The Journal

of the Royal Signals Institution

Over the last twelve months, the Institution has seen a vigorous review of its Charter and Regulations, activities and responsiblities, and indeed its whole raison d'etre. During this time, three workshops were held for MOD and Industry leaders to debate the problems of timely and agile equipment acquisition. Towards the end of the year, a highly successful Seminar for Defence and Industry and the ever-popular London Lecture and Dinner were particular highlights. The attendance of the Chief of Defence Staff as our speaker was a notable coup and a fitting end to a successful year. In addition to the prizes awarded a t this event, many others were awarded in the course of a fruitful twelve months, including several of the newly-instituted Signal Officer-in-Chief (Army) Commendation. This edition of The Journal contains a comprehensive section on Technology, with particular contributions from the CSD Networks organisation, and in our Historical section, a most appropriate article in our 90th anniversary year on the formation of C Troop, Royal Engineers. As ever, our aim is to inform, enlighten and bring together all members of the greater Corps family, serving and retired, and to this end we encourage contributions under any of our standard topics from readers of all generations. This is your Journal, read by all senior officers in the Corps - where better to make your views known?

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Corps Pipe Major Sergeant Jimmy Scott leads the Corps Pipes and Drums at the 2009 Basle Military Tattoo, where they will aagain be performing this year.

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THE LONDON LECTURE 2009

The Speaker this year was the Chief of the Defence Staff, Air Chief Marshal Sir Jock Stirrup GCB AFC ADC, the most senior military officer ever to address the gathering. The Speaker was introduced by the Chairman of the Royal Signals Institution, Major General Tim Inshaw, who drew attention to CDS' busy schedule and underlined our appreciation of his having made time to address us.

CDS covered a wide range of topics in his speech, including the ongoing conflict in Afghanistan, the difficulties of overstretch and equipment provision and keeping all in balance. All of the major issues confronting the MOD were dealt with openly and frankly, as were his responses to the detailed questions posed by an appreciative and well-informed audience, once more at capacity for the event.

The Master of Signals, Lieutenant General Robert Baxter CBE summed up the evening in his closing address and reiterated our thanks to the Speaker for an informative, absorbing and forthright address, adding his congratulations to the Institution prizewinners who had been honoured in the course of the evening.

The 2010 Royal Signals Insitution London Lecture and Dinner will be held once more in premises of the Institute of Directors, 116 Pall Mall, London on 18November. The dress in black tie, with no medals. As in previous years, the event is a sell-out, with the venue once more at capacity. RSI members desirous of attending should aim to secure an invitation to join one of the tables sponsored by industry. Details are available on request from the Secretary.

THE MASTER OF SIGNALS AWARD

GROUP CAPTAIN NIGEL PHILLIPS

Group Captain Nigel Phillips was Chief of Staff and Deputy Commandant of the Defence College of Communications and Information Systems from August 2007 to August 2009. He was responsible for directing, and making plans for the future of, individual training and education for signallers from all three Services. He is an energetic and innovative officer who has grasped the joint initiative and made a whole raft of ambitious improvements to training, while preserving and strengthening the ethos of the 11,000 or so officers, soldiers, sailors and airmen trained each year at DCCIS'

four sites. His has been a defining influence in shaping training, turning DCCIS into an organisation committed and resourced to delivering servicemen and women ready for today's and tomorrow's operations. This has included changing just about all Phase 2 and 3 career courses, and developing countless initiatives to bring training up to date with the technical and physical demands of current operations, new equipment and changes in commercial technology. He is a genuinely 'purple' officer and signaller, but not in the sense of some sort of superior, 'Defence' identity - he is a committed and courageous, grass-roots advocate for the Royal Corps of Signals and the fledgling CIS trades in the Royal Navy as well as for Trade Group 4 and Communications Electronics Engineers in the RAF – his heart is in the CIS business and that gets him through challenges that would defeat others. His influence in securing, thus far, the necessary and unique mix of CIS-related, technical, command and military training and education in the

Group Captain Nigel Phillips receives his Award from the Master of Signals

Defence Training Rationalisation programme has in itself made a magnificent contribution to the understanding and future delivery of Information and Communications Services across Defence, but so too has his determination to improve training in the short to medium term. He has earned enormous respect across the training and CIS piece, as well as in Head Office, for his sage, imaginative advice, his inimitable mix of wilco-ness and steadfastness on important matters of principle, and an unparalleled capacity for hard work and long hours.

Group Captain Phillips has driven the modernisation of CIS training across Defence and has done all humanly possible to protect its principles for the future. He has gone far beyond the boundaries of his official

responsibilities and is thoroughly deserving of formal recognition by the Institution.

MR ALEX WILSON

On 20 October last year, Mr George Alexander Wilson completed 50 years in the service of the Royal Corps of Signals. His first deployment overseas took place at the age of 18 to the Middle East, when he sailed for Aden on the last troopship together with the last of the national servicemen. This set the mould for a well-travelled military career, typical of many servicemen at that time, and saw him serving in the Far East, Western Europe, the Shetland Isles and most parts in between.

Mr Alex Wilson receives his award for 50 years service to the Corps from the Master of Signals.

After experiencing a range of units, theatres and roles he completed his active service after 22 years in October 1981, retiring with the rank of Sergeant, but immediately enrolled for work in 8 Signal Regiment as an Instructional Officer, just as he completed his degree course with the Open University. There he established himself as a wise and knowledgeable instructor whose theoretical teaching was illuminated by practical references and understanding rooted in his military background In 1994, he was made an offer he couldn't refuse, and started commuting to Blandford Camp where he taught in Command Technology Division the first Foreman of Signals course to be awarded a degree by Cranfield University. When the rest of 8 Signal Regiment arrived at Blandford Camp in 1995, he was already well established and making his mark as a very capable teacher with unbounded enthusiasm for his subject of fixed systems.

In 2001, he was due to retire from the Civil Service at the age of 60. However, his great wealth of expertise and his own willingness to stay in post enabled a case to be presented to extend for a year – and then another year – and yet another until the law changed in 2006 when he could stay on as long as both parties wished! This, the Royal School of Signals and the Corps has welcomed, as he has played a leading role in the introduction and training for Cormorant in 2 and 30 Signal Regiments and kept a valued watching brief on the developments of Falcon.

Within the Faculty, he is something of a legend in his own lifetime. Every Technical Officer Telecommunications, Traffic Officer, Foreman or Yeoman of Signals has experienced him expounding his knowledge of the telecommunications alphabet soup of acronyms, initials and abbreviations. With typical Irish charm he has guided, nurtured and developed all of his students in such a way that they feel encouraged and empowered. The Faculty has long been accustomed to basking in the reflected glory of the testaments that his former students have adduced in support of his instructional abilities. He retains a youthful and infectious enthusiasm for his subject, which he imparts to his students, and a lively sense of humour underpinned by a solid loyalty to the Corps and its traditions.

CAPTAIN LES JORDAN

After 38 years service to the Royal Corps of Signals, holding every rank up to acting Major, and on retirement serving with the TA as a Permanent Staff Administrative Officer, Captain Jordan has come to the end of a career which has seen him serving in six regiments and corps. Throughout, he has maintained exemplary standards of courage, professionalism and dedication, and his conduct is surely a role model for every Royal Signals soldier.

He has shown genuine compassion and leadership, be it in establishing Boy Scout troops, or raising many hundreds of thousands of pounds for charitable causes, including the Army Benevolent Fund, the McMillan Appeal, the Army Cadet Trust and hospice and childrens' charities.

Despite these accomplishments, Captain Jordan has quietly continued to work steadily for the good of the military community, and has demonstrated a rare ability to understand others, be it in patrolling in Northern Ireland, working with the United Nations or teaching new recruits, based on an ability to identify problems and offer sympathetic, thoughtful solutions.

Such is his dedication to duty, he voluntarily extended his retirement date to see his unit through a particularly difficult time, a reaction typical of a life of service which has seen him earn the British Empire Medal, a Commander-in-Chief's Commendation and a Lord Lieutenant's Certificate. For this outstanding career of service, he is presented with the Master of Signals Award.

LIEUTENANT COLONEL HUW JENKINS

Lieutenant Colonel Huw Jenkins and the Master of Signals

Lieutenant Colonel Jenkins assumed command of 32 (Scottish) Signal Regiment (Volunteers) in January 2007, a unit responsible for the provision of command support in the event of a national emergency in Scotland. Nine months later, HQ Land had decided that alternate OP TOSCA tours could be led by TA signal regiments with 2 Signal Brigade, which involved patrolling the Green Line in Nicosia, Cyprus. He had deploy considerable persuasive abilities to convince both UK and UN headquarters that this was possible, and such was his success that within six weeks the UNFICYP Chief of Staff declared he would rather have a TA regiment undertaking this difficult task than a regular battalion.

He set about moulding a formed and coordinated body from 27 different units from across the north of Britain, including developing a comprehensive risk management plan, and ensuring trained and mobilised soldiers at the end of a six month training process. This was a consummate success. In mounting the deployment he had to confront a number of TA specific logistic issues, in particular overcoming the limits on mobilised service by innovative use of centralised and dispersed training. He successfully argued the case for an invaluable n-theatre reserve, which is now standard practice.

The success of this deployment was directly due to his determined leadership, planning, commitment and resolution, an accomplishment which will have far-reaching implications for future deployments. He is thus recommended for the Master of Signals Award.

