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The Next Edition of AUSTRALIAN GUNNER will be incorporated in COMBAT ARMS to be be published in May 1982. Contributions should be sent to the EDITOR, Australian Gunner, Directorate of Artillery Campbell Park Offices Canberra, ACT 2600.
Photographs accompanying the article should preferably include the negative.

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STOP PRESS!
Australian Army has ordered 1,295 Unimog UL1700L vehicles

A commercial vehicle that will join the army with little more than a change of uniform.

Commercial vehicles rarely, if ever, are designed to handle the extremes of terrain and conditions encountered in military operations.

A remarkable exception is Mercedes-Benz Unimog. Primarily designed for arduous on and off-road commercial work, firefighting and search and rescue, military purposes were also foreseen.

It's not surprising, therefore, that without major adaptations and additions, without compromising the basic design technology, Unimog can easily meet the general service and first line needs of an army.

Ample evidence is that 65 armies world-wide operate Unimog, and a further 19,000 are currently being supplied to NATO forces.

The Unimog UL 1700L Military Vehicle features:

- a high powered turbo charged diesel engine
- synchromesh gearbox
- high clearance hub reduction axles with differential locks
- fully independent suspension on each wheel
- disc brakes
- low centre of gravity with high side angle stability

In addition, Unimog shares many features with Mercedes-Benz heavy duty commercial vehicles, thus providing economical maintenance, simplified mechanic and driver training and ready availability of spare parts.

Mercedes-Benz.
Makes sense.

Mercedes-Benz Australia. Mulgrave, Victoria.

HOLT 0599 MB

routes and main supply and administrative centres within the division; not the forward arms units.

Moreover, for the greatest effectiveness, command and control of all air defence resources should be exercised at the highest level to enable rapid reaction to keep pace with the ever increasing speed of aerial warfare. This is patently more difficult if these resources have been farmed out organically to arms units within the division. Flexibility would clearly be inhibited. The removal of air defence resources from the *least* vulnerable units and areas to the *most* vulnerable units and areas would have to be effected by many command agencies rather than just one.

If on the other hand, air defence resources (VLLADs) are brigaded, they can be quickly allocated as required to those areas where they are needed most, or deployed en masse in defence of one particular point or area. What is more the command and control systems organic to such a unit would be instantaneously available whereas for a conglomerate unit they would have to be fabricated from whatever resources were available at the time. The result is not likely to be effective.

If VLLAD weapons are placed under command of arms units throughout the division the communications network necessary to effect minute-to-minute control over them will be so large as to preclude its implementation. As such, control of the weapons would have to be of a procedural nature. Again this is not making the best use of an available resource. The weapon control order in force, at best, would be "Weapons Tight". Depending on the air situation and the state of training of the operators it is more likely to be "Weapons Hold". This would effectively make the VLLAD weapon a self-defence system only.

What is more important is the fact that the amount of early warning received would be virtually nil. With fast low level intruder tactics being increasingly favoured by modern air forces the time for an effective engagement by VLLAD weapons is decreasing. Early warning sensor systems are becoming vital to enable VLLAD detachments firstly to identify targets as hostile and secondly to maximize the time to prepare for and engage hostile aircraft. Such early warning information being passed with speed and accuracy by trained operators is becoming more and more critical as the speed of aerial warfare increases.

With the present system of dedicated air defence units the control facilities exist already to effect minute-to-minute control and pass early warning information.

Conclusion

In the arguments presented, it has not been my intention to advocate the stripping of any active air defence potential from the other arms units of the division. Rather I have endeavoured to present the case for brigading resources under central command. Should the situation demand, resources can be allocated to these units. What I do believe to be vital is that the decisions to allocate air defence weapons be made at the highest possible level with proper cognizance taken from professional advice. Once these decisions are made, leave their execution to an air defence officer rather than a well-intentioned amateur.

Centralization of VLLAD weapons into specialist units promotes a higher standard of expertise and professionalism. Flexibility is enhanced in a manner which enables rapid and wide dispersion of elements should it be required or their utilization en masse. The full potential of the weapon can only be obtained if proper command and control facilities are made available and brigaded resources is the only means in which this can be effected successfully. Decentralization will only serve to denigrate an already viable system.

