3. Final ortho-photo positives prints 1/10000 (two sets)
 4. An offset printing plate for each sheet

APPENDIX IV

List of equipment to be used for field survey by the Japanese Survey Team

1. Theodolites
2. Electro magnetic distance measuring equipment
3. Electro optic distance measuring equipment
4. Short wave transmitter receivers
5. Tranceivers
6. Heliotropes
7. Signal lamps
8. Precision levels with staves
9. Auto levels with staves
10. Electronic calculators
11. Vehicles including trucks
12. Camping materials including food staff
13. Materials and components of observation towers
14. Generators
15. Small instruments, office equipment and consumables

Note: Above mentioned equipment are subject to alteration.

第 2 年 次

