FINAL REPORT

SIWA SALLUM 3D

3D HPVA Vibroseis

From June 2007 to September 2007

FOR

APACHE

By

CGG ARDISEIS

Compagnie Générale de Géophysique

CREW EGY3363

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PRESENTATION

GENERAL

This report describes the 3D Vibroseis seismic survey carried out during the period June 2007 to September 2007 close to Marsa Matrouh area, for **APACHE** by the CGG ARDISEIS Crew **EGY 3363** .

This survey has an acquisiton surface of 1146.7 km2 and is constituted with 15 swaths, 192 receivers lines (115704 receiver points) and 171 Source lines (152904 sources points locations).

PROSPECT LOCATION

The Base camp is located for Siwa Sallum 3D prospect at position 30º 12’ 03.0” of latitude North and 25º 47’ 52.9” of longitude East.

Figure 1 - Main location map.

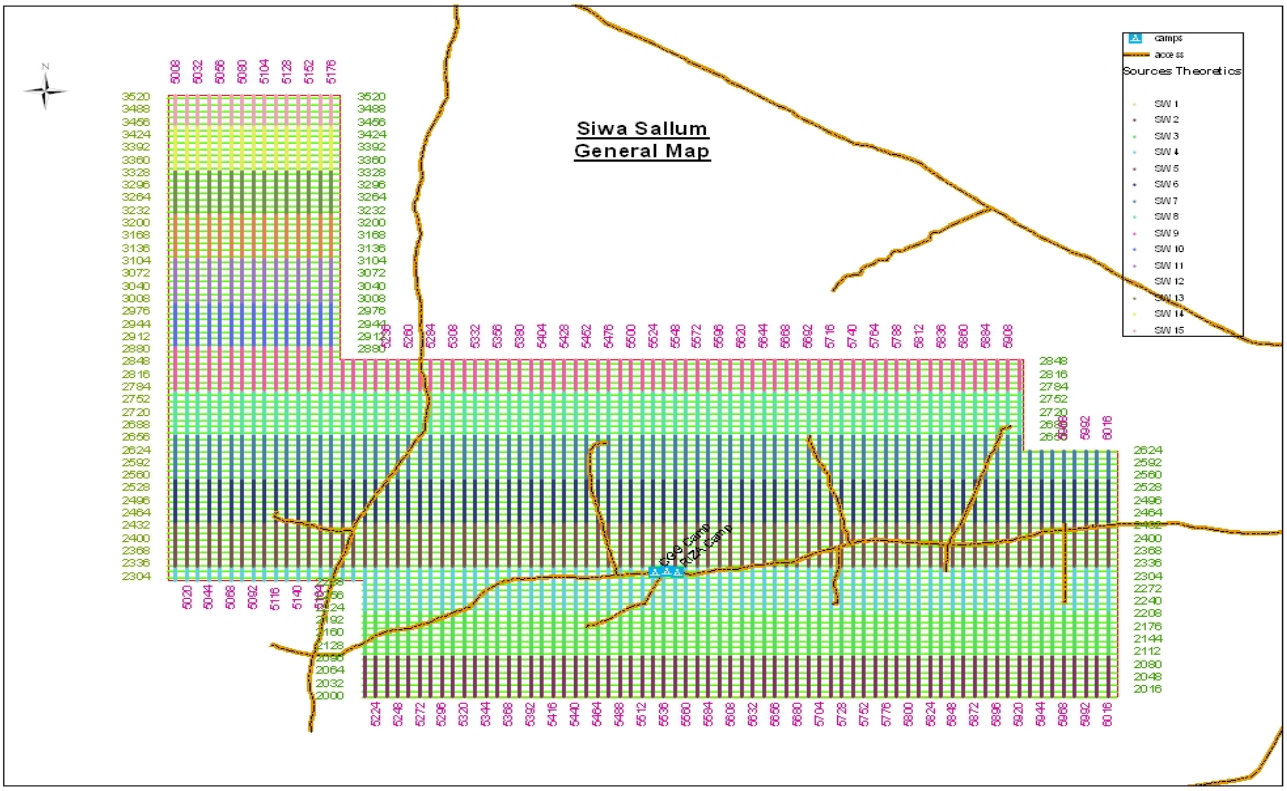


Figure 2 - 3D Siwa Sallum map.

3D spread	
Number of RP lines	14
Swath overlap (lines)	0
Maximum offset	5365 m
Largest minimum offset	333 m
Smallest maximum offset	3997 m
Surface for 1 salvo	0.8400 km2
Fold coverage	
Total	163
In-line	11.67
Cross-line	14.00
Bin size	25.0m × 12.5m
Shot points - SP	
Distance between SP	25.00 m
Not staggered SP cols	
Number of SP per salvo	224
Column spacing	300 m
Nb of shots / km2	266.67
Nb of shot pts / km2	133.33
SP line clearance / km2	3.33 km
Receiver points - RP	
Distance between RP	50 m
Number of RP per line	140
Number of channels	1960
Line spacing	200 m
RP density / km2	100.00
RP line clearance / km2	5.00 km
Number of RP to layout	
-after a salvo is shot	84
-in average per shot	0.38
Receiver aspect ratio	0.37

Figure 3 – Siwa Sallum 3D design.

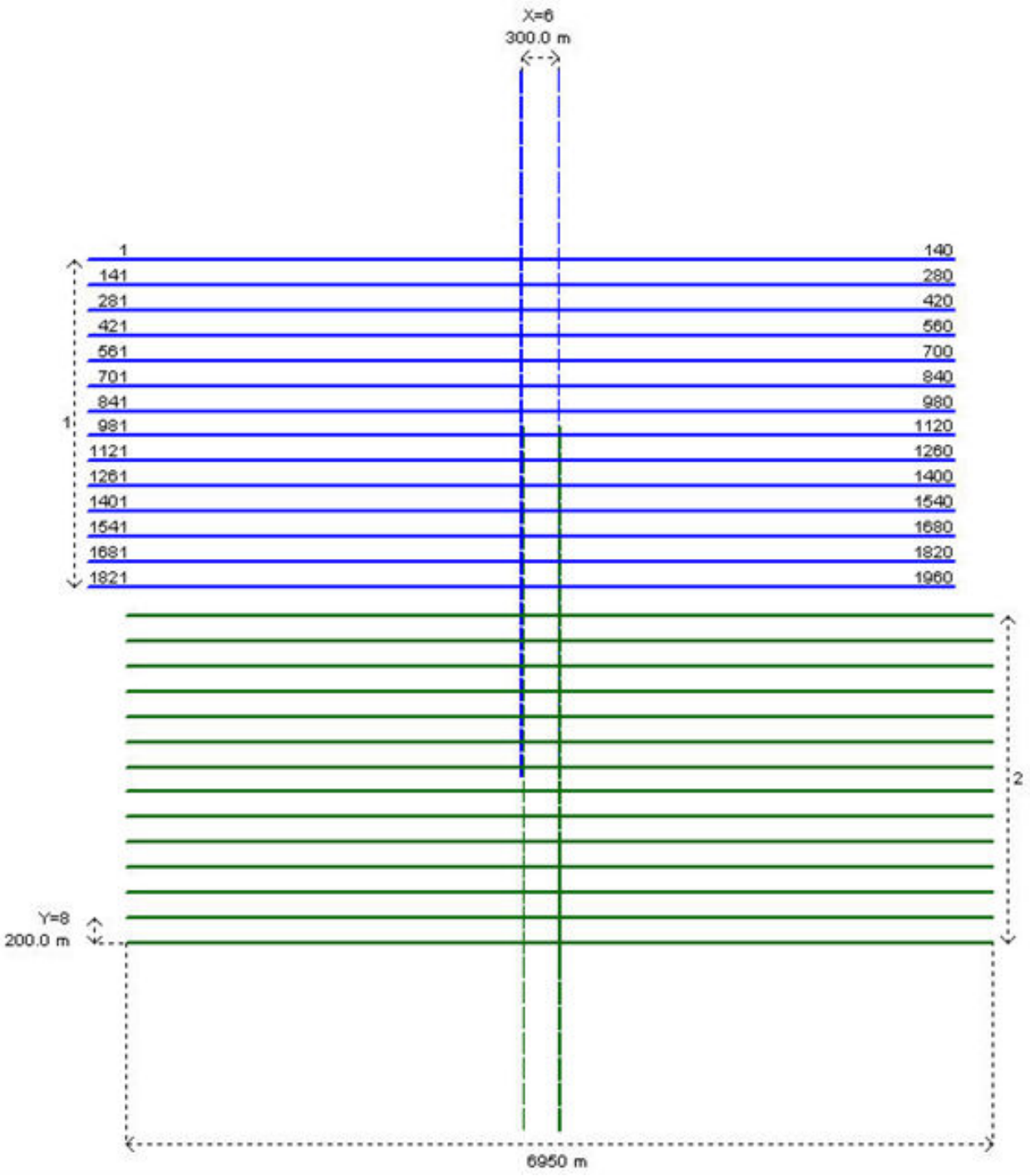


Figure 4 – Siwa Sallum 3D Layout.