THE ROYAL SIGNALS INSTITUTION SILVER MEDAL

CAPTAIN THOMAS GARDNER

Captain Gardner made a vital contribution to offensive operations throughout Op HERRICK 10, during which he was double-hatted in Headquarters Task Force Helmand (TFH) as both the Electronic Warfare Squadron Second in Command / Operations Officer and SO3 Electronic Attack. The use of Airborne Electronic Attack in support of ground operations is comparatively new to the British Army; the UK does not possess its own assets.

Entirely self-taught, Captain Gardner displayed the utmost professionalism, and an infectious enthusiasm for the development of this role. He spent many hours forging enduring relationships with Battlegroup Headquarters, Regional Command (South) and Headquarters ISAF in order to deliver effect in the TFH Area of Operations. He projected his relaxed yet robust personality to real advantage; ground control stations and aircrew knew him personally and were trusting of his instincts and thought process. During some of the toughest fighting yet seen in Helmand, he planned and orchestrated EA for deliberate operations at Task Force and Battlegroup level, such as in support of Op PANCHAI PALANG, the centre piece operation during Op HERRICK 10.

He was, however, at his very best when ground callsigns declared Troops in Contact. His ability to conduct a ground estimate, fuse it with the Air Picture, request dynamic tasking of air assets in support and hand off control to EW callsigns on the ground was hugely impressive and undoubtedly saved many lives on the ground. On a number of occasions, his queuing of EA disrupted insurgent communications sufficiently to prevent coordinated and complex follow-up attacks on CASEVAC helicopters after multiple IED events. Captain Gardner always remained one step ahead of the enemy. Captain Gardner's leadership drew the very best from people, whatever their role, with many notable successes. He showed an innate ability to distil complex information to a level appropriate to his audience - straightforward, but not over-simplified. Future deployed EW squadrons will reap the benefits of his unstinting hard work, at the tactical and operational levels, and conceptually. His staff work was used as best practice for others throughout theatre to imitate and Headquarters ISAF described him as the best EW Operations Officer in Afghanistan. His contribution was in accordance with the highest standards of the Royal Corps of Signals, and he is recommended for the Royal Signals Institution Silver Medal.

WARRANT OFFICER CLASS TWO (FOREMAN OF SIGNALS) PETER SANDERSON

Warrant Officer Class 2 (Foreman of Signals) Sanderson was pivotal to the engineering of all UK communications information systems within Baghdad on Operation TELIC 13. Whilst the British military footprint was reducing in South East Iraq, the need for reliable communications in Baghdad could not have been greater at such a strategically crucial time. Baghdad is home to a total of twelve UK "stars" filling key posts within the US-led coalition and within Iraqi ministries and security forces. Supporting these officers and their staffs proved to be a very real challenge for Foreman Sanderson. In addition to leading all engineering activity and assuring the support solutions for ongoing services, he was appointed as the project officer responsible for the move of all UK CIS from the US Embassy sited in the Republican Palace to new locations within the Baghdad International Zone. These locations supported the Senior British Military Representative, Lieutenant General Cooper, and Director Force Strategic Engagement Cell, Major General Porter.

The move from the Republican Palace involved a complex technical communications solution, utilising a unique mix of military and commercial systems. Under considerable time pressure, Foreman Sanderson had to liaise with a large number of agencies, including the Multinational Corps Headquarters, the US Department of State, US Embassy security and CIS staff, Information Systems and Services staff in UK and Theatre, and local contractors. Technically, Foreman Sanderson was exceptional and he displayed the utmost motivation and professionalism throughout his tour. With the intuition of the very best communication system engineers, he put plans in place to mitigate much of the risk and potential delays that are commonplace in such a complex and sizeable move. Unforeseen issues with flooding, electrical safety, mains power supply and technical security threatened a near immediate halt to the move. However, by attacking the multiple problems with his usual vigour, technical resourcefulness and networking skills, Foreman Sanderson worked effortlessly to sustain the project. Taking matters in his stride, he intelligently balanced risk in other areas to reinforce the stated Main Effort.

A significant project in its own right, Foreman Sanderson's task was magnified by holding simultaneous responsibility for other, smaller moves for in-place UK CIS across the greater Baghdad area. Also, in lieu of a Yeoman of Signals, he was instrumental in establishing a new Bowman network across Baghdad and reconfiguring an existing commercial talk-through system to improve performance in a complex electromagnetic environment.

His outstanding achievement in overcoming the multiple engineering challenges of all these changes whilst managing 'routine' engineering and technical support underlines Foreman Sanderson's technical ability, drive and project management skills.

This operational tour has placed significant demand on Foreman Sanderson. Despite deploying only one year since a tour in Afghanistan on Op HERRICK, he nonetheless threw himself into the role. For outstanding engineering achievement and professional endeavour, Warrant Officer Class 2 (Foreman of Signals) Sanderson receives the Royal Signals Institution Silver Medal.

THE ROYAL SIGNALS INSTITUTION MEDAL FOR ADVENTUROUS ENDEAVOUR

CAPTAIN ROBERT HARRIS

Captain Harris planned and executed an expedition to summit Africa's third highest and most technically demanding peak – Mount STANLEY, MARGHERITA Peak in the RWENZORI Mountain Range, UGANDA. Impressively, the expedition was planned in a compressed timeframe due to the Unit's return from operations in November 2008 and a summit window due to weather constraints and unit commitments. It should be noted that this was the Armed Forces first summit of this peak and due to the high risk and remote nature of the expedition the planning was significant. The requirement for expedition members to be proficient in winter mountaineering meant those that took part were required to complete winter training in advance; however, the majority had very limited experience in this form of mountaineering.

Due to the high risk nature of the expedition a number of external qualified instructors were required, however, the success of the expedition is down to the leadership and dedication shown by Captain Harris to overcome significant hurdles in its planning and execution in his role as expedition leader. The expedition's aims and plan were scrutinised heavily. This was preceded by numerous forms of communication in order to develop and present a valid plan, which would ultimately withstand the scrutiny of this panel. The most notable contingency plan was that for medical evacuation which required both fixed wing and rotary assets to be on call should there be a requirement for CASEVAC. Equally challenging was assembling experienced and qualified instructors covering the demands of the ascent involving altitude, glacier traversing and rock climbing. The scarcity of such individuals placed further pressure on Captain Harris who was required to project manage the expedition with a number of 'go', 'no-go' decision

points, aligned with other work-strands such as funding and pre-training requirements.

The expedition needed external sponsorship to reduce the cost borne by those that participated. In line with the planning phase, a media and information campaign was organised to ensure best use of the expedition to promote the Army and Royal Signals, and attract public-funding to support travel costs. This has subsequently been used by both Commander 16 Air Assault Brigade and Joint Helicopter Command, as an example of what can be achieved with respect to Adventure Training.

Once in country, the ascent was mentally and physically taxing. The team went from approximately 1000m to 5000m in six days with the summit day lasting thirteen hours. During the entire time, Captain Harris remained in charge with the instructors presenting options to him for his decision based on their recommendation. The average fitness of those involved was good, yet all found the climb extremely difficult. On his return, Captain Harris painstakingly generated a comprehensive Post Expedition Report to assist those that may wish to tackle this remote mountain range in the future, and will have utility for anyone wishing to undertake any similar remote and high risk expedition. He also presented to a component from the 3 Battalion, the Parachute Regiment, on training in UGANDA ahead of the Army's first military exercise in the country.

The Master of Signals presents Captain Robert Harris with his Medal for Adventurous Endeavour

This expedition easily surpassed all the aims for Adventure Training – eight soldiers with only limited experience of this type of mountaineering succeeded in summiting on one of Africa's most technically demanding peaks. All soldiers and officers who participated in the expedition understood its significance and recognised it as a once in a lifetime opportunity. It placed them outside their comfort zones and provided them with a real sense of achievement after a demanding tour on Op HERRICK 8. Not only was this the first

attempt to climb Mount STANLEY by the Armed Forces, it is in an area seldom ventured by commercial tour guides. Such information as exists on the mountain range is limited and lacks currency, and Captain Harris' plan was under constant scrutiny to ensure it conformed with the rules and regulations for a high risk and remote expedition. Given that this expedition beat a new path for the Armed Forces on a technically challenging ascent and given to the remote nature of the mountain range Captain Harris is recommended for the RSI Medal for Adventurous Endeavour.

THE PRINCESS MARY MEDAL

LANCE CORPORAL DANIEL NASH

Signaller Nash was a junior member of FINDER 43C, a Light Electronic Warfare Team (LEWT) from 14th Signal Regiment (Electronic Warfare), attached to 19 Light Brigade's Reconnaissance Force (BRF) for the duration of Op HERRICK 10. His role was to intercept and direction find insurgent transmissions, in conjunction with other FINDER call signs, leading to Tactical Tip Offs to provide his commander with insurgent locations and intent.

This, his first operational tour was a baptism of fire. In addition to his technical skills, which were exemplary when operating ground based EW equipment, he had to coordinate with airborne electronic attack (EA) assets flying in close support. He also had to master advanced infantry skills, including the use of crew-served weapons. Despite being the youngest and least experienced member of the BRF, Nash performed with distinction.

The summer of 2009 saw the hardest season of fighting in Helmand yet and the BRF regularly came into close contact with insurgents during its patrols. Nash's priority during a contact was always to locate insurgents and forewarn of their impending actions. His composed demeanour, even when under fire, earned him the respect of those he fought alongside. One event in particular provides a measure of the man and a reflection of his outstanding performance throughout the tour.