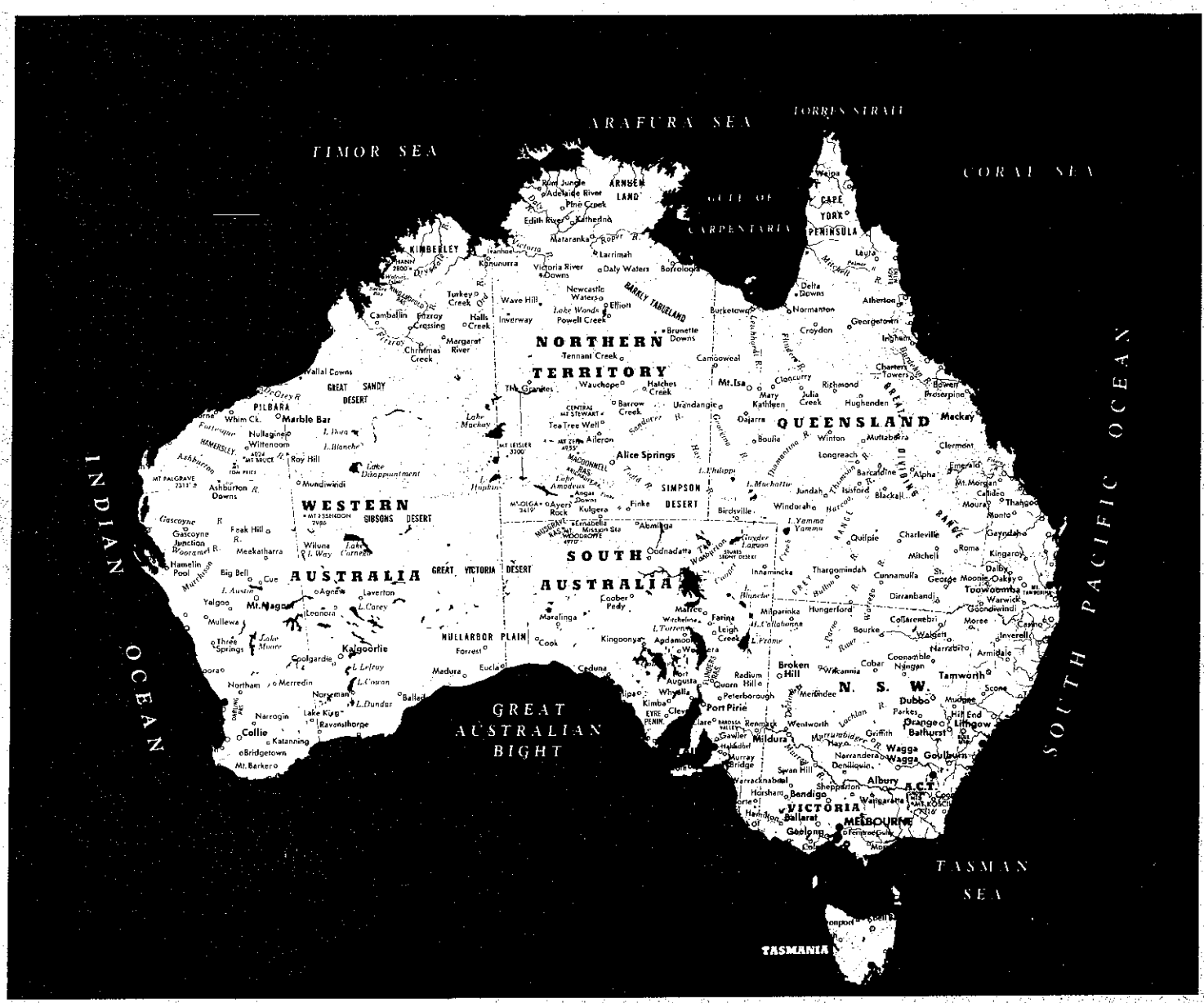
Shorts Blowpipe

FACE INSTALLED IN LANDROVER VEHICLES

On 29 June 1981 4Fd Regt in Townsville was equipped with Field Artillery Computer Equipment (FACE) mounted in Land Rover. To enable the Operational Deployment Force (ODF), of which 4 Fd Regt is part, to have a more complete fire control system than the hand held, calculator based, Field Artillery Back-up System, (FABS), it was decided to equip them with FACE in Land Rover.