Siwa Sallum 3D

	Sources				Receivers			
Swath	**Line min**	**Line max**	**VP min**	**VP max**	**RL min**	**RL max**	**First trace**	**Last trace**
1	5212	6022	2000	2107	2000	2048	5210	6025
2	5212	6022	2000	2219	2056	2160	5210	6025
3	5212	6022	2108	2331	2168	2272	5210	6025
4	5002	6022	2220	2443	2280	2384	5000	6025
5	5002	6022	2332	2555	2392	2496	5000	6025
6	5002	6022	2444	2667	2504	2608	5000	6025
7	5002	6022	2556	2779	2616	2720	5000	6025
8	5002	5920	2668	2891	2728	2832	5000	5923
9	5002	5920	2780	3003	2840	2944	5000	5923
10	5002	5182	2892	3115	2952	3056	5000	5185
11	5002	5182	3004	3227	3064	3168	5000	5185
12	5002	5182	3116	3339	3176	3280	5000	5185
13	5002	5182	3228	3451	3288	3392	5000	5185
14	5002	5182	3340	3527	3400	3504	5000	5185
15	5002	5182	3452	3527	3512	3528	5000	5185

1) No Overlap between Receivers Lines

Sw 1	7 RP Lines
Sw 2	14 RP Lines
Sw 3	14 RP Lines
Sw 4	14 RP Lines
Sw 5	14 RP Lines
Sw 6	14 RP Lines
Sw 7	14 RP Lines
Sw 8	14 RP Lines
Sw 9	14 RP Lines
Sw 10	14 RP Lines
Sw 11	14 RP Lines
Sw 12	14 RP Lines
Sw 13	14 RP Lines
Sw 14	14 RP Lines
Sw 15	3 RP Lines

2) Overlap between Sources Points

	From VPs	To VPs
Sw 1 - Sw 2	2000	2107
Sw 2- Sw 3	2108	2219
Sw 3- Sw 4	2220	2331
Sw 4- Sw 5	2332	2443
Sw 5- Sw 6	2444	2555
Sw 6 -Sw 7	2556	2667
Sw 7 - Sw 8	2668	2779
Sw 8 - Sw 9	2780	2891
Sw 9 - Sw 10	2892	3003
Sw 10 - Sw 11	3004	3115
Sw 11 - Sw 12	3116	3227
Sw 12 - Sw 13	3228	3339
Sw 13 - Sw 14	3340	3451
Sw 14 - Sw 15	3452	3527

SWATH	Number of RP	Number of VPs
1	5712	14688
2	11424	29920
3	11424	30464
4	13944	35644
5	14364	38304
6	14364	37556
7	13140	35652
8	12936	30068
9	4818	16292
10	2604	6944
11	2604	6944
12	2604	6944
13	2604	6944
14	2604	5828
15	558	2356
Total	**115704**	**304548**

Figure 5 – Siwa Sallum 3D descriptor.

NATURAL ENVIRONMENT

The topography in this region is flat desert with an elevation difference upto 40 meters of the whole prospect .

Figure 6 – View of the 3D survey.

CLIMATIC CONDITIONS

The weather was sunny and very windy some afternoons (especially the end of July).
Fog appeared early some days during the month and delayed the time of crew's start of work (end of August and on September).
The temperature became to decrease slightly during September.

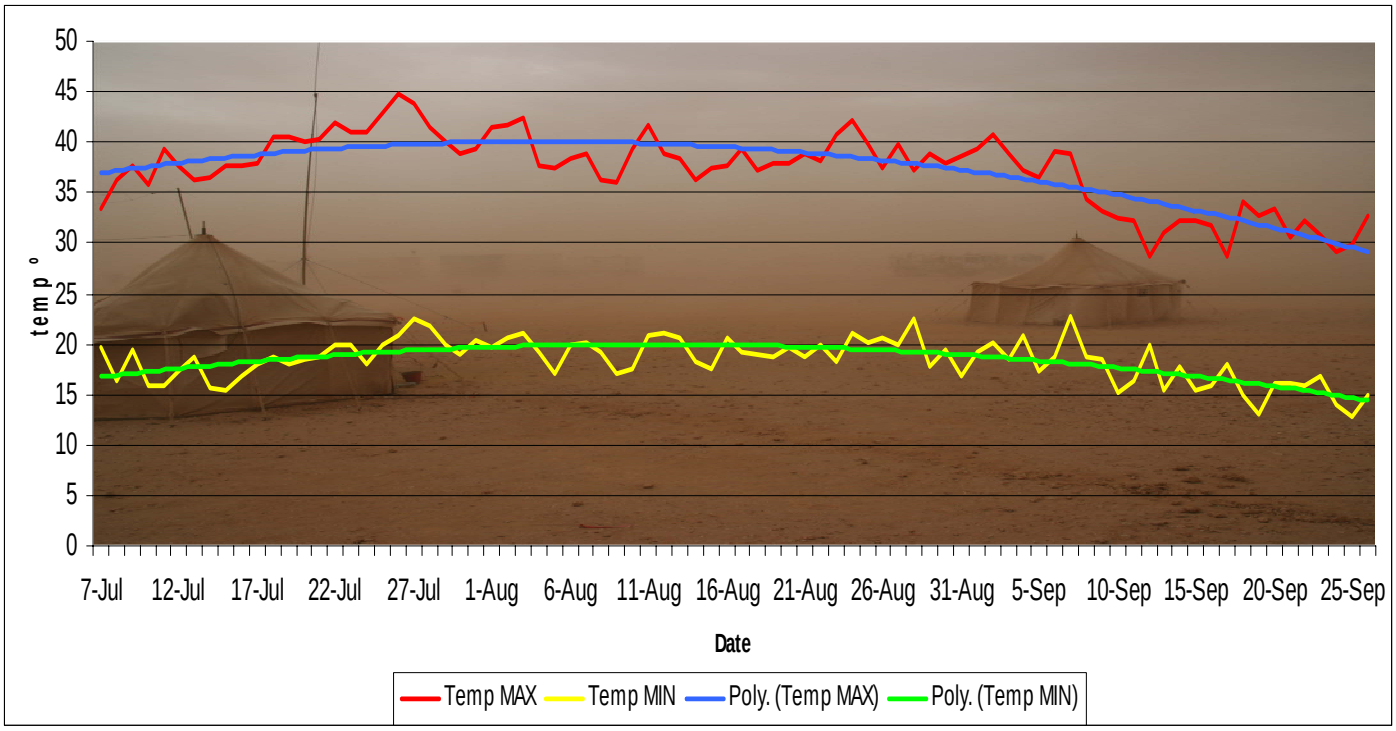


Figure 7 - Overview of the temperatures.

WORKFORCE STAFF ON THE SURVEY

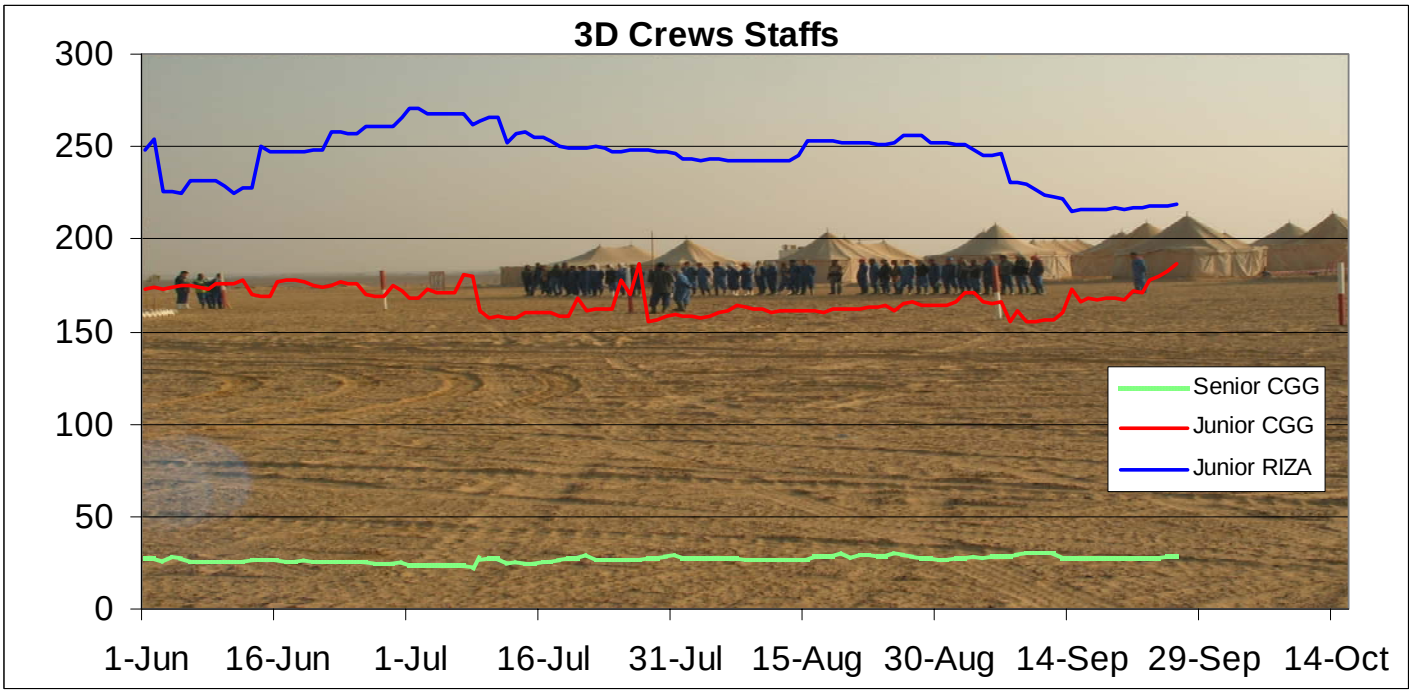


Figure 8 – Crew staff for the 3D crew.