At first light on the morning of 30 May 2009, during Op MAR LEWE, a BRF Troop was patrolling to the southwest of Musa Qal'eh with FINDER 43C in support. A huge explosion occurred to the rear of Nash's vehicle. A BRF vehicle had struck a mine and was catastrophically damaged. With scant regard for his own safety, Nash and his LEWT commander dismounted and immediately moved back to assist the stricken vehicle and its crew, while the patrol medic and patrol commander were conducting Op BARMA mine-

clearance toward the stricken vehicle from another direction. Together, they attempted to save the lives of two BRF members, both of whom had suffered multiple injuries including double amputations. Despite Nash's valiant efforts to save life prior to the arrival of CASEVAC, the casualties had sustained fatal injuries. Undaunted, he immediately put this harrowing experience behind him and returned to his vehicle to set about providing local protection and EW support to the patrol. He intercepted insurgent transmissions, indicating their intent to conduct a follow up attack, which, thanks to Nash's warning, was deterred.

Lance Corporal Daniel Nash receives the Princess Mary Medal from the Chief of Defence Staff.

During a later patrol, Nash was wounded in action when in close-contact with the enemy in Babaji, but he refused CASEVAC, instead continuing to provide EW support despite receiving rocket-propelled grenade fragments to his leg.

Throughout a hugely demanding and dangerous tour, Signaller Nash demonstrated professionalism, courage and maturity far beyond that expected, given his age and inexperience. His outstanding performance is in the highest traditions of his Regiment and Corps and he receives the Princess Mary Medal.

THE BRITISH COMPUTER SOCIETY AND ROYAL SIGNALS INSTITUTION JOINT LECTURE

This event will be held this year on 27 April in the Main Conference Suite at the Ministry of Defence Main Building, when Lieutenant Colonel Fred Hargeaves OBE, the Commanding Officer of 1 Armoured Division Signal Regiment will speak on "Coalition C4ISR". The event has been fully subscribed, and a report will appear in the next edition of The Journal.

AWARDS TO ROYAL SIGNALS PERSONNEL IN NEW YEARS HONOURS LIST

MBE

Major JC Maynard
Captain S King

QVRM

Colonel SJ Potter
Major JF Byrne

MSM

Captain RF Campbell
Captain DR Taylor

CORPS PRIZES AWARDED IN 2009

Princess Mary Medal

Lance Corporal D Nash

Silver Medal

Captain T Gardner
Warrant Officer Class 2 PSanderson

Master of Signals Award

Group Captain N Phillips, Royal Air Force
Lieutenant Colonel H Jenkins
Major B Skinner
Captain L Jordan
Mr GA Wilson

Adventurous Training Award

Captain R Harris

SO-in-C(A) Commendation

Lieutenant Colonel S Hutchinson
Captain B Jeffery
Sergeant E Standen
Sergeant PJ Parton
Corporal G Austin
Lance Corporal A Jarman
Signaller L MacPherson

FALCON - AN OVERVIEW

By Lieutenant Colonel Simon Purser and Major Rob Salter

Lieutenant Colonel Simon Purser is the SO1 Area Systems Group in Command Support Development (Networks) at Blandford. His team are responsible for capability integration of FALCON. Rob Salter was the System Design Authority for FALCON from 2001 through the Concept and Assessment phases as well as the early part of the Manufacture phase. He now has responsibility for the onward development of the FALCON solution to meet the needs of the UK and export customers.

FALCON is the British Armed Forces' new generation tactical trunk communications system. It is an all-IP (Internet Protocol) system which provides the final building block in upgrading the Deployed Networks Capability for the British Armed Forces sitting alongside BOWMAN, Skynet 5 and DII. It is a vital component in achieving the UK's vision for Network Enabled Capability. FALCON will begin to enter service after Field Acceptance Trials scheduled for the end of 2010. It will equip both Royal Signals units and the Royal Air Force 90 Signals Unit. It is intended to field the first batches to Afghanistan. This article provides a brief overview of the background and architectural principles behind FALCON, goes on to describe the elements of the FALCON system. A subsequent article will cover the modifications and enhancements to FALCON to bring the system to Theatre Entry Standard (TES) in order to meet the UOR requirement to replace the current core switching solution in OP HERRICK.

FALCON was originally conceived as the long awaited replacement for PTARMIGAN which was introduced in to service in 1986 and was only finally retired last year. PTARMIGAN provided secure wide-area trunk connectivity for UK Land forces and, in its day, provided leading edge capabilities and tactical resilience. PTARMIGAN was designed primarily to support voice telephony, however, and provided only a limited data capability. It was manpower intensive to operate, and the rapid development in communications and computer technologies meant replacement was urgently needed. FALCON addresses these shortcomings as well as providing facilities required in the current operating environment including provision of multiple security domains allowing support to coalition operations to be provided efficiently and securely.

FALCON gained Initial Gate (IG) approval in July 2002 as a programme with four Increments, each addressing a different capability area. Increment A subsequently passed through Main Gate (MG) in March 2006, with BAE Systems Insyte awarded the contract. This is a soft skinned, air transportable variant designed to provide the communications infrastructure to meet the needs of the Allied Rapid Reaction Corp (ARRC). Increment A provides an Initial Operating Capability (IOC) and Introduction into Service Date (ISD) at end 2010 but is delivered in four tranches. The final tranche will not be delivered until beginning of 2013 when Full Operational Capability (FOC) will be declared. The contract to deliver Increment C, which provides the communications infrastructure for the RAF's deployed Joint Operating Bases (JOBs), was also awarded to BAE Systems Insyte and will deliver in 2011. Increment B is intended to meet the requirements of Division and Brigades, including provision of armoured capabilities. Increment D provides mobile subscriber facilities. Increments B and D are now grouped under the "Future FALCON" programme, but has not yet passed through Main Gate so is not discussed further in this article.

FALCON represents a marked change in technology compared to previous systems. PTARMIGAN used a circuit switched architecture optimized for voice. Later systems such as CORMORANT were based on Asynchronous Transfer Mode (ATM) technology, a cell-switching protocol better able to handle the increasing requirement for data, but now legacy technology. Like most modern commercial telecommunications providers, FALCON adopts Internet Protocol (IP) technology internally for all traffic.

The benefits of adopting IP in military systems was set out in an article by Maj Gen Bill Robins in Royal United Services Institute Defence Systems magazine in Summer 2004[1]. This article highlighted the key criteria that at that time was driving technology choices in corporate networks as well as FALCON's architecture, namely the decision to adopt an all-IP network design. The logic is shown in Figure 1, reprinted from that 2004 article. In the 1970s when PTARMIGAN was introduced, over 90% of total traffic was voice, so it made sense to adopt circuit switched architecture which is efficient for voice. This
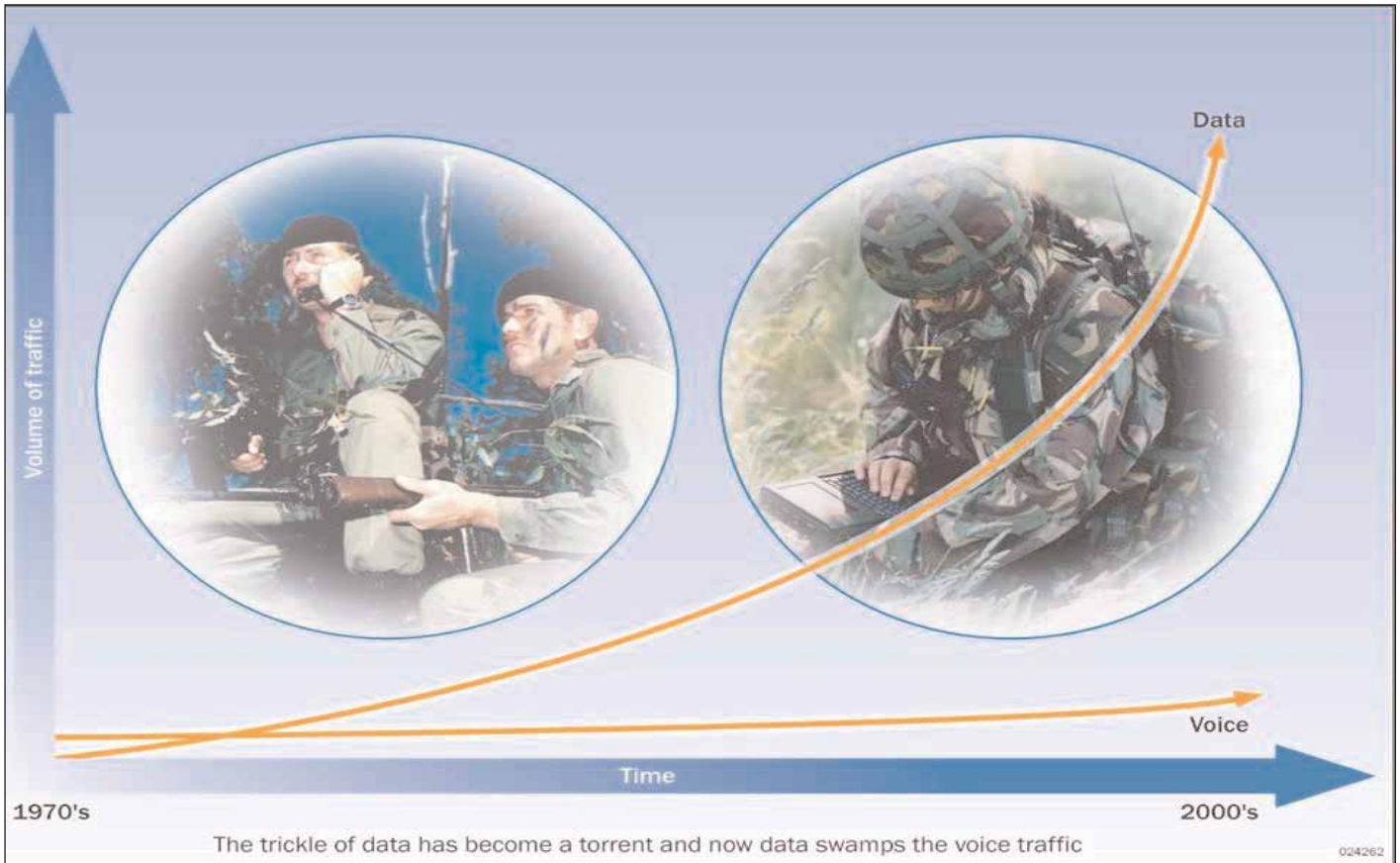
Fig 1. Graph showing the increasing proportion of total bandwidth occupied by data.

accepted the inefficiency of a circuit switched architecture for the small amount of data carried over networks at that time.