First a project vehicle was produced by maintenance Engineering Agency (RAEME) and then a prototype model by Engineering Design Establishment (EDE). After User trials were conducted on these design equipments by 8/12 Mdm Regt the final design was accepted. 1 Base Workshop in Bulimba was then tasked with the job of building four FACE in Land Rover for 4 Fd Regt which they completed in June.

The FACE mounted in ACV, in service since 1974, may well become a thing of the past. It now has been decided to re-equip both 1 Fd Regt and 8/12 Mdm Regt with FACE in Land Rover also. Plans are currently being made in DAEM to have four FACE in Land Rover for 1 Fd Regt and six FACE in Land Rover for 8/12 Mdm Regt introduced into service in mid 1982. One additional equipment will be issued to the School of Artillery for instructional purposes. Each RAA gun battery will then be equipped with two FACE in Landrover.



The country with a lot of land to defend has made a vehicle with enough torque to get to the action.

Australia is a land of vast distances and daunting terrain.

A country with long stretches of remote coastline.

Now there's a Land Rover made in Australia, uniquely suited for defence work under these conditions.

Under the bonnet is the 3.9 diesel motor from an Isuzu truck.

It is the most powerful motor available in a vehicle of this kind.

A motor with the torque to haul a 1.3 tonne load up a mountain. Or move men and equipment quickly to where they are needed.

This new Land Rover will also travel down the road smoothly and safely, even at the high speeds the motor is capable of achieving. Because it features the Range Rover permanent 4WD system, which provides traction to all four wheels. (A system we've already used successfully in the 3.5 petrol Land Rover.)

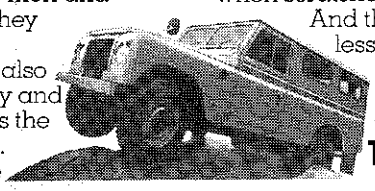
It also allows you to drive off the road without stopping. (A perfect tactic for fast manoeuvres.)

It's worth mentioning that in Australia there are Land Rovers still working after 30 years of tireless service.

Their owners have found that our aluminium alloy body panels do not rust, even when scratched or holed.

And that our rigid box section chassis is less likely to bend or twist under stress.

These things we have not changed. They offer protection from the country itself.



The new 3.9 Diesel Land Rover. Made in Australia.

LA5837/FMMH

Investigations into the Biological Effects of High Level Impulsive Noise on Personnel

by Leigh Kenna National Acoustic Laboratories Department of Health and Ralph Smith Advanced Engineering Laboratory Defence Science and Technology Organisation

Introduction

New generations of weapons currently being introduced into service present a problem of considerable importance to the Department of Defence. The problem is that of the high levels of impulsive noise, the "bang" produced by their operation. In some cases, the noise has reached the situation where it is physiologically damaging to the personnel operating the weapons. It can produce temporary and permanent hearing losses, even when conventional hearing protection devices are worn. It is also possible that it may produce other, non-auditory, effects such as damage to the lungs. In addition the noise and the hearing protection devices can make verbal communications between members of the weapon's crew extremely difficult. In an endeavour to quantify and solve the problem, joint projects involving the National Acoustic Laboratories (NAL) and the Advanced Engineering Laboratories (AEL) of the Defence Research Centre Salisbury have been initiated.

Impulse Noise and Weapons

Impulse noise is definable as a single burst of sound energy in which the sound level increases rapidly to a maximum and then decreases, in a total time interval of one second or less, to the background sound level that existed before the impulse occurred.

The time duration of the impulses produced by weapons fired in the open is generally very short: for small arms, the impulse duration may only be a few milliseconds, and for artillery the duration may be of the order of 40 to 50 milliseconds. However, for some weapons, the level of the sound is so great that the firing of a single round exposes the operator to a greater noise dose than that received by a worker in a noisy factory during a full eight-hour shift.