OPERATIONS SUMMARY

OPERATIONS TIMING CHART

Siwa Sallum

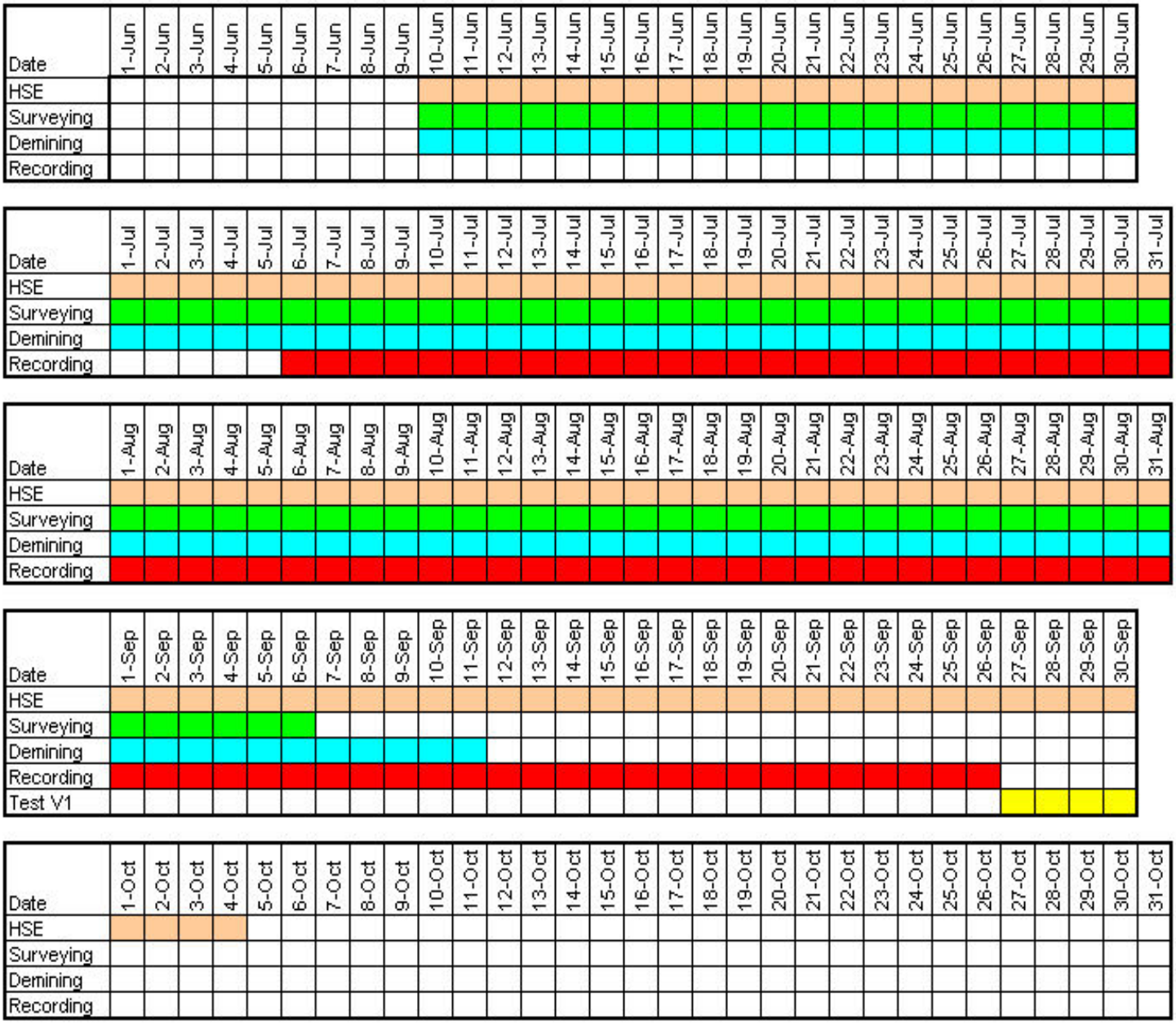


Figure 9 – Operations Timing Chart.

The surveying of the entire prospect took 87 days and recording 83 days.

HPVA TECHNIQUE

HPVA is inspired by the slip-sweep technique, which is essentially designed to boost crew productivity by allowing a vibrator group to sweep without waiting for the previous group's sweep to terminate.

The advantage of the HPVA technique is that it overcomes the technical limitation usually associated with slip-sweep: the recording of harmful harmonic noise, which can contaminate the data. The HPVA technique, patented by CGG, reduces the harmonic noise to an acceptable level. By estimating the harmonic content of each record, noise can be efficiently predicted and subtracted from the field data. This process is performed in the field, usually overnight, generating clean data for processing. As a result, the slip time can be reduced without degrading data quality, thereby improving crew productivity and maintaining the same signal-to-noise ratio.

CAMPS

All staff were installed in the base camp established on July 06th and located in the middle of the 3D prospect until the end of the production.

A fly camp was established on August 15th located in the north of the prospect and used by the recorder crews on August 26th to September 05th and from September 13th to the end of the recording operation.

Communication was ensured by SSB and VHF Radios, 2 Inmarsat telephones, 5 Thuraya .

2 satellite antennas were provided by EgyptSat Company for the base and fly camps for Internet and e-mail communications.

CGG Siclop e-mail system was still kept on the crew but was not used.

Figure 10 – View of the Labo fly camp.

SAFETY

Hygiene/Health:
The main focus on health and hygiene was the maintenance of a high hygienic condition of the base camp.
The medical department has conducted several first aid and hygiene lectures mainly involving the catering and other sections.

Environment:
The back crews picked up the receiver (blue) flags at the same time they picked up the geophones.
Green team: The line cleaning operation (pin flags picking) started on August 15th on source points (red flags) for swaths 1 and 2 and finished at the beginning of October after the V1 test on the north prospect (swath 15).
Labors adhered to environment preservation most of the time. The disposal of garbage is still a big problem in this country.
Back crew picked up receiver (blue) flags at the same time they picked up the geophones.
Labors adhered to the environment preservation policy.

MSV:

One was done on June 16th by Alain Spinella on Riza PPEs Management.
A second one done on June 17th by Muriel Cardinaux and P. Benazet.

Drills:

Man Lost drill was done on June 17th.
Fire drill was conducted on the base camp on June 18th.
MEDEVAC drill on June 24th on survey fly camp on Siwa Sallum prospect.
Fire drill done on June 28th on survey fly camp on Siwa Sallum prospect.
MEDEVAC drill on July 20th.
Fire drill was conducted on the base camp on July 26th.
One MEDEVAC drills conducted on August 19th .
A man lost drill conducted on August 31st.
Fire drill was conducted on the base camp on September 18th.
Medevac drill done with Front Crews on September 25th.

MEDEVAC

A Medevac was done at the end of August to evacuate one RIZA driver to Matrouh after a car accident.

INCIDENTS

Two fire accidents occured end of August, one with the generator of the labo fly camp and the second with a truck's load The reaction of the people present for the two case were satisfactory. The bad point

that some extinguishers, assumed to be good were not. An action point was done to improve this point (checking and remplacement of bad extinguishers).

HSE Statistics:

	June	July	August	September
Medical Check	55	51	51	82
HSE Induction	78	51	37	51
Nbr of people trained	639	191	200	216
Crew committee meeting	5	4	5	3
Sectionnal meeting	25	8	12	3
Inspection	70	77	84	42
Cross-Inspection	8	3	4	0
MSV	2			
External audits				
Drills	4	2	2	2
NEM / UNA	110	57	147	199
MAA				
FAC	4	2	4	1
MTC	1		1	1
RWC				1
LTI				
FAA				
Nbr of day without LTI	30	31	31	26
Working hours	160356	166044	163020	132036

Figure 11 - HSE statistics.

DEMINING

The main hazard faced by the HSE Department during the surveying and recording operations, was keeping all the vehicles inside the de-mined corridors and tracks.

This first step was based on personal behaviour in which some training was added and then monitoring.

Some special measures were implemented to enforce the control of the conducted activities considered as main hazards such as road transportation, trekking, heavy maintenance.

An important point for HSE on this crew is to make sure all cars are driven inside mine cleared corridors to avoid risk of accident with any UXO's outside the corridor.

This lead to the monitoring of the vehicles with the Falcon system and a graphical representation of the journeys (See example below).

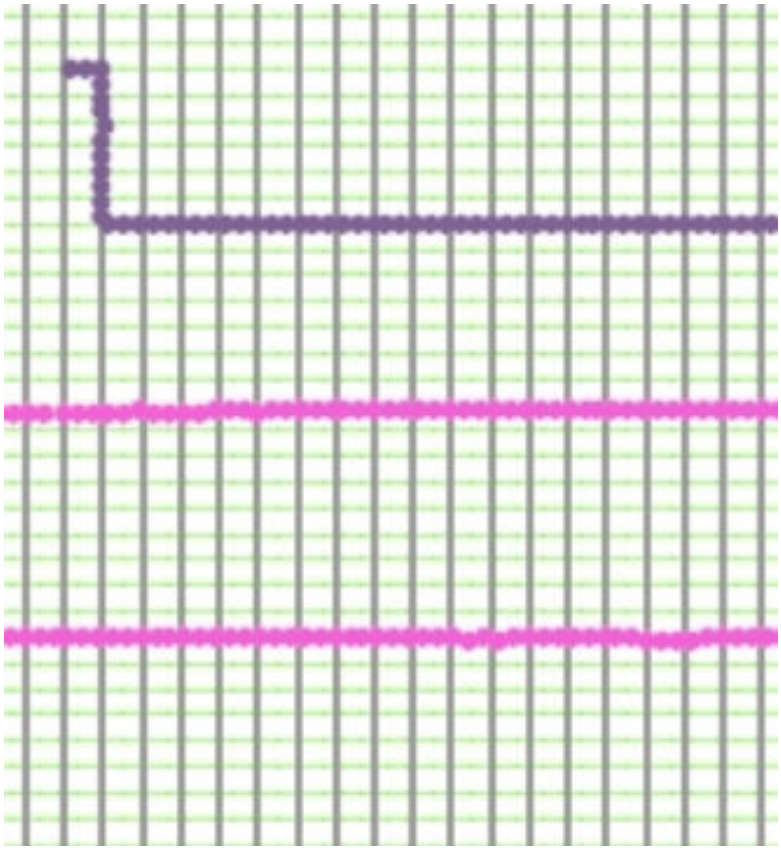


Figure 12 - Falcon monitoring.