The logic is now reversed, for while voice traffic has only increased marginally (staff can only hold one telephone conversation at a time!) the volume of data continues to spiral upwards, particularly with the growth of mission and logistics databases and Intelligence, Surveillance Target Acquisition and Reconnaissance (ISTAR) products that need to be rapidly moved across the battlefield. Given that practically all of those applications are now IP based, it makes sense to design a network optimized for IP and then adapt it for legacy applications and voice, which will eventually represent less than 10% of total traffic.

That is not to say that adaptation of IP to carry legacy traffic and voice is a trivial matter. Ten years ago, IP networks were largely confined to the computer data networks of commercial organizations and the growing Internet. The wide area connections were overlaid on networks provided by telecommunications companies (telcos) using technology largely designed for voice traffic. The last ten years has seen the telcos moving all of their backbone networks to IP[2], in order to reduce the types of networks they have to support. This has necessitated the development of ever more powerful hardware and additional protocols within the IP family of

network protocols to support this migration[3]. Many of these protocols have been developed to support the requirements of specific types of applications and to ensure that they are handled appropriately by the network, in other words to provide a suitable Quality of Service (QoS). FALCON is built on these protocols and exploits the benefits of a single network technology, but carefully applying only those protocols that ensure the network meets the security, robustness and survivability needed from a tactical network.

FALCON is a complex communications system with a Local Area System (LAS) and a Wide Area System (WAS) with a transmission sub-system. The components of FALCON are packed in to different installations types or nodes, most of which are vehicle mounted. The system is supported by Management and Security sub-systems and dedicated maintenance installations. These elements are described below.

FALCON Local Area System (LAS) provides the interface to the staff user's terminal equipment. With the exception of telephones and faxes, this is not provided as part of FALCON but will typically be a Defence Information Infrastructure (DII) terminal. The LAS supports four separate domains using an architecture explained in the Security section below. The LAS distribution is based around Ethernet switching technology. Desk Access Units (DAU) are the smallest

switches, each one presenting six data and six voice ports for connection of terminal devices in a staff cell. These ruggedised switches are connected to terminal equipment by short (up to 5m) copper cables. DAUs are connected by fibre cable runs and these are daisy chained together from a Subscriber Group Access Unit (SGAU). Backbone Ethernet switches known as Red Ethernet Concentrators allow interconnection of a larger number of DAUs within a SGAU sub-network. This is illustrated in Figure 2.

The SGAU supports users within a single security domain and provides a number of services to the terminal equipment in the sub-network, including Dynamic Host Configuration Protocol (DHCP) for IP address allocation
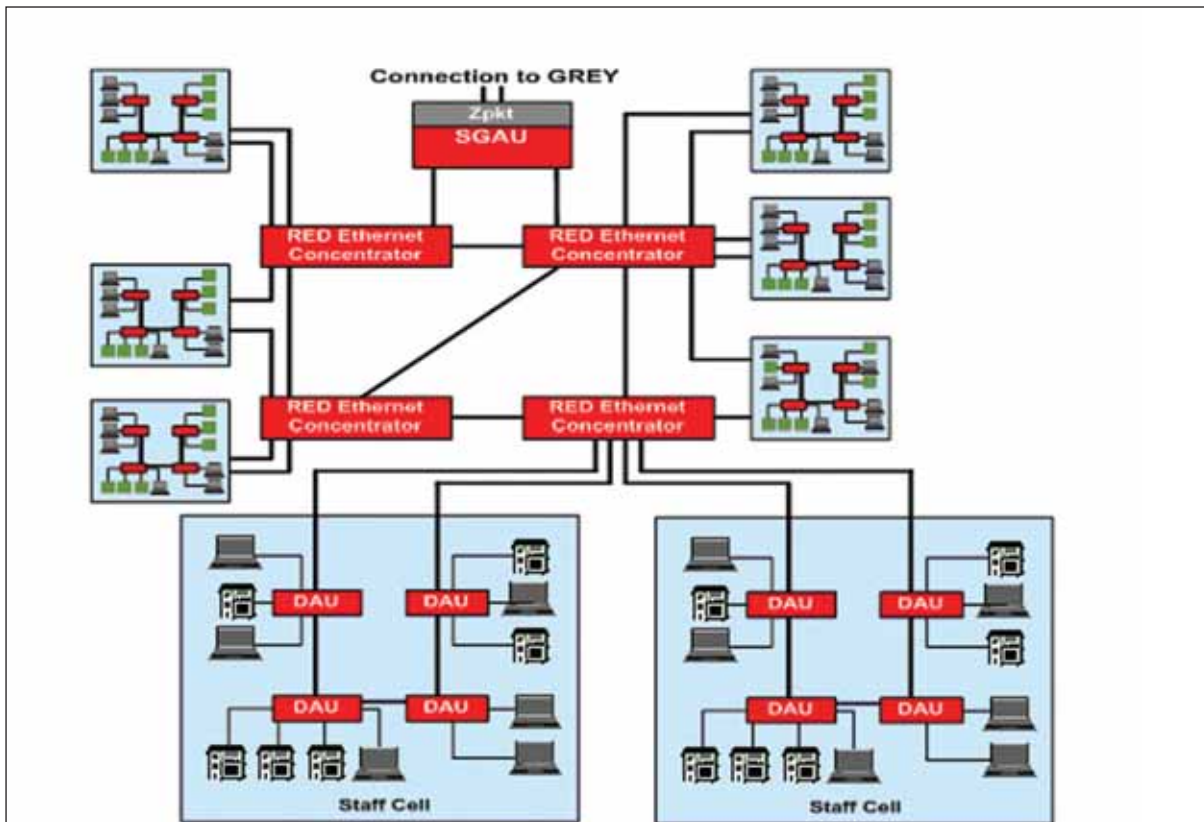
protective marking of the domain, but, because the data in the Grey network is high grade encrypted, a lesser degree of protection is required. Grey networks can span across sites and form a Metropolitan Area Networks (MAN), up to the two kilometre distance limitation of multimode fibre Ethernet. Both the Grey fibre cable runs between SGAUs and the fibre connections from SGAU to DAUs would normally be laid out in rings. Running Spanning Tree protocol ensures that if a cable run is accidentally cut, the path is switched to the redundant leg of the ring.

All of the SGAUs within a Grey MAN must be connected to the Wide Area through a Wide Area System (WAS) node. Using standard IP, each of the WAS nodes will be able to communicate with any of the other nodes in the network by passing information to one of its adjacent nodes, where the data will be relayed onto another node until the message reaches its destination. Each packet in a message will, thus, make a series of hops across the network until it reaches its final

Fig 2. Diagram showing the layout of a single domain SGAU subnet as part of the FALCON LAS architecture.

and Domain Name Service (DNS) for address resolution. It also routes data out to the wide area router or to sub-networks on other SGAUs. The SGAU also provides voice services, including conferencing and all voice facilities. With the exception of voice, FALCON precludes the transfer of data between security domains[4]. The SGAU contains High Grade IP encryption and separation devices so that packets leaving the SGAU sub-network go on to a packet encrypted "Grey" network shared by traffic from other security domains. This Grey network also uses Ethernet technology to connect other SGAU communities together and may use Grey Ethernet Concentrators to connect larger sites. Data within an SGAU community is unencrypted so the cabling and devices must be protected, commensurate with the

destination.

When each packet is generated, the system will automatically evaluate the existing traffic levels in the system and decide along which route the packet should be sent. The system will also react dynamically to the loss of links and nodes that result from: enemy EW, destruction of FALCON assets, and the disruption caused when FALCON assets have to re-deploy in order to support manoeuvring troops. This planning and dynamic re-planning makes FALCON a very resilient system; each message is able to use a number of alternative routes making best use of all available nodes and links. The FALCON radios must be able to operate in 'electronically noisy' conditions. This noise could be

FALCON WASP Installation

occurring naturally or as a result of interference or enemy action. To counter this noise, advanced error correction schemes are used. These guarantee the user that data will arrive intact, but in order to achieve this robustness, additional overheads must be applied to the data. This has an impact on the WAN data rate. Before data is transmitted across the WAN links, it is further encrypted with a High Grade link encryption device. Although the data payload of the IP packets in the Grey network is already protected by High Grade encryption, the packet headers are still visible if the transmission is intercepted. This can reveal a certain amount of intelligence so this exploit is eliminated by the second layer of encryption.