A consequence of the high levels and short durations of impulse noise is that it cannot be measured with ordinary sound level meters. The peak levels are far above the point where a typical sound level meter will be overloaded, and even if it were not, the needle of the meter moves far too slowly to provide a meaningful measurement of the brief impulse. Special instrumentation and measuring techniques are required to measure impulse noise in order to determine its potential for damage to exposed personnel.

The impulse noise of a weapon such as a rifle or a howitzer is caused by the sudden discharge into the atmosphere of high pressure propellant gases from the muzzle. There are three main reasons why the impulse noise produced by modern artillery is a greater problem than it was previously. Firstly, the howitzers are made as light as possible to allow for transportation by air. To decrease weight, barrels are shortened, which means that the source of the impulse noise, the muzzle, is closer to the crew. Secondly, reductions in weight of the barrel and other component parts tend to increase recoil velocities, and this tendency is compensated for by use of muzzle brakes. However, a muzzle brake deflects impulse noise back towards the gun crew.

Finally, the ranges of the new weapons are much greater than that of the older weapons. The extra range is achieved by using larger charges of propellant, which develop higher pressures and consequently produce greater noise levels.

Effects of Impulse Noise

It has long been known that exposure to loud noise, whether impulsive or not, can cause hearing damage. For non-impulsive noise, the experimental evidence indicates that the amount of hearing damage can be related directly to the amount of sound energy, or the noise dose, to which an individual has been exposed during his lifetime. For high level impulse noise, there are indications that the amount of hearing damage is greater than would be predicted from sound energy considerations alone.

The reason for the enhanced damaging effect on hearing is as follows. The human hearing mechanism contains a built-in protective device, known as the aural reflex, to protect it from loud sounds. The reflex, which involves the contraction of muscles in the middle-ear, is a response to a loud sound and provides about 10 to 15 dB of sound attenuation. However, it does not come into operation until about 150 milliseconds after the commencement of the sound which initiates the reflex. This activation time is much longer than the duration of typical impulse noise from weapons. Hence, the sound energy contained in a short duration impulse passes into the inner-ear without the attenuation that a long duration or continuous sound would have undergone.

Within the inner-ear, the sound energy impinges on the sensory hair cells of the acoustic nerve, which convert the sound to signals which can be perceived by the brain. Depending on a combination of its level, duration and number of occurrences, the sound may fatigue the hair cells, producing a temporary hearing loss which will recover after a period of quiet, or destroy the cells, in which case the resultant hearing loss is permanent and incurable.

An immediate effect of either a temporary or permanent hearing loss is that the ability to communicate verbally is reduced, resulting in a loss of efficiency of members of a gun crew.

In addition to being of sufficient level that it will cause immediate irreparable damage to the hearing of unprotected ears, the impulse noise produced by some weapons has the potential to cause other physiological damage. Some of the energy of the impulse noise passes into the body and travels through the tissues as a sudden pressure increase. Not all tissues are equally susceptible

Gunnery Wing

Adjustment of an Area – A New Concept

One of the more difficult missions for an observer to complete in a timely fashion is the adjustment where all guns are required to fall within the target area.

A number of observers experience difficulties with the procedures involved with area adjustment missions, especially at large Angle T. Their difficulties centre on proper adjustment of the MPI prior to adjustment of individual guns and also on the recording of individual gun observations in such a manner that any correction which may subsequently be required is self evident.

Mission procedures in training pamphlets require that at the split of the short bracket in an area adjustment, "Battery Right/Left" is ordered and, when the guns fire, the correctness of the MPI is assessed and a record is kept of observations of rounds for individual guns. It is all too easy to forget that the correctness of the MPI is the first consideration at this stage. If the MPI is not right, the appropriate correction must be ordered. Such a correction makes redundant the individual gun data just recorded. This data must be struck through or erased.