During mine clearance operations, munitions were collected and dispatched in a temporary bunker on the prospect close to the military camp.

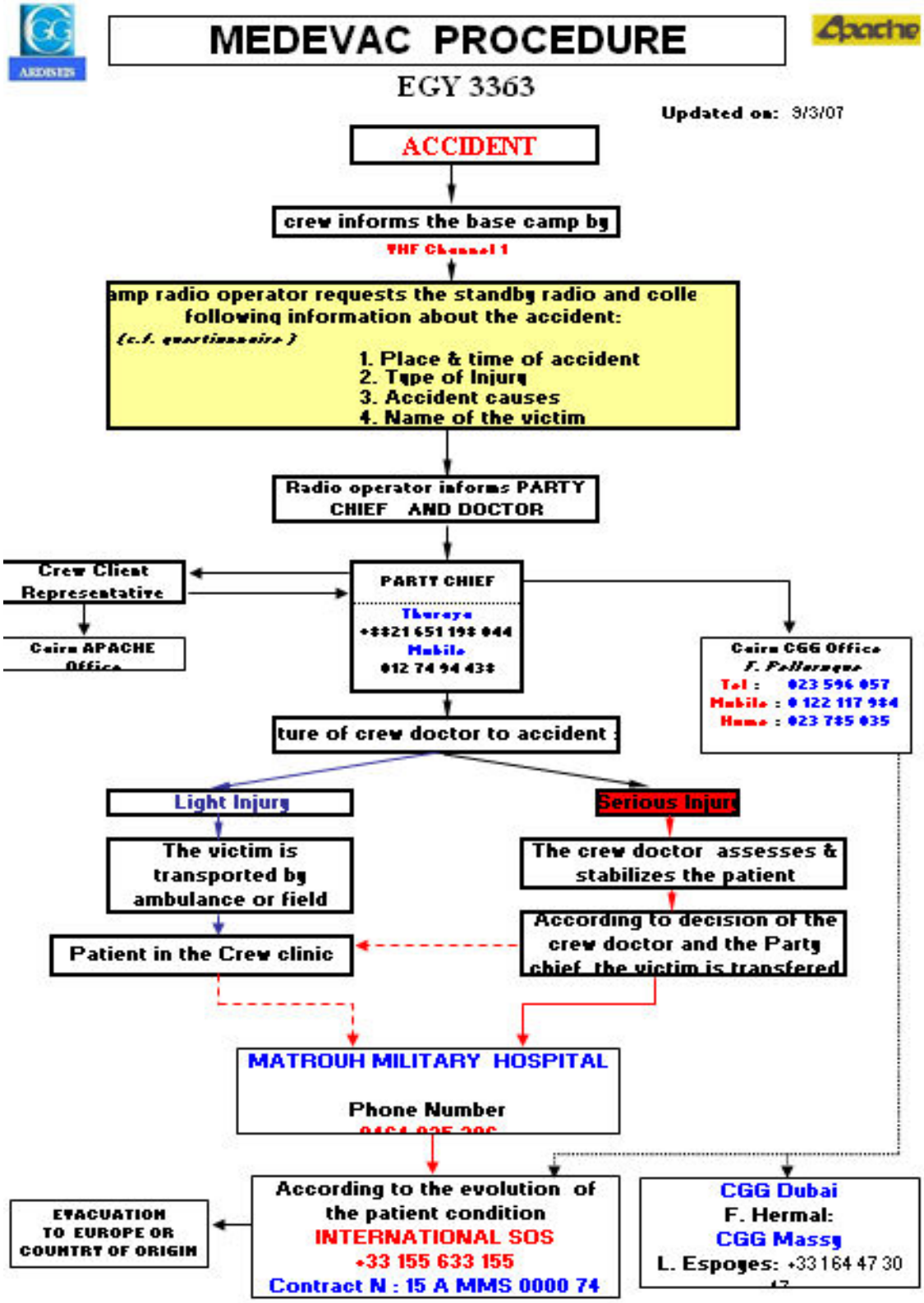
This bunker was cleared and the munitions were destroyed outside the acquisition prospect at the end of the recording production.

CAMP

The demobilization of the Siwa Sallum 3D base camp finished on the 4th of October. It was organised in several small convoys, beginning from the 10st of September (survey crews). There was no incident regarding the move during this period.

Decommissioning of the base camp finished on October 3th and the fly camp on October 2th.
There were approved on October 3th .

EMERGENCY RESPONSE PLAN



HSE PROGRAMS

The following table is an example of HSE program. It schedules all the meetings and trainings for a month.

EGY3363 Siwa Sallum 3D SEISMIC SURVEY

HSE PROGRAMS August 2007

SECTIONAL MEETING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	LOCATON / CHAIRMAN
	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	
SENIOR STAFF																																
COUNTRY Manager Meeting																																Discretion of Country Manager
Crew Committee Meeting																																PC / HSEA
SURVEY Dept																																Survey trailer / Chief Survey
RECORDING																																Discretion of observer
MECHA WORKSHOPS																																Meca Workshops / Chief Mechanic
VIBROSEIS																																Meca workshop / Field manager
CAMP LABOUR																																Near clinic held by the CAMP BOSS
CATERING(Kitchenstaff)																																In senior mess held by DOCTOR
DRIVERS																																Radio tent held by Transport Coordinat
C.REPAIR WKSP																																Line assistant
FIRST AID TRAINING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		DOCTOR
SURVEY & BULLDOZER Dept																																
RECORDING																																
DRIVERS																																
VIBROSEIS																																
CAMP LABOUR																																
CATERING (Kitchenstaff)																																
MECHA WORKSHOPS																																
C.REPAIR WKSP																																
TRAINING																																
Radio Operator																																Radio tent/ HSEA / DOCTOR
Fire Team Training																																Camp / HSEA
Man lost drill																																Discretion of PC
Fire Drills																																Discretion of PC
Medivac																																Discretion of PC
GENERAL CAMP INSPECTION																																Camp boss
Fire alarm test																																Discretion of PC / HSE A
Extinguisher Check																																Camp, Done by HSE Departement
Smoke detector test																																Camp, Done by HSE
RCCB & EARTH test																																Camp, Done camp electrician.

N.B : Please note that the copy of meeting minutes must be given to HSE dpt the same day or a day after the meeting completed.

SURVEYING

MAP PROJECTION : **Purple Belt – Old Egyptian 3 parameters**

Projection Type :	Transverse Mercator
Central Meridian :	27º 00’ 00” East
Latitude of Origin :	30º 00’ 00” North
False Easting :	700 000 m
False Northing :	200 000 m
Scale Factor at Origin :	1

LOCAL DATUM : **EGYPTIAN 1930**

Name :	HELMERT 1906
Semi-major axis :	6378200.00
Inverse flattening (1/f) :	298.300000

SATELLITE DATUM : **WGS 84**

Name :	GRS 1980
Semi-major axis :	6378137.000
Inverse flattening (1/f) :	298.257223563

DATUM SHIFT (From WGS 84 to local) : **3 parameters**

ΔX = + 115.033 m (plus)
ΔY = - 115.760 m (minus)
ΔZ = + 3.978 m (plus)

VERTICAL DATUM : **Mean Sea Level**

Units of measurements : meters
Geoidal model: OSU91a
Constant to MSL Adjustment: +0.70 m

POINT OF ORIGIN FOR THE SATELLITE SURVEY : **2006-WK03(Western Geo.)**

DATUM:	WGS 84	PURPLE BELT (TM)	
Latitude:	30º 50’ 58.9928” North	Easting:	789103.056 m
Longitude:	27º 55’ 59.2277” East	Northing:	294548.694 m
Ellipsoid Height:	152.734 m	MSL Height:	133.998 m

PERSONNEL

- 1 Expatriate
- 1 Field Supervisor
- 13 GPS Operators
- 27 Helpers
- 13 Drivers

EQUIPMENT

Field

- 3 Receivers GPS Trimble 4000 SSI 9 channels L1-L2
- 14 Receivers GPS Trimble 4700 or 5700
- 2 Trimble radios Trimmmark 2 II 25 W for Bases Repeaters; Freq 450 – 470 MHz
- 3 radios Pacific Crest PDL 2W for GPS receivers; Freq 450 – 470 MHZ
- 6 Magellan Meridian color
- 2 Garmin GPSMap 60 CX

Office

Hardware

- 2 Dell Pentium 4 Computers
- 1 HP Deskjet 1280 C printer A3 format
- 1 HP Laserjet 1320 printer

Software

- GPSeismic V 2006.3.00
- Grafnet Grafnav V 7.50.24.26
- Microsoft Office Pro XP
- ArcView V3.2
- ArcGis ArcMap V9.1

Vehicles

- 1 Toyota Pick up
- 3 Toyota Hilux
- 1 Toyota SW
- 8 Toyota HardTop.