FALCON provides its own trunk Line of Sight (LOS) radio bearers for WAN interconnection between nodes[5]. Two types of radios are provided integral to the FALCON system. These are the Ultra Band I/III+ radio typically operating at 8Mbps, and the Thales Band IV radio capable of data rates up to 34Mbps. Depending on the node installation type, up to six radio links can be anchored by one node. Whilst not part of the FALCON contract, additional transmission media, such as SATCOM and Tropospheric Scatter, commercial radios as well as E1/T1 and E3 commercial leased lines can be used to build up inter-nodal WAN links where these are available in theatre. Currently there are limitations on the number of different types of external bearers that can be connected, due to the different physical interfaces required. Frequency availability has a direct impact on data rates. A more crowded battlespace means more equipment trying to use the same bits of radio spectrum which in turn means less availability. Good planning of the spectrum and detachment siting will be required to allow the FALCON radios to run at maximum speed. The table opposite shows planning figures for ranges and data rates for different radio links.

The sub systems described above are connected together in a modular manner to create a network to meet the operational and tactical requirement. Most FALCON nodes will be delivered installed in purpose built containers or Mission Modules, although some of the equipment is delivered as individual assemblies for transport as palletised loads. There are a number of installation types for different roles. The Command Post Support (CPS) installations support staff facilities and headquarters. The CPS 1 is a smaller palletised installation supporting a single security domain utilising a WAN bearer of opportunity. The CPS 2 and 3 support larger staff communities so are provisioned with more LAS equipment and a reduced number of radios. The Wide Area Support (WASP) is designed to build the wide area network so is scaled with radios sufficient for up to six links. The Mission Modules for all installation types are actually identical, the difference between them being the Complete Equipment Schedule (CES) scaling of assemblies, cables, masts and radios. This means there is the flexibility to re-role Mission Modules if required. All Mission Modules contain a Wide Area Router Assembly (WARA), with appropriate number of link hardeners, link encrypters and radios. This means that all Mission Modules perform the role of a switching node, whether they are WASP or CPS. Up to two SGAUs can be housed inside the Mission Module and additional LAS facilities can be added outside depending on the size of the headquarters. Although the principle role for a WASP is to contribute to the wide area communications network, it can also support collocated staff users[6].

The Mission Module is self contained with system and cryptographic management tools for use by the crew and can carry all fuel rations and equipment for 72 hours unsupported operation. A continuous-run generator provides power, while an uninterruptible power supply (UPS) will sustain communications in the event of a power failure. Secondary power is provided by a hydraulic generator connected to a Power Take-Off (PTO) from the prime mover, the Army's new 6 tonne General Service Vehicle (GSV), the MAN HX-60. An environmental conditioning unit (ECU) provides assemblies inside the installation with full Category A environmental protection for both hot an cold climates. A cage on the front of the Mission Module houses antennae heads, camouflage nets and G1098 equipment. Up to six 12 or 18 metre masts are carried including a quick-into-action mast vertically mounted on the front

Type	Data Rate	Range
Short Range	34 Mbs	10 to 40 km
Medium Range	8Mbs	20 to 50 km
External Bearer of Opportunity	64 kbs - 34 Mbs	NA

bulkhead, enabling the crew to bring the first communication link up within 20 minutes of arrival in location. The cab of the HX60 has sufficient seats for the three-person crew so no support vehicle is necessary.

A Bowman HF radio provides tactical control and situational awareness during deployment. The Mission Module can be removed from the prime mover and each element can be airlifted in tactical air transport, although palletised installations are more appropriate when airlift capacity is at a premium. The Mission Module can be underslung from a CH-47 Chinook although at a weight approaching 6 tonnes, it presents a challenging load and this is unlikely to be a preferred method of deployment.

FALCON Mission Modules contain a management assembly to enable the crew to perform local management of their detachment. For wider network management, FALCON Management Installations (FMI) will be mounted within a container on the back of a vehicle or provided as palletised installations. The FALCON Management Installation (FMI) will allow control of the FALCON network from within the installation or an attached shelter. The FALCON network will be managed, manipulated and monitored by Management Cells in a number of different locations. The extent to which Network Managers will be able to control the system will depend on their level in the FALCON management hierarchy, and the permissions and authorities which they have been allocated. The FALCON Network Management System will have a range of capabilities, from being able to redirect traffic

Fig 3. Overview of the FALCON security architecture, showing the separate domains sharing the wide area network connectivity.

around WASPs, through to controlling the attributes of individual telephones and data terminals connected to the LAS. A high degree of remote management, monitoring and fault finding is possible from the management system.

The FALCON system will provide four security domains from UNCLASSIFIED to SECRET UK EYES ONLY within a single network. UNCLASSIFIED and RESTRICTED domains are fixed in the system, and a choice of any two SECRET Domains can be added (eg SECRET UK/US, Mission SECRET etc). Although FALCON provides the mechanism for voice calls between domains, it prevents data from leaking between security domains. Where data connections between domains are required, this is implemented at the infrastructure and application layer using accredited guards, not within FALCON, which operates at the network layer and below. Within an SGAU subnet, the Ethernet transmissions are unencrypted but each SGAU encrypts data on to the Grey network, even the UNCLASSIFIED domain is encrypted. This is described as an all-encrypted network. (The term GREY is used as shorthand for "High grade all encrypted network" and was coined back in ancient FALCON history to avoid debates about whether IP encryption could ever be called "Black"). This multi-domain architecture allows sharing of a single wide area network, so increasing efficiency. Figure 3 illustrates this architecture.

One of the key design elements of the FALCON security is the separation of voice and data within the local area. This design ensures that data cannot leak through the voice security gateway and is the key enabling architectural choice that allows the deployment of an accreditable all-IP System. Clearly, the separation of voice and data could destroy the benefits of a converged network by requiring the deployment of 2 networks. Here, FALCON provides the solution through the provision of a red local area "quad" fibre that separate voice and data onto separate TX/RX pairs; the DAU presents the voice and data network on separate connections on the same box. When these separate networks reach the SGAU they are fed through high grade domain separators and into the packet crypto.

FALCON makes extensive use of built in test equipment and remote monitoring and diagnosis. A number of Communications Support Vehicles (CSV) are provided, these are containers mounted on the HX60 vehicles. Second line communications engineers can remotely diagnose many of the faults and the Forward Repair Teams (FRT) can be sent forward with replacement components or assemblies where this is necessary. The policy for Setting up a Palletised FALCON Installation repair of most FALCON equipment is a "1st to 4th"
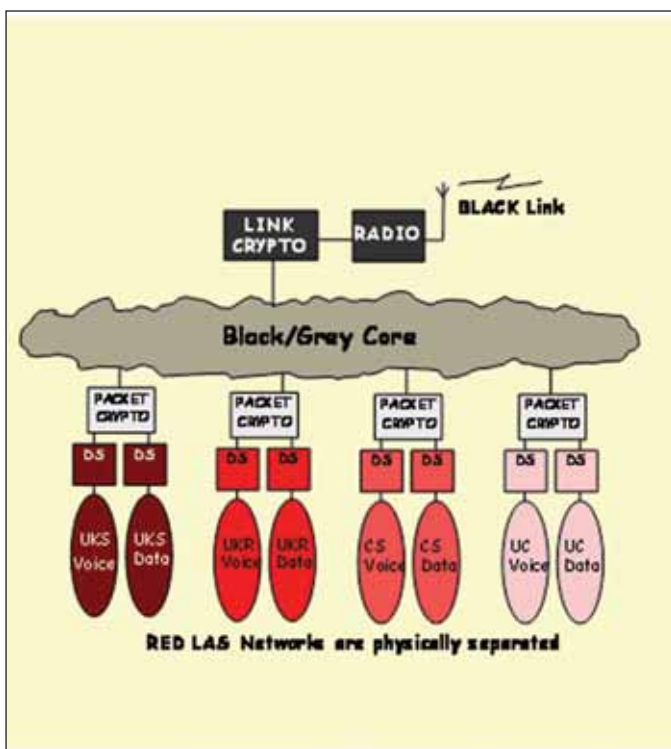
Setting up a Palletised FALCON Installation

return of defective equipment to BAE Systems who will support the programme under a CLS (Contractor Logistic Support) arrangement. A number of BAE Systems Exchange Points (XP) will exist at unit barracks, currently planned for Blandford, Stafford, RAF Leeming and Elmpt Station in Germany.

There are different types of peripheral devices that can be connected to the FALCON LAS via the DAUs. The first are the FALCON telephones and fax machines, which will be provided as part of the system. Users will also be able to connect computer equipment such as laptop computers and printers, which are not provided as part of FALCON.

FALCON Telephones will operate in the same manner as modern Voice Over IP (VoIP) telephones but with additional military features. Users can pick up any telephone and key in their ID number and pass code (a process called affiliation) and calls to them will automatically be routed to the phone to which they have most recently affiliated. When they make a call or answer their telephone, a display will tell them who they are connected with by role and appointment. Since users will have different levels of security (set by the management system), the FALCON telephones will also be able to notify all the users involved in a conversation of the lowest level of security domain that is present for that telephone call. Calls that do cross security domains will be routed through a Voice Security Gateway (VSG) which will impose warning tones into the call to ensure users are aware of the need to avoid breaching security.

There are many features and functions that will be available to FALCON telephone users, each of which can be overridden by the staff operating the FALCON Network Management System. These range from conference call facilities through to group pick-up and call transfer as well as three precedence levels. Users of PTARMIGAN will be very familiar with these facilities,

the difference being they have now been encoded in a VoIP device rather than a circuit switched network. FALCON also provides facsimile machines, an intercom facility for connection around staff cells and adaptors for legacy analogue and ISDN telephones. All of these devices use VoIP encoding to convert the analogue signal to IP packets for transmission and routing across the FALCON system. Call set up from a telephone uses the services of Sentinel Call Manager housed in each SGAU.