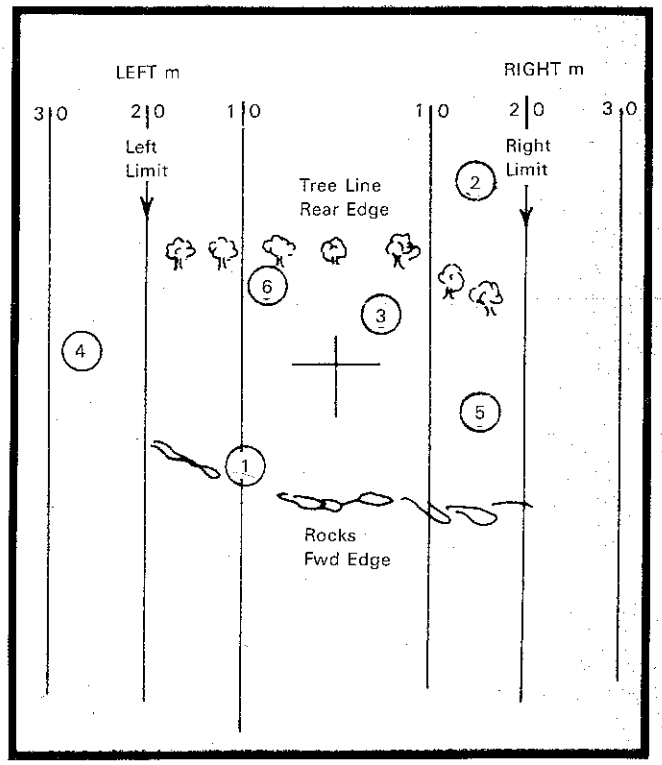
The record of individual gun data is only useful when the MPI has been found to be correct, when it is used in determination of amount of the correction (if any) to be ordered to individual guns to ensure they fall within the target area.

The question is, how does one go about determining individual gun corrections, that is, how does one proceed from the point at which a round at Battery Right/Left has been fired, the MPI has been found to be correct and one round of observations of individual gun data has been recorded? Why not order "Repeat" (thus causing another round of Battery Right/Left to be fired at the same information) and again record individual gun information? This would satisfy the doctrinal requirement to base orders to each gun whose MPI was not correct (i.e. not in the target area) on the observation of two rounds and would also allow a greater degree of confidence that the MPI of those guns which, on the first round fell within the target area, were indeed correct. The experienced observer will realise that this greater degree of confidence is essential in missions where he has to contend with large Angle T. To "Repeat" at this stage is not doctrinally mandatory, but produces the desired effect without complicated rules at the possible cost of a few rounds in a small or no Angle T scenario.

As noted above it is doctrinally mandatory that orders to guns whose MPI is not correct are to be based on the observation of two rounds. Again it would seem a simple rule once a correction has been fired to order "Repeat". The two rounds thus obtained would allow determination for all Angle T of another correction based on a 'bias' or that the gun MPI now lies in the target area.

Finally, a word about collection of individual gun data during this process. The methods for data collection are left to the discretion of the observer, but it is suggested that a diagrammatic representation is helpful. Such a diagram can be prepared using a gridded page from an AAB 64 Field Message Book or any suitably ruled piece of paper. Represent the adjustment point with a cross at any convenient line intersection on the page. Mark the vertical lines either side of the cross with mils equivalents according to a scale determined by the observer. Notate the left and right limits of the target. Annotate horizontal lines above and below the centre cross to represent forward and rear edge. As rounds fall, the observer then calls to his assistant his observation, eg. Number 1 left 10, forward edge; Number 2 Right 15 over; Number 3 Right 5, half rear etc. The assistant then annotates the diagram by drawing a circle containing the gun number in the appropriate place as shown below.

The observer can now see at a glance the relative position of the guns.



Development Wing

Hewlett Packard HP 33C Hand Held Calculator

The School has been aware for sometime of serviceability problems with HP25 and HP25C Calculators. Since both are superseded models problems are arising in obtaining repair parts. Consequently the School has investigated a replacement calculator which can be absorbed into FABS with the minimum of change. Such a calculator is the HP33C.