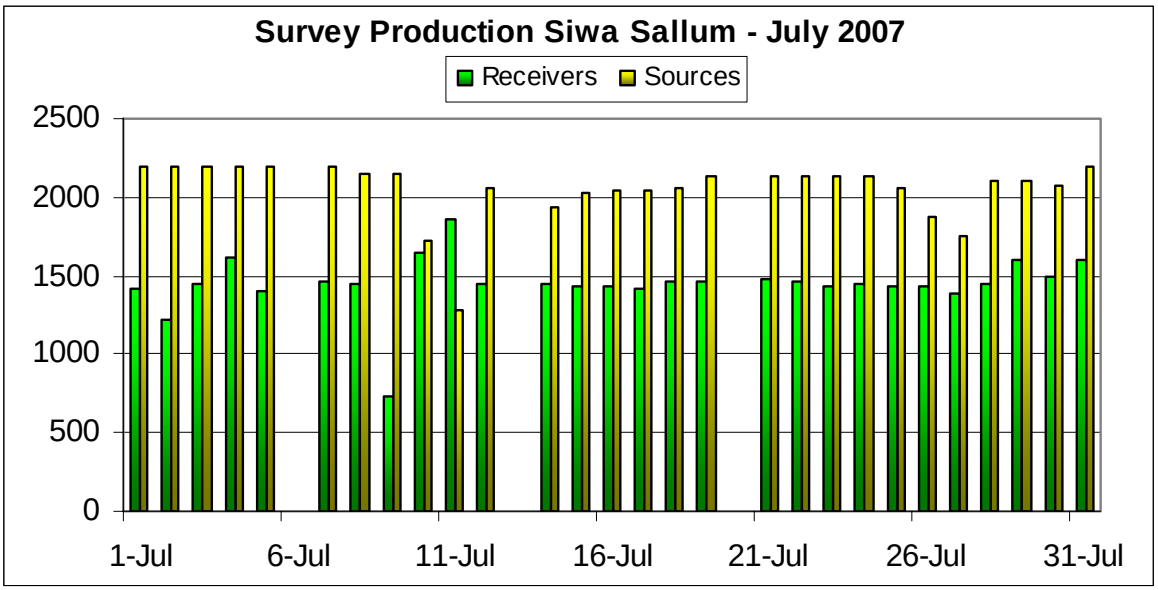


Figure 19 - Surveying production for July 2007.

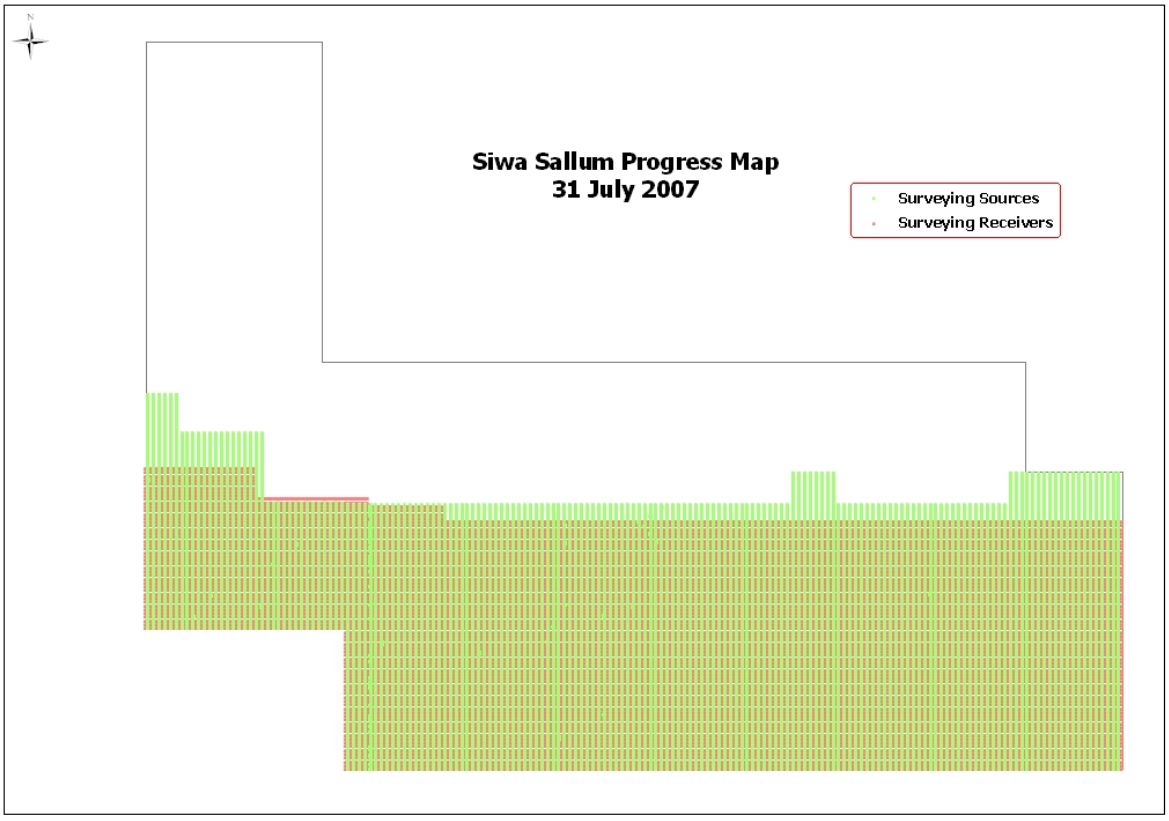


Figure 20 – Surveying progress map end of July.

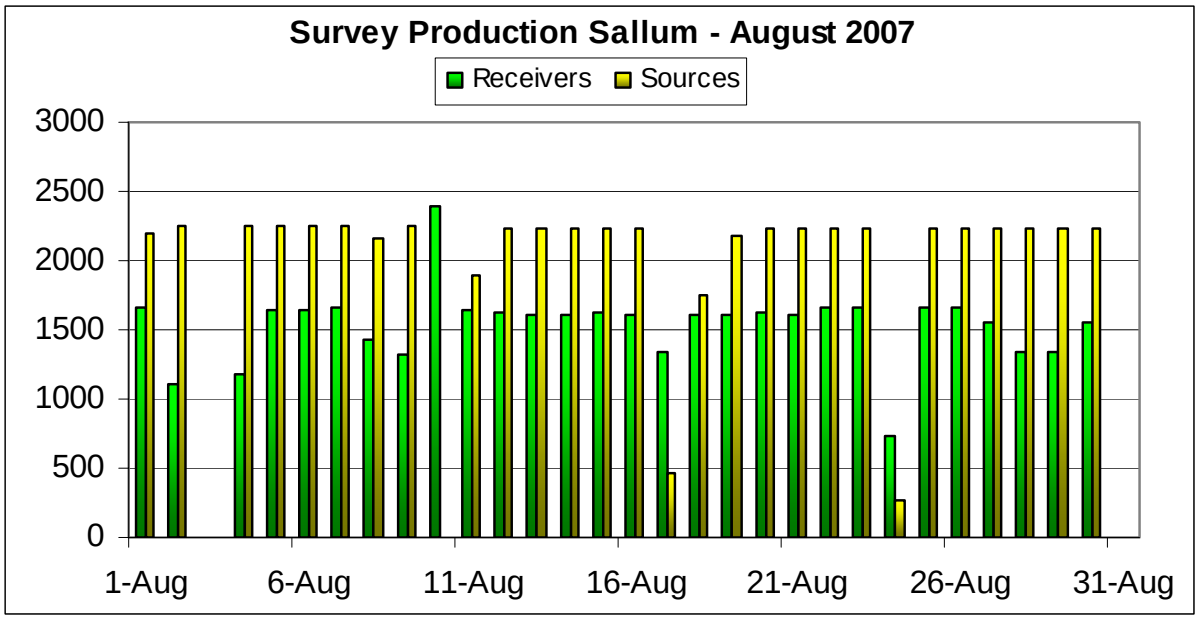


Figure 21 - Surveying production for August 2007.