FALCON is designed to enable infrastructure terminals and servers to be hosted directly on FALCON DAUs in the appropriate security domain. This means that signallers should not have to lay out multiple LAN cabling and switches to support the plethora of different infrastructure systems, just one cable lay for each domain. When a terminal is connected it uses DHCP to be allocated an IP address from the SGAU and the terminal then "finds" it's server and peer devices to which it needs to communicate, via DNS requests which are handled by the DNS server in the SGAU. At first fielding, the infrastructure systems that are currently in service do not conform to this architecture. They already have their own LAN cabling and switches, operate with different IP address and naming mechanisms and most will require some degree of reconfiguration to directly connect to FALCON. This will present a considerable engineering challenge for MOD signals community. All subsequent infrastructure systems intended for tactical use will need to be specified to integrate with the FALCON LAS if networked capability is to be deployed efficiently.

Many legacy infrastructure systems, while operating IP internally, do not present IP at their boundary interface. Often they present an encrypted constant bit rate interface which, in current systems is transported by dedicating bandwidth across a communications bearer by using a multiplexer. In order to be the single deployed trunk system, FALCON has to be able to support such systems so a Legacy Terminal Adapter (LTA) is provided. The LTA has to support a synchronous bit stream across an asynchronous IP network without the ability to carry the clock. Packets transiting the network are subject to varying delays (jitter) at intermediate routers so the data has to be played in to a jitter buffer at the distant end LTA. This data is then played out using a recovered clock. FALCON uses Circuit Emulation over IP (CEoIP) interfaces on Cisco routers to provide the LTA function. CEoIP packets transiting the network require a high Quality of Service as any packet loss results in a burst error to the distant end device. Carrying data over an LTA carries an overhead of control data, but this slight

inefficiency is compensated for by avoiding the need to run a separate network.

As previously described, FALCON can connect to external networks through a range of interfaces in the WAS to utilise these networks as a Bearer Of Opportunity (BOO). FALCON also provides mechanisms to connect at baseband, both for voice and data. These are made through an assembly called a Single Data Gateway. This provides a routed connection and encryption on to the all-encrypted Grey network in the appropriate domain for the connection. The router operates Border Gateway Protocol version 4 to exchange routing updates to the peer data network to which it is connecting. Voice packets are passed to a second device, a Multi Level Interface Assembly (MLIA) which de-packetises the voice packets and passes the voice stream out as a variety of interfaces, including:

> TacISDN
> STANAG 4206
> STANAG 4578
> Commercial ISDN (variety of flavours)
> Basic rate ISDN
> Analogue

All these interfaces are available on the skin of the installation.

FALCON will provide a step change in capability for Royal Signals units not seen since the introduction of Ptarmigan a quarter of a century ago. The adoption of an all-IP system provides a platform that is compatible with commercial CIS and is aligned with industry and allied military developments. Bespoke developments ensure that the system provides the security and resilience required of a tactical system, but the underlying architecture ensures that it can be adapted and upgraded to meet changing requirements. In a subsequent article, the adaptation to FALCON to meet the Theatre Entry Standard (TES) standard required for deployment to OP HERRICK in Afghanistan will be explained.

[1] The Internet Protocol and Contemporary War. Bill Robins. RUSI Defence Journal Summer 2004. http://www.rusi.org/downloads/assets/Robins.pdf

[2] For example, BT's entire network is migrating to an IP based architecture with the roll out of their 21st Century Network (21CN). See: http://www.btplc.com/21CN/Whatis21CN/index.htm Most other Telcos have similar migration strategies to move to "all-IP" based networks.

[3] IP is just one of many hundreds of network protocols that have developed under the auspices of the Internet Engineering Task Force (IETF). These are often collectively referred to as "IP protocols" although IP itself is a specific protocol.

[4] Data exchange between domains must be implemented outside FALCON at the infrastructure and application layers.

[5] The Air Command Concept of Use (CONUSE) for FALCON would not normally envisage use the LOS radios for WAN links but they would be dependent on satellite reachback for WAN connectivity. The Band IV radios will be used to distribute services over short ranges around a JOB.

[6] This might be particularly relevant where ISTAR collection assets might be exploiting similar sites due to terrain.

CYBER SPACE AND CYBER WAR: SCIENCE FICTION OR SCIENCE FACT?

By Lieutenant Colonel Ian Buchanan, Royal Signals

Lt Col Ian Buchanan was commissioned into the Green Howards in 1984. His technical training started with the Regimental Signals Officer (RSO) Course at Warminster in 1991 followed by the Combat Arms Fighting Systems Course (CAFS) at Shrivenham in 1994. Following a staff appointment as an SO2 in Project Management Special Projects (PMSP) in the Procurement Executive, he returned to Regimental Duty and commanded a Warrior Company serving in Germany and on operations in Bosnia. In 2000 he undertook the Design of Information Systems MSc course at RMCS, followed by an IS staff job in London. He transferred to the Corps in 2003 and was posted to 2 Signal Regiment in 2004 as Second-in-Command. Promoted Lieutenant Colonel in 2005, he became the Senior J5 Plans Officer in the NATO HQ, Sarajevo. In June 2006, he was posted to the Logistics Applications IPT as the SO1 JAMES Programme Manager. He was short-toured to become the Chief Operations Officer in the UN Integrated Office in Sierra Leone, returning in July 2008 to take up post in DSTL as the SO1 Communications in September 2008.

The SCI-FI author William Gibson coined the term "cyber space" in his short story "Burning Chrome" and later popularized the concept in his debut novel, "Neuromancer" published in 1984, well before the development of the World Wide Web in the 1990s . Today, with the progress in computers and communications technology, cyber space has significantly increased in importance. Yet, as cyber space has developed, so have the vulnerabilities and threats which can not only impact upon an individual's home computer, PDA or mobile phone, but could lead to the catastrophic failure of an industrial process and ultimately undermine national security. This article will examine some of the issues surrounding cyber space to demonstrate that not only is cyber space now a reality that impacts upon everyone at both a national and international level but that we may have already witnessed the first example of a coordinated joint cyber and conventional military operation.

The recently published UK Cyber Security Strategy (CSS) defines cyber space as encompassing "all forms of networked, digital activities; this includes the content of and actions conducted through digital networks." It is now recognised that cyber space underpins almost every facet of life including the economy, civil infrastructure and national security. In effect, modern computing and telecommunication technology has transformed the global economy and our everyday lives, in a way that few could have imagined only a decade ago. However, this infrastructure was created with little thought for security, and as a result, a number of state and non-state actors are actively taking advantage of the inherent weaknesses to conduct a variety of attacks against governments, commercial organisations and individuals within cyber space. These attacks aim to compromise, steal or change information and could even cause disruption to critical national infrastructure. The costs of these attacks can be large in financial terms but as yet there have not been any recorded deaths due to a cyber attack. The NCSS states that the attack vectors in cyber space are the use of radio frequency transmissions to disrupt electronic components, subversion of the supply chain and computer network attacks. The primary focus of this article will be on network attacks in which the attacker attempts to gain access to a network in order to undertake malicious activity.

The attack methods that have been used on networks include hacking, malicious software (Malware) and the use of Robot Networks (Botnets) to deliver a Denial of Service Attack (DoS). Hacking in this context refers to someone who undertakes an activity to break in to computers. They can be divided in to White Hat Hackers (breaks security for legal non-malicious reasons), Grey Hat Hackers (borderline legality), Black Hat Hackers (those who undertake illegal activities, usually for criminal financial gain) and script kiddies (a non-expert who uses automated tools with little technical understanding) . There is however a growing number of what are termed "Hacktivists" who are people undertaking actions in cyber space for political purposes One of the best known and currently on-going hacktivist campaigns is between supporters of Israel and the Palestinians, in which web sites are defaced, social network sites are hijacked and propaganda from both

sides is distributed .

The types of Malware most often seen are the Virus (a computer program that can copy itself and infect a computer without the knowledge of the owner in order to cause damage to computer files), Worm (a self-replicating computer program that can send copies of itself to computers on the network without any user intervention) and Trojan (a program that appears to perform a desirable function but facilitates unauthorized access to a user's computer). The anti virus company Symantec report that the threat of malware is rising at an astonishing rate. They state that in 2008 they added 1,656,227 new malicious code signatures to their products compared with 624,262 in 2007 and increase which can be clearly seen in Figure 1.
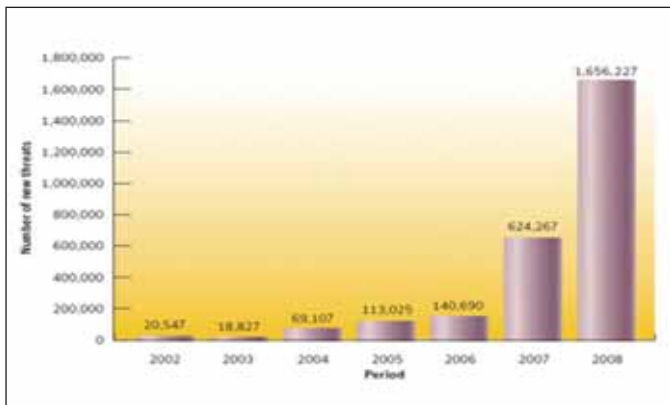

Fig 1 - New Malicious Code Threats
Source: Symantec

Botnets are an insidious and growing threat across cyber space. Fundamentally, a botnet is a group of computers infected with some form of malware. Once the malware has been successfully installed, the infected computers become zombies or drones, unable to resist the commands of the botnet owner (bot master), while the owner of a zombie is totally unaware his system has been compromised. Due to the global nature of cyber space, the botnet owner will gain control of zombie computers or botnet master servers in a number of different countries, which often makes it difficult to identify the source of an attack. Botnets vary in size with the largest composed of tens of thousands of zombie computers (Symantec observed an average of 75,158 active bot-infected computers per day in 2008, an increase of 31 percent from the previous period). Botnets can be used for key logging, identity theft, spamming campaigns, phishing attacks, IP traffic monitoring and DoS attacks . The latter type of attack is aimed at preventing user access to a web site or web services and was recently seen in a series of attacks conducted against US and South Korean Government systems over 4 - 5 July 2009 . Interestingly one of the primary sources for this attack appears to have been a botnet master server based in the UK which may have been involved in controlling

166,908 zombies from 74 countries .