Comparison of HP 33C and HP 25C

The HP 25C and HP 33C have the same storage and programme memory capacity, namely eight data storage registers and 49 lines of programme memory. Unlike the HP 25C, the HP 33C:

a. has a sub-routine capability.
b. displays an error code, and
c. has a self check capability.

The HP 25C and HP 33C contain the same number of keys, however the position and markings of certain function keys differ between the models and the HP 33C has the following additional key functions:

a. → DEG converts radians to degrees.
b. → RAD converts degrees to radians.

c. MANT temporarily displays all 10 digits of the mantissa of the number in the window.
d. L.R. (linear regression) computes the y intercept and slope for x and y data points accumulated using $\Sigma+$.
e. $\hat{x}_{y}$ (linear estimate) computes a predicted x value for a given y.
f. $\hat{y}_{x}$ (linear estimate) computes a predicted y value for a given x.
g. r computes correlation co-efficient of x and y values accumulated by $\Sigma+$.
h. GSB (go to sub-routine) followed by a number 01 to 49 causes the calculator to start executing instructions beginning with the designated line.
i. RTN (return) if executed as a result of a programmed GSB instruction, returns control to next line after the GSB instruction.

The sub-routine capability of the HP 33C gives it a greater programming capability than the HP 25C.

Compatibility of the present FABS Programme with the HP 33C.

The HP 25C programme used in FABS was investigated to determine its suitability for use with the HP 33C. For user evaluation the HP 33C and the gunnery programme were given to an instructor familiar with the FABS system. Some difficulty was found in programming the HP 33C due to the different locations of certain function keys, for example '→ P', and the different style of marking, for example, on the HP 25C – 'x ≥ O' whilst on the HP 33C – 'x > O'. No difficulty was found in the use of the HP 33C for the FABS routines.

A second instructor was then given the HP 33C and the evaluation repeated. The same problems presented themselves on this occasion. Once again no problems were found in using the HP 33C for the FABS routines.

In both cases the HP 33C was used to determine:

a. map bearing, map range and angle of sight;
b. predicted bearing and range;
c. target grid corrections, and
d. target reduction.

The results obtained were identical to those obtained using a HP 25C.

As a result of the problems incurred in programming the HP 33C the School has written a new programme for the calculator as an addition to the FABS pamphlet. This programme will be promulgated as an interim measure by means of a Training Note.

Compatibility of the Present Locating Programmes with the HP 33C

Survey, meteorological and sound ranging programmes designed for use on the HP 25C were tested on the HP 33C and found to be compatible.

Publications

Final drafts of the following publications have recently been forwarded to HQ Training Command for production as part of the Australian Army Manual of Land Warfare series:

a. MLW Two 3.13. Orders for Practice.
b. MLW Two 3.3. Survey within the Unit.
c. MLW Two 3.5. Survey Troops – Duties in Action.
d. MLW Two 4.2. The Air Defence Regiment.

The following publications are in an advanced stage of production at the School:

a. MLW Two 1.5. Field Artillery Staff Duties.
b. MLW Two 1.6. Artillery Intelligence Staff Duties.
c. MLW Two 3.1. Gun Regiments – Org and Deployment.
d. MLW Two 5.1. DUAI Director L1A2.

Training Notes

Recent Amendment Lists to Training Notes are as follows:

a. AL15.
   (1) New Training Note 217 – Calaibration Policy 105mm Ammunition.
b. AL16.
   (1) Training Note No 248 – Artillery Range Safety Briefings.
   (2) Training Note No 307 – Modification to GAK/1 Observation Drills.
   (3) Training Note No 308 – Modification to Tellurometer MRA 301 Booking Drills.
   (4) Training Note No 309 – Modified Synchronized Astronomical Observation.
c. AL17.
   (1) Training Note No 249 – Training Aid – Artillery Fire.
   (2) Training Note No 250 – Face in Landrover.
   (3) Training Note No. 251 – Local Crest Clearance Drills for the Reconnaissance Officer.