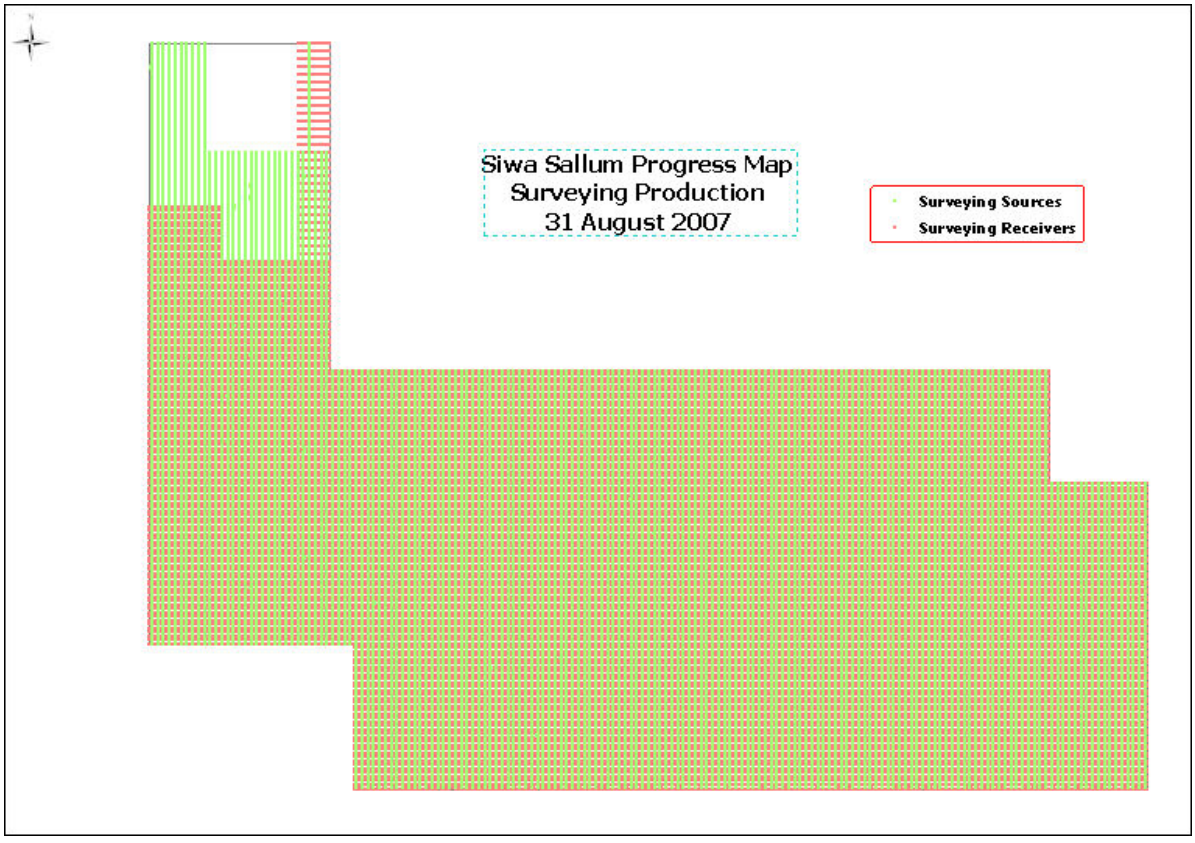


Figure 22 - Surveying progress map end of August.

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Survey operations began on June 09th from a fly camp located at the position of the Base Camp.

At the end of June, 22048 receiver points (19% of the prospect) and 33025 source points (21.6% of the prospect) were surveyed.

At the end of July, 35% of receivers (40548 RPs) and 37.5% of sources (57436 VPs) were surveyed the 3D prospect.

At the end of August, 44652 receiver points were surveyed (38.6% of the prospect) and 57963 source points were surveyed (37.9% of the prospect).

The surveying production finished on September 05th for the receiver points (8456 RPs, 7.3% surveyed in September) and finished on September 02nd for the source points (4480 VPs, 2.9% surveyed in September).

The operations were managed from the Base Camp from the beginning of May.

Even though the production was finished in September, activities continued for the RTK crews:
- some points were resurveyed and other points offset were checked,
- tracking of corridors,
- control and maintenance of survey materials.

As the Mine Clearance crews were not working on Friday, the surveying work was slowed down.

The demining operation finished on Siwa Sallum 3D on September 11st.

MINE CLEARANCE

About 140 military worked on this area to perform the mine clearance :

12 Pilot crews for the production and detours.
12 Main crews under the supervision of 12 MIM Supervisors contracted by Apache.

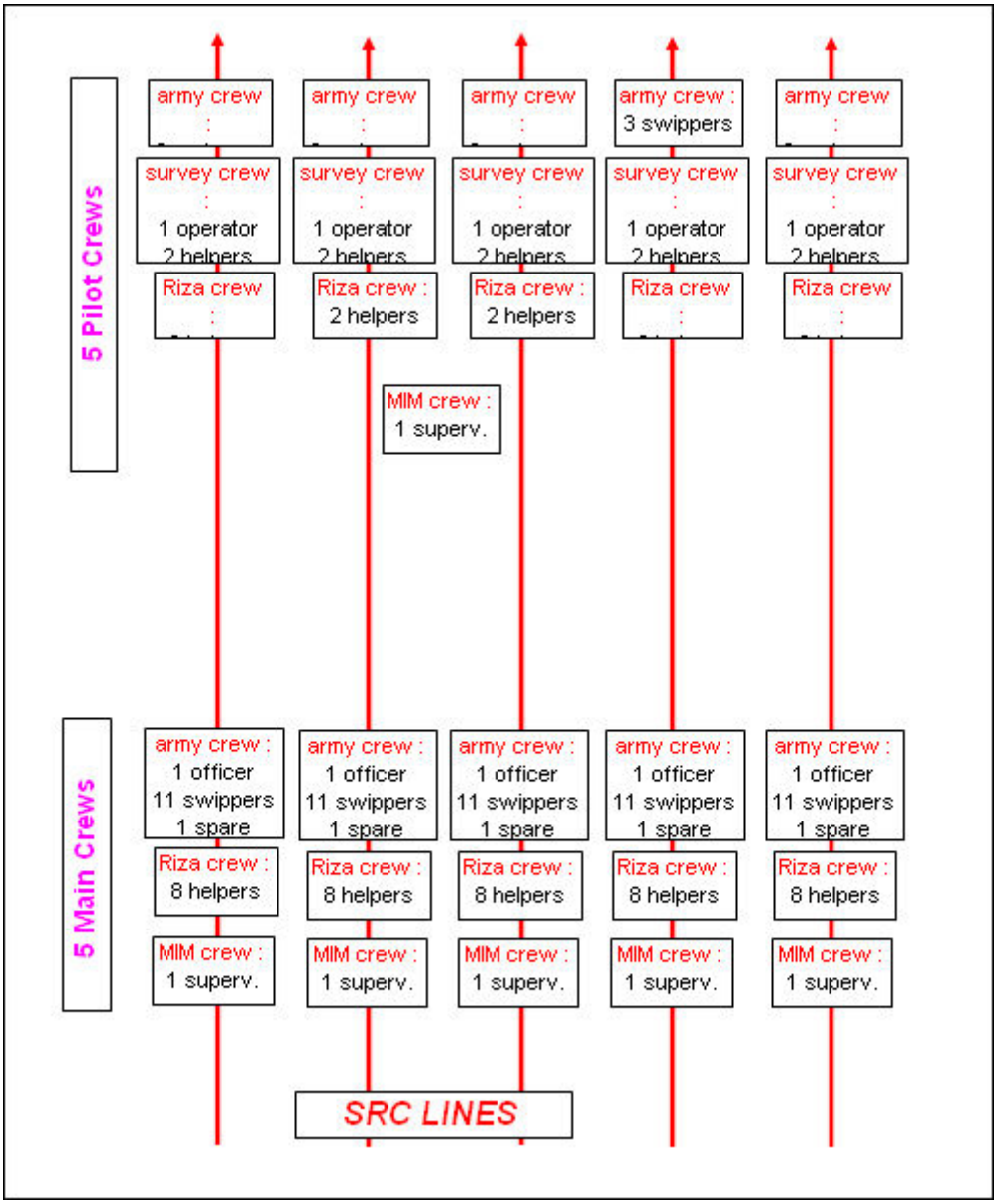

Figure 25 – Organisation of demining crews for source points.

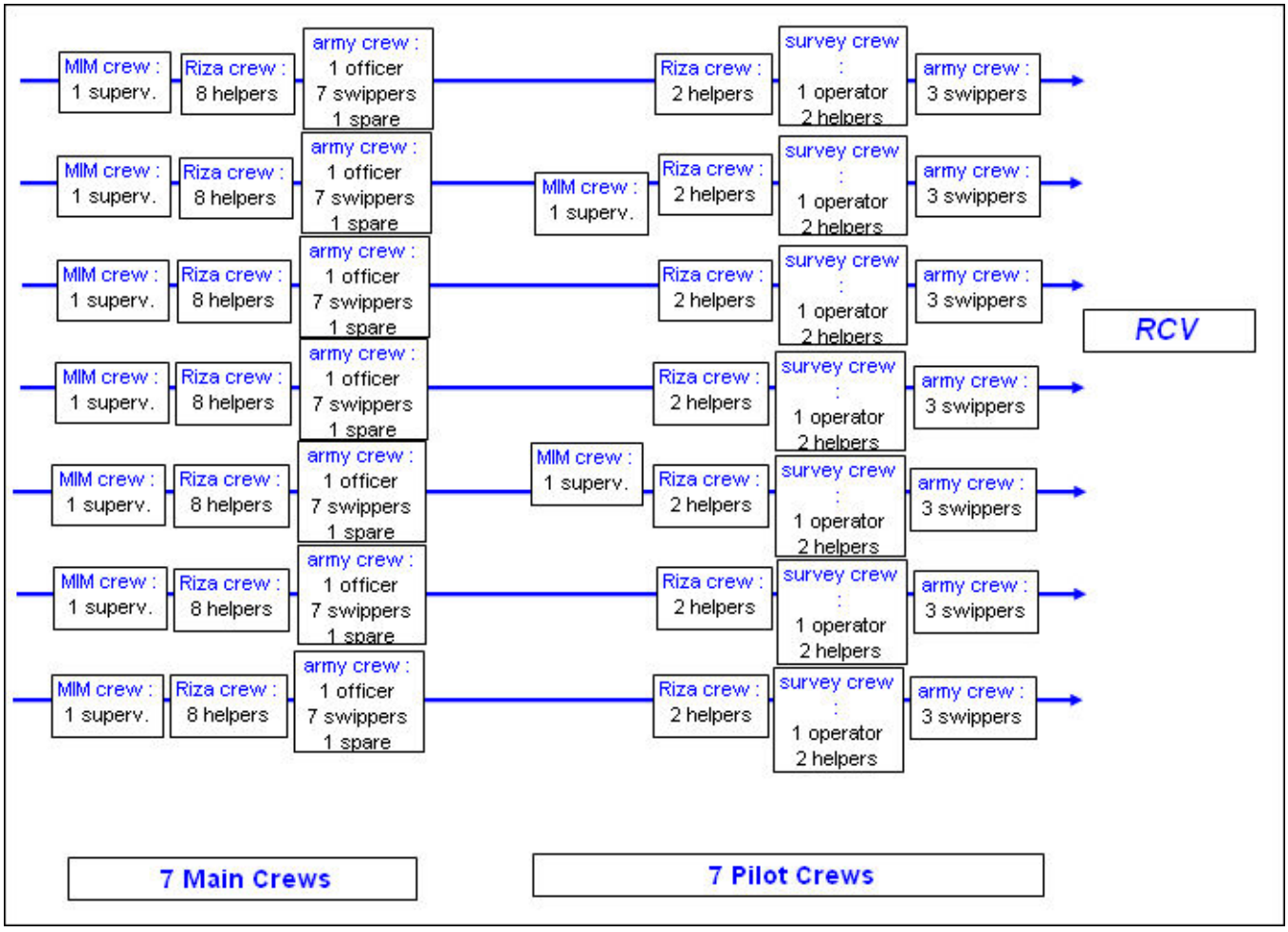

Figure 26 - Organisation of demining crews for receiver points.