As cyber space grows and more systems become connected, the number of potential system vulnerabilities increases. In the civilian environment these include telecommunication and computer systems in a vast array of organisations including government, banking, commerce, Just-in-Time (JIT) logistics and industrial process control systems. The latter category is also known as Supervisory Control and Data Acquisition (SCADA) systems. These systems are nothing more than a computer system controlling some form of industrial process and can be found in manufacturing, production, power generation, fabrication, and refining. Many of these systems are based on commercially available software packages and are often connected over cyber space to enable efficient but remote management. Unfortunately, these developments also introduce a number of vulnerabilities which can be used to subvert or even allow an attacker to take control of the SCADA system . One of the best known cases of SCADA attack was in 2000 when Vitek Boden conducted a series of electronic attacks on the Maroochy Shire sewage control system in Australia. Over a two month period Boden used a laptop and a data radio to gain access to one of the SCADA processors. His actions resulted in the release of millions of litres of raw sewage to spill out into local parks, rivers and even the grounds of a Hyatt Regency hotel . The recently released report from the Council for Science and Technology recognises that the UK Critical National Infrastructure (CNI) is poorly prepared to meet the challenges of the 21st Century and that many of the SCADA systems in use are potentially vulnerable to malicious cyber attack .

There are of course a number of potential vulnerabilities in the military battle space that could be attacked. For example, command and control systems, air defence systems, and logistic systems all have potential vulnerabilities. Many of the NATO military forces are gradually moving towards a network enabled capability based upon IP networks . The stated aim of the UK's Networked Enabled Capability (NEC) programme is to "link sensors, decision-makers, weapon systems and support capability to achieve enhanced military effect through improved exploitation of the information available" . This integrated network will undoubtedly act as a force multiplier in delivering effect on the battlefield but will also provide an adversary with a single point of failure to attack. One recent example of where military systems were compromised by cyber activity was with the Conficker Worm in January to March 2009. In the UK, a number of the disparate Ministry of Defence (MoD) IT systems were allegedly involved, although the Ministry stated no operational capability was affected. However, it was also reported that the French Navy were

unable to fly some of their aircraft because flight plans could not be downloaded . Although the full impact of such attacks are unlikely to be made public on security grounds, it is reasonable to assume that as the military reliance on cyber space grows, so too does their vulnerability to a determined attack, whether it be carried out by state or non-state actors. The importance of cyber space to the military can also be seen by reviewing the international context surrounding this issue.

In the US, as early as 1998, President Clinton published his 'Presidential Decision Directive 63' to secure critical national infrastructure. Subsequently, in 2003, the Bush Administration published the 'National Strategy to Secure Cyber Space'. However both these initiative failed to deliver the comprehensive approach required to deal with cyber space issues . One of the first actions by the Obama administration was to order a 60 day cyber security review which reported in May 2009. This report not only recognised the vulnerability of the US to cyber attack but also identified the importance of cyber space in military and intelligence operations, especially in counter-terrorism. The report also recognises that the US must work with military allies and intelligence partners to fully exploit opportunities within cyber space . The key policy change recommended by this report is the appointment of a "cybersecurity policy official responsible for coordinating the Nation's cybersecurity policies and activities" who will be based in the White House and report to the National Security Council and National Economic Council.

At the same time, the US Department of Defence (DoD) have also taken significant steps with regard to cyber space by announcing the creation of the four star Subordinate Unified US Cyber Command (USCYBERCOM), under Strategic Command (STRATCOM) that will undertake "Military Cyberspace Operations" . This new command will integrate the current Joint Task Force–Global Network Operations (JFC-GNO), responsible for the operation and defence of the DoD Global Information Grid (GIG) and the Joint Functional Component Command-Network Warfare (JFCC-NW), responsible for coordinating offensive computer operations. According to the announcement, the Commander USCYBERCOM will also double as the Director of the National Security Agency (NSA) (a DoD Agency itself). The creation of the USCYBERCOM as a four star headquarters which will have a clear mandate to conduct both defensive and offensive operations in cyber space, is a significant step forward by the US military. There is also the USAF Air Force Cyber Command (Provisional) (AFCYBER(P)) which is now migrating to be the 24th Air Force under Space Command . This new Air Force "will provide combat-ready forces trained and equipped to conduct sustained cyber operations, fully integrated with air and space operations" .

It has also been recently announced that the Defense Advanced Research Projects Agency (DARPA) is to invest some $25m in a National Cyber Test Range in which tools, techniques and procedures can be trialled and tested . These developments combined with the US doctrine published in the declassified and recently released document "Information Operations Roadmap ", demonstrates the resolve of the US to protect its national and military infrastructure and actively seek military advantage in cyber space.

Another major actor in cyber space is China, who is aggressively pursuing cyber warfare capabilities in order to provide itself with an asymmetric advantage over more technologically advanced nations . It is believed that China has recognised it cannot militarily match potential adversaries and must therefore seek out other options to achieve strategic equivalence which they believe are now based in cyber space. To do this, the Chinese have developed their Information Warfare (IW) theories and integrated them with their traditional military concept of the 'people's war" . In effect, the Chinese now see that anyone who can use a computer could become a warrior in an Information War and with a reserve force of 1.5 million possibly being turned into mini IW regiments, they certainly have potential capability .

The view of Western experts is that China will use some of the lessons from their classical military writings and attack their adversaries' cyber space weaknesses to the extent that they would be unable to conduct conventional military operations. In particular, they would attempt to attack and disrupt military and civil logistic network systems thus aiming to prevent forces deploying from their home bases and subsequently look to sever the links between weapon platforms and decision makers . The Chinese are also alleged to have developed some 250 Trojan and other software tools , penetrated the US electrical power grid , infiltrated US and UK industry to steal technology secrets in order to 'leapfrog' western technical capabilities / and released software worms on to the internet (Myfip in 2004 and Code Red in 2001) .

It is not only nation states that have allegedly been the target of Chinese cyber activities. In March 2009, a report was released which made clear that the Chinese have been conducting large scale and highly sophisticated cyber attacks against the independent Tibetan community loyal to the Dalai Lama . Overall therefore, the Chinese have realised that they will find it hard to militarily match more advanced western nations. Consequently they have instead attempted to develop an operational capability in cyber space, having recognised it as the domain in which it could achieve strategic parity,

if not superiority, over the military establishments of the United States, its allies and any dissident groups they choose to target.

Russia too has a reputation for being involved in nefarious cyber space activities and is believed to have had an "aggressive" cyber warfare programme for a number of years . The results of this programme are alleged to have been seen in a number of incidents in the last three years. Firstly in Estonia 2007, there was a cyber attack lasting three weeks which blocked websites and virtually paralysed the information infrastructure across what is a highly networked country / . Although the Estonian authorities seem to believe Russia was behind these attacks, there is little evidence to prove they were actually state sponsored. However, a comment by Sergei Markov, a State Duma deputy from Putin's Unified Russia party in March 2009, would seem to suggest that there was some state involvement . Interestingly, one of the results of this incident has been the establishment by NATO of the Cooperative Cyber Defence Centre of Excellence at Tallinn in May 2008 .

Another, but much more sophisticated attack, allegedly carried out by Russia, was conducted against Georgia in August 2008 and seems to have been deliberately synchronised with the armed intervention. The cyber space attacks initially started in mid-July with a series of DoS attacks conducted by botnets against government websites using Trojan malware. However, on 7 August
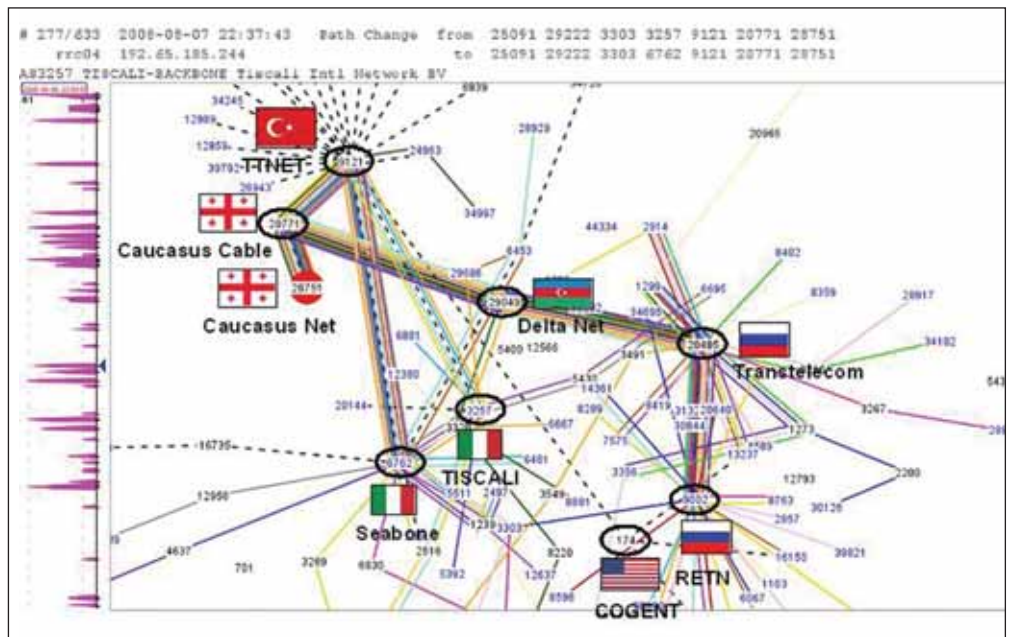

Fig 3. Georgia Internet routing at 0001 on 9 August 2008.

internet connectivity between Georgia and the outside world was severely affected. Figure 2 shows the internet traffic routing at 2043 hrs, with most traffic routed via Cogent and Tiscali links to Turkey. As a result of a number of routing updates received that evening, all traffic was re-routed to Russia via the Transtelecom network as seen in Fig 3 .