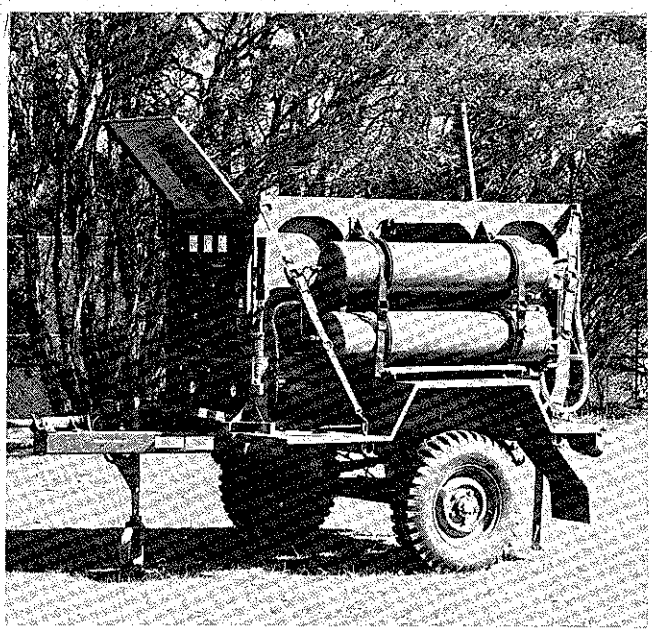
Locating Wing

The students of the 1/81 Subject 4 for WO (Locating) Course marched into the School on 7 Jul to commence five months of training in survey, mortar locating radar, meteorology and sound ranging. From time to time the course will be joined by officers who will be gaining appropriate section commander qualifications – the officers should benefit from the knowledge and experience of the senior NCOs.

It is proposed that the Artillery Survey Grade 1, Radar Operator and Operator Command Post Sound Ranging courses become IET for new OR members of the Corps commencing in July 1982. If this is adopted, recruits intended for RAA will be screened at 1 RTB for their suitability to undergo specialist locating trade training and those selected will then march into the School to attend the next appropriate Locating Wing course. While this system would dramatically reduce the period of time before a soldier becomes productive in his specialist trade, it will create other problems and these are currently being examined.

131 Div Loc Bty will be conducting trials later in the year on vehicle-mounted inertial position and azimuth systems. It is probable that one of these systems will be selected for purchase by the Army to give a much faster means of providing survey to gun units and locating devices. The School is looking forward to the results of the trial with great interest.

The School has just received two field hydrogen generator systems. These are currently being used to verify operator procedures and this is expected to be completed in mid October this year. The equipment will then be available for issue to user units and for training at the School.



Hydrogen Generator

AD Wing

Now that the Rapier conversion series has been completed more work is required to establish a viable training system to support Rapier. The level of expertise needs to be raised further and an equipment consciousness impressed on all ranks. At North Head, accommodation works and establishment deficiencies exist and have yet to be remedied.

Training programmes are being developed which exploit the capabilities of the various simulators and training aids. The School's Classroom Trainer is complete. This trainer provides a capability to teach the Missile Gunners' operator drills efficiently. A programme using the Launcher Simulator for training tactical controllers is also under development.

Courses need major rewrites to accommodate both Redeye and Rapier. Formal courses and on-the-job training have to be co-ordinated. A milestone is the first Missile Number Grade One course which instructs Rapier to an employment level. This course commenced in October.

Over the past few years, pamphlets have been produced catering for this new equipment and changing capabilities. MLW Two 4.1 Planning and Control of Air Defences is presently being distributed. The pamphlet MLW Two 4.20 Weapon Drill Rapier will be published by the end of this year; whilst it is envisaged that MLW Two 4.2 The Air Defence Regiment will be published in early 1982. This doctrine must now be confirmed by experience. Written doctrine must be rigidly applied, but critically analysed and, if necessary, amended.

There are a number of trials taking place at the School. A decoy 'blow-up' Rapier launcher has been purchased from the UK and is undergoing trial to ascertain if a quantity buy is warranted. The Rapier Launcher, Radar Tracker and 1-tonne vehicles are undergoing a series of air portability trials as external and internal loads. Towards the end of this year there is a trial at RAN Range Beecroft of likely target systems to replace the DELMAR target for Rapier. Also, the School has been approached to conduct proof firings of the locally assembled Rapier missiles.