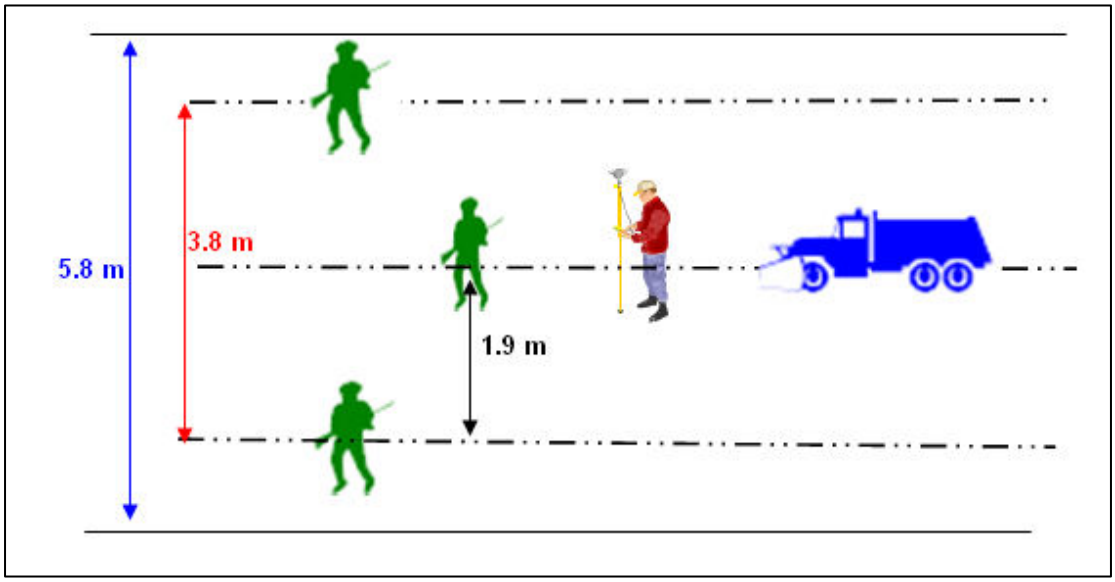

Figure 27 - Pilot crews sketch.

Figure 28 - Military in mine clearance operation on Siwa Sallum 3D.

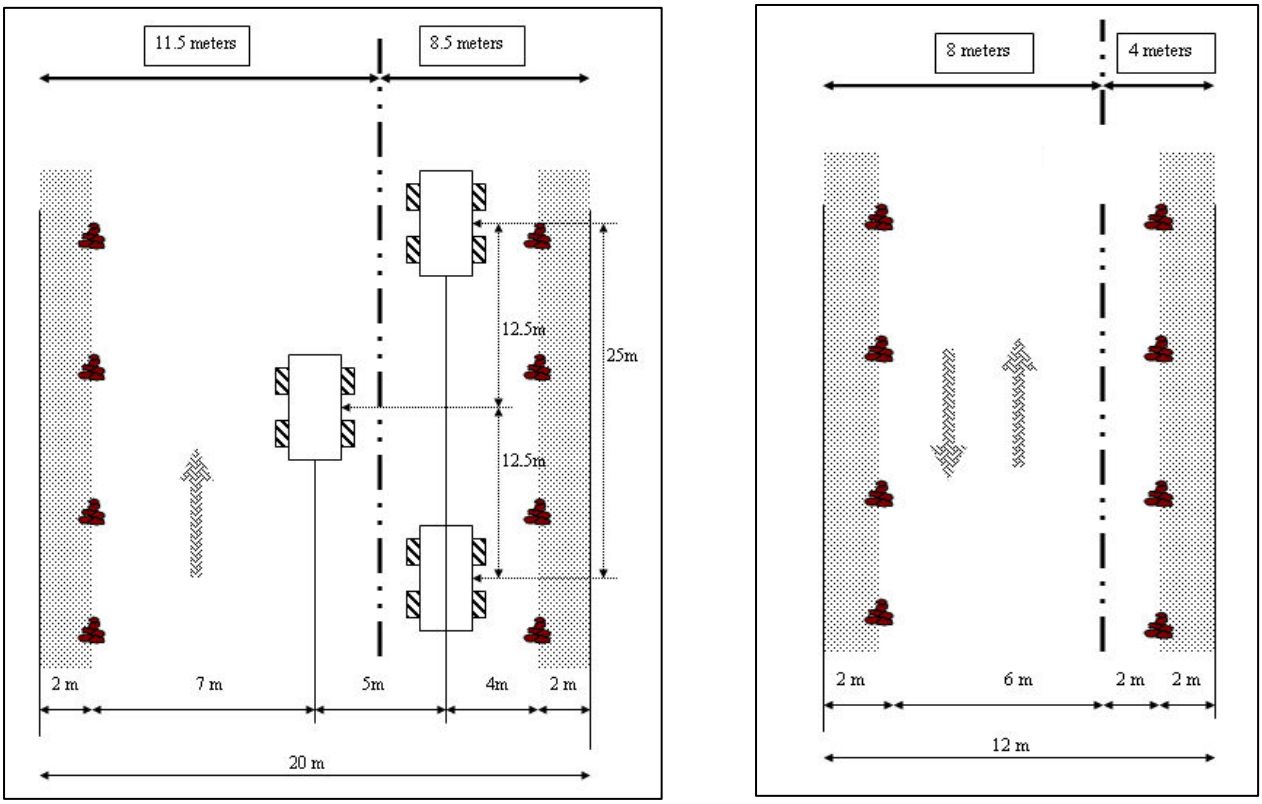

Figure 29 - Corridors Description.

MUNITIONS

The following munitions were discovered during the mine clearance operations:

Bullets & Cartridges	Shell & Morter	Hand Grenades	Mines	Fuses	A. Bombs	Thermal Bombs	Cluster Bombs	Others
15	8					1	1	

During mine clearance operations, munitions were collected and dispatched in a temporary bunker on the prospect close to the military camp.

This bunker was cleared and the munitions were destroyed outside the acquisition prospect at the end of the recording production.

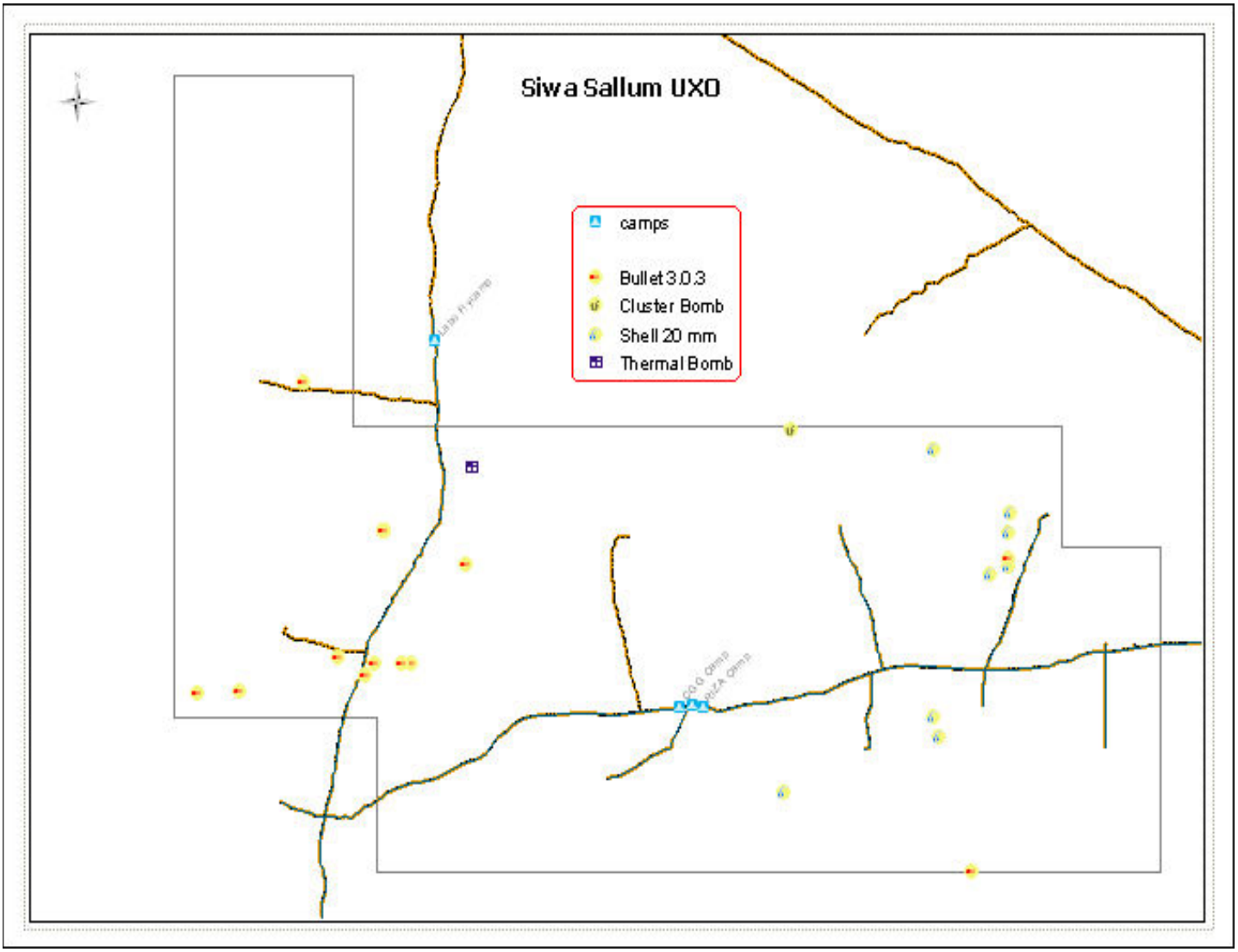

Figure 30 - Location of temporary bunkers.

RECORDING

PERSONNEL RECORDER

3 Senior observers
3 Labo Assistants
1 Junior (Trainee)

Vibrators

21 Vibrator drivers
2 Vibrator field managers
2 Vibrator mechanics
1 Service truck + 2 refuelling trucks

Labo layout

Front crews : 7 crews (120 helpers and 7 foremen).
Back crews : 7 crews (57 helpers and 7 foremen).

7 Trouble shooters

Workshop

1 Labo Assistant (Workshop)
2 Foremen
8 Cable Repair
12 Workshop Helpers (RIZA Subcontracted)

EQUIPMENT

18 M27 / P23 Vibrators
1 Recording system Sercel SN408CMXL
2 SMT 200 (Geophones tester)
1 4x4 seismic recorder truck
16 4x4 Toyota
13 Iveco 4x4 Light Truck
1 Magirus 6x6
36 Sercel 408 LAUX
122 Sercel 408 LAUL
4418 Sercel 408 FDU – 100 shipped to other crew 4459
8796 Sercel SG-10 (String x12)

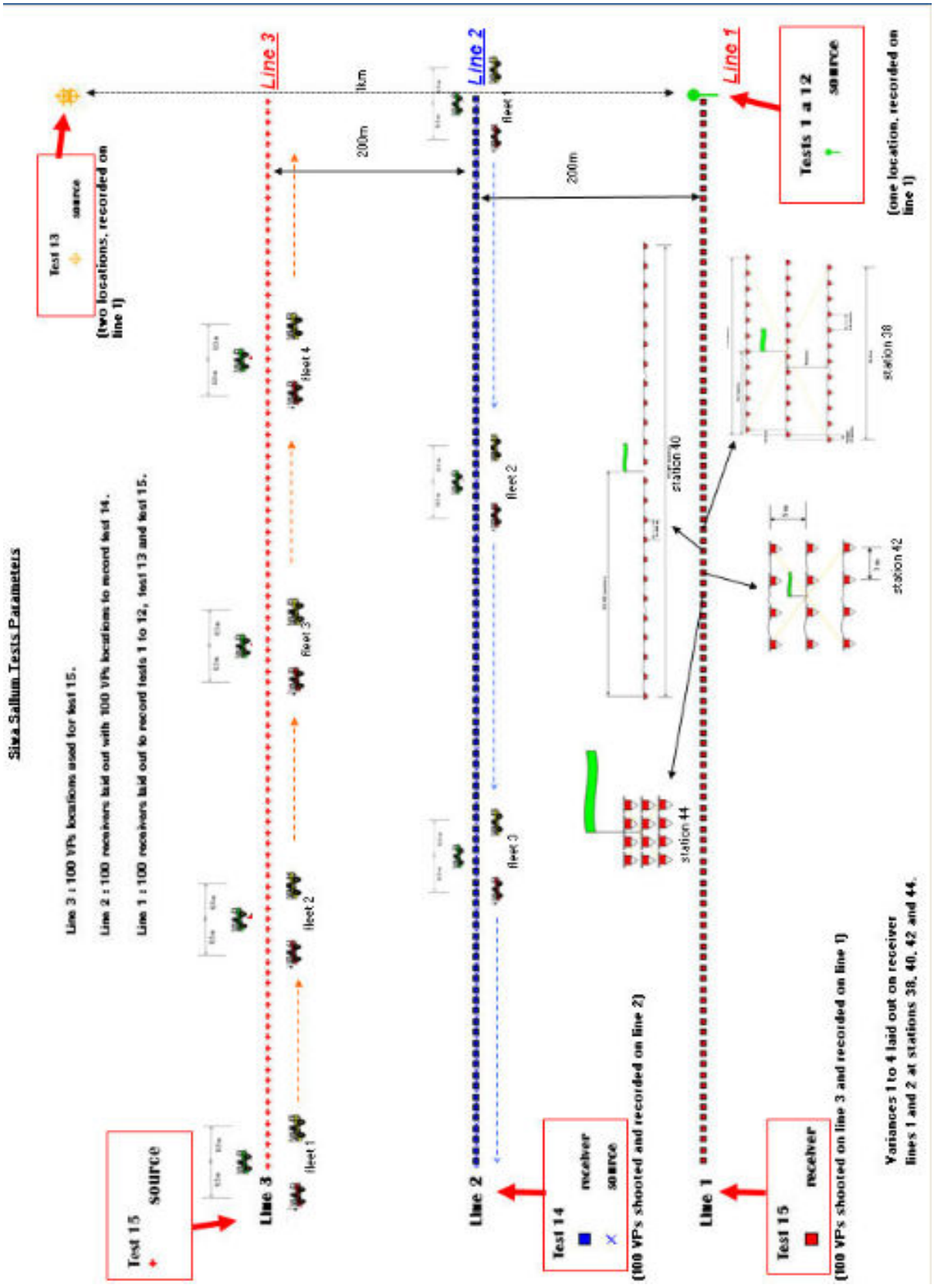

Figure 36 – Tests planned location.

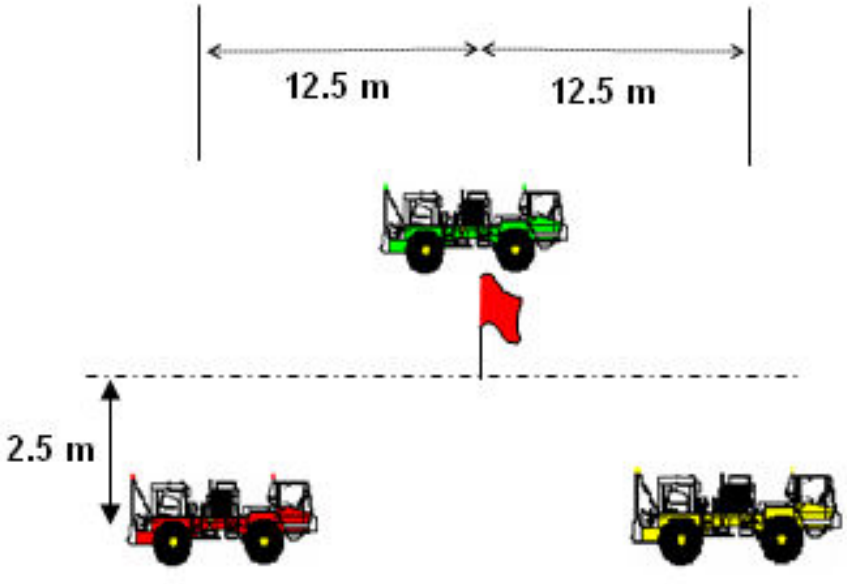

Figure 37 – Vibrator pattern.

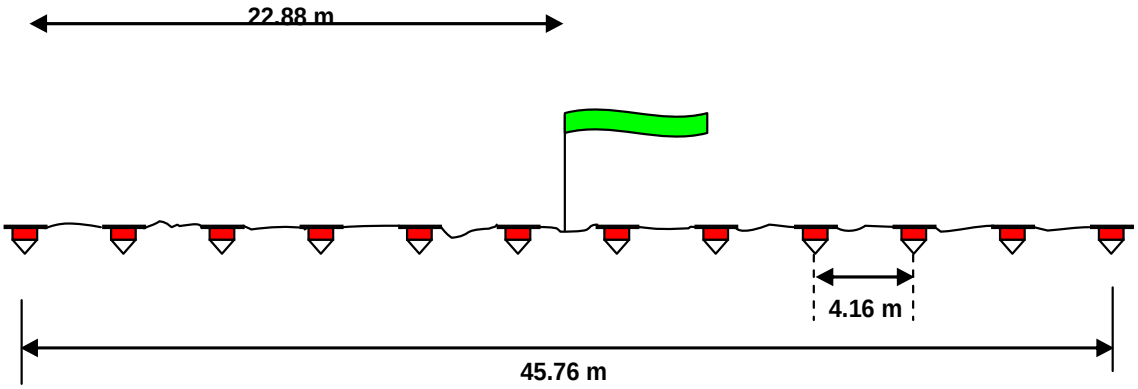

Figure 38 – Geophone pattern.