Normal routing was not re-established until approximately 1100 hrs on the 8 August after Russian troops entered the disputed territory of South Ossetia at 0530 hrs that morning. Due to the limited SATCOM

Fig 4. Defacing of Georgian Ministry of foreign Affairs website.

connectivity and lack of any other large bandwidth capabilities within the country, the result of these changes was that the Georgian Government was effectively unable to get any of its messages to the outside world. On 8 August, further DoS attacks were again conducted against a number of Georgian Government websites, with

Fig 2. Georgia Internet routing at 2043 on 7 August 2008.

reprisal attacks aunched against Russian news websites by Georgian sympathisers . On 9 August, the Georgian Ministry of Foreign Affairs website was defaced with pictures of Mikheil Saakashvili being compared Adolf Hitler as seen in Fig 4 . This attack shows a level of sophistication which strongly suggests a significant degree of operational planning prior to the events taking place.

On 15 August spam attacks were conducted with emails alleging that President Saakashvili was homosexual, but the email contained links to other websites which when clicked, uploaded Trojan malware on to the users computer / . In addition to these attacks the "stopgeorgia.ru" (75.126.142.110) web site was established which enabled Russian Hactivists to download basic hacking tools to deliver further DoS attacks against Georgian websites .

The interesting point about the Georgian attacks is that the Russian Authorities deny responsibility and suggest they were the work of independent Russian nationalist groups such as 'Nashi' (Molodezhnoye demokraticheskoye antifashistskoye dvizhenye" translation, "Youth Democratic Anti-Fascist Movement "Ours!"). However, the 'Grey Goose Report Phase II' not only suggests that these attacks and Nashi were state sponsored but can also demonstrate that the stopgeogia.ru website can be linked to an organisation based in a building next door to the Headquarters of the Main Intelligence Directorate of the Russian Armed Forces General Staff (GRU) in Moscow . According to the report, one of the tasks of the GRU is technical espionage and hacking computer networks to gain access to sensitive information. The report also points out that the Russian state owns, or controls the licenses for, all national communication links including the Transtelecom network which was so central to the actions taking place on 7 August. Although all this may be coincidence, the probability is that the cyber attacks on Georgia were all part of the first documented case of a synchronised cyber and conventional military operation, with the cyber element operating in line with the traditional Russian military doctrine of 'Maskirovka' .

The alleged actions of both China and Russia in cyber space raise a number of legal and ethical issues. In the first place, there is no agreed international definition of cyber space or of what constitutes cyber warfare. Additionally, if an attack is conducted via a third country can the attacker be positively identified? Furthermore, can these actions be regarded as an armed attack? If so, what retaliatory action could be undertaken particularly if the response was to go via computer infrastructure in a third country? The UN Charter prohibits the use of force against territorial integrity (Article 2(4)) and acknowledges the right of self-defence in the event of an armed attack (Article 51). The author Thomas Wingfield states that there is confusion with the Charter, as some academics argue that it is the amount of damage inflicted in an attack that is the issue (1000lbs bomb and a line of malicious code in a SCADA system could equal the same result), while others argue it is the means of an attack and therefore only applies to use of traditional military forces undertaking an 'armed attack' (cyber attacks must therefore fall outside this definition) .

Wingfield suggests that the view of international lawyers is that an armed attack is one that results in "the direct causation of physical damage to property or injury to human beings" and that a lack of these effects excludes the use of military force as a response. In that event, a cyber attack which does not result in significant damage could not have a military response but still leaves open the question as to what cyber response would be appropriate. Wingfield recommends the uses of the 'Schmitt Analysis' as a methodology for assessing cyber attacks. This methodology looks at several qualitative and quantitative criteria to asses whether a cyber attack can be defined as a military attack (Severity, Immediacy, Directness Invasiveness, Measurability, Presumptive Legitimacy, Responsibility) . Using this analysis it is suggested that the Estonian attacks should not be considered as a military use of force as defined by the UN Charter . The use of cyber in a military context will of course also have to follow International Humanitarian Law (IHL) and Law of Armed Conflict (LOAC) which brings in to the equation issues such as proportionality, humanity, military necessity and distinction. Overall there is still some confusion as to how the law can be applied to cyber warfare. Wingfield summarises the situation well when he states "applying these rules of law to the emergent world of computer network attack is still in its infancy ".

Legal issues aside, a number of other countries are also openly acknowledging that they are seeking to undertake operations in cyber space. The view of the French is laid out in their Defence White Paper 2008 in which they state that "Cyberspace has become a new area of action, in which military operations are already taking place. France therefore needs to develop a fighting capacity in this space" and that in "IT field more than any other, defence will mean knowing how to attack" . The French therefore make it very clear they view cyber space as an environment in which they will seek the "development of defensive and offensive cyber-war capabilities" . The Australian Defence White Paper also takes a strong stance on cyber space and they state "we must focus on developing capabilities that allow us to gain an edge in the cyberspace domain" . Although their stance is predominantly defensive (including the development of a Cyber Security Operations Centre), the implications of

Country	Estimated Military Spending	Intent	Estimated Threat	Current Capabilities	Basic Data Weapons	Intermediate Data Weapons	Advanced Data Weapons
China	$55.90	5.0	High	4.2	Yes	Yes	Yes
Iran	$9.70	4.0	Elevated	3.4	Yes	Limited	No
Libya	$1.30	3.0	Moderate	2.5	Yes	No	No
North Korea	$5.20	3.0	Elevated	2.8	Yes	Limited	No
Russia	$44.30	5.0	High	4.0	Yes	Yes	Yes
Syria	$8.90	3.0	Moderate	2.2	Yes	No	No

Estimated Military Spending is in Billions of U.S. Dollars

Rating Scale: 1 = Low   2 = Limited   3 = Moderate   4 = High   5 = Significant

Fig 5. National cyber capabilities.

the White Paper suggest they will be seeking broader capabilities than just those required for defence.   In Germany, the Bundeswehr is reported to have created the Department of Information and Computer Network Operations consisting of 76 operators   capable of undertaking cyber operations.   Other countries who are assessed to possess cyber capabilities and who could be regarded as potential adversaries of the US include Iran, North Korea and to a lesser extent, Syria and Libya (see Fig 5) .

However, it is not only nation states who are taking an active interest in cyber space. Non-state actors including terrorist and criminal organisations are also developing cyber capabilities. The Russian Business Network (RBN) is one such criminal group purported to be involved in a multitude of illegal activities and are also thought to have been involved in the cyber attacks against Estonia and Georgia . Terrorist organisations such as Hezbollah and Al-Qaeda are also alleged to be developing cyber capabilities, and as far back as 2002 a CIA report suggested that Hezbollah were planning attacks on western computer systems. More recently Michael Chertoff the former Homeland Security Secretary, stated that Hezbollah "have expressed a desire to use cyber means to target the United States" . These terrorist groups also continue to use cyber space to spread their messages, videos and propaganda but in addition, as means to conduct 'cyber planning' for the command and control of their activities. As Timothy L. Thomas states "the Internet provides terrorists with anonymity, command and control resources, and a host of other measures to coordinate and integrate attack options" . The US Director National Intelligence also acknowledged the importance of cyber and its ability to reach out and Influence international opinion in his 2009 Report to the Senate. He stated "Terrorists will continue to be motivated to conduct spectacular attacks in part by the desire to achieve maximum media exposure for their cause. Increasing global connectivity is enabling radical groups to recruit and train new members, proliferate extremist ideologies, manage their finances, manipulate public opinion, and coordinate attacks. In the recent conflict in Gaza, for example, the media played an important role for both sides in shaping public perceptions of the conflict. We can expect future adversaries to similarly employ mass media in an attempt to constrain US courses of actions in a future crisis or conflict" .

In the UK, the recent publication of the CSS also seems to suggest that cyber is starting to be taken more seriously by the UK Government. The strategy, while focussing primarily on the security and resilience of UK systems, does make the statement that the UK will 'intervene against adversaries' . The strategy goes further by saying "We recognise the need to develop military and civil capabilities, both nationally and with allies, to ensure we can defend against attack, and take steps against adversaries where necessary" .

The stated view of the UK MoD towards cyber space as a military relevant environment is however not so unambiguous. The Joint Warfare Publication 3-80 (JWP 3-80) on Information Operations is one of the current publications covering some cyber space issues, although cyber itself is not specifically mentioned. Nonetheless, the publication makes specific reference to Computer Network Operations which are described as consisting of Computer Network Attack (CNA), Computer Network Exploitation (CNE) and Computer Network Defence (CND) . Whereas it accepted that CND is a non-discretionary activity which must be properly funded, the military view of CNA is not so precise. The lack of published doctrine on the subject maybe to do with sensitivities surrounding