These firings are scheduled from December 1982. Moreover, there is a programme of modification for the Safety and Monitoring Equipment for Rapier (SEMAR) whereby the cables are being replaced by British Aerospace and the UV recorders are being multi channelled. These modifications will increase SEMAR's capability and reliability.

With all these events it may be wise to consider that as far as Rapier is concerned, we now find ourselves at the "end of the beginning", but with challenging tasks still ahead.

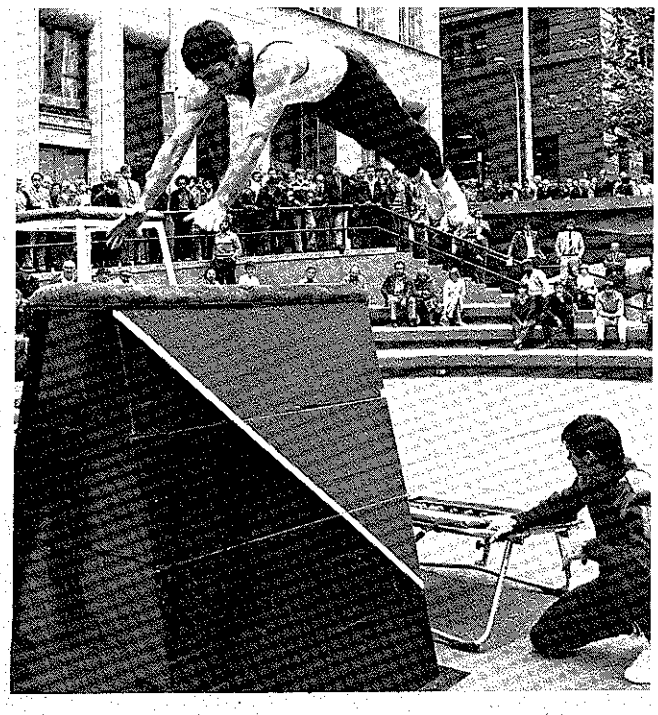
Regimental Training Wing

In the past 12 months Regimental Training Wing (RTW) has changed to suit the times. These changes include the introduction of the Laser Range Finder (LRF) and the Director Artillery L1A2 F1/F2. The LRF is now an integral part of OP CP (Fd) Grade 2 training, ensuring that the FO's assistant is kept up to date with changes to drills and equipment. The imminent issue of the new director into the Regiments required the Op CP (Fd) Grade 1 course to be updated to allow for instruction on the equipment's operation and characteristics.

The new missile numbers course (the pilot course commenced in Aug 81), which is designed to produce a gunner basically trained in the handling of air defence weapons has been divided into three stages comprising: signals training; Redeye training; which includes aircraft recognition and map reading; and a Rapier leg involving mobile and standing drills for both optical and radar tracker systems.

During this course a three day exercise is conducted at Beecroft Range with the simulated engagements of both high and low performance aircraft and culminates with a familiarization visit to NAS Nowra covering those aircraft currently in service with the RAN.

RTW has also expanded its field recently and now conducts the OP CP (AD) course.



RTW provides a good basis for newly appointed SNCO and later in their careers, for experienced SNCO, to consolidate their instructional and technical knowledge. Junior NCO should consider the benefits of a posting to RTW in their career progression.

1/81 Sgt PTI Course Fly High in Sydney

On 22 June 81 the 1/81 SGT PTI course from the PT Wing of the School of Artillery, performed in a Public Demonstration at Martin Place in the heart of Sydney.

Students from the course and PT staff from the wing went through a series of gymnastic exercises for a very enthusiastic civilian crowd.

The demonstration included groundwork and vaulting. The main attraction was the vaulting over the 7 ft tower and the High Box. The degree of excellence shown by all participants had the crowd consistently applauding.

Examples of two of the vaults can be seen in the two photographs.

BDR Daryl Jenkins has been caught in flight on both occasions. His first vault is a Bent Back Lift over the long box

The second photograph has caught BDR Jenkins in a perfect handstand position on the high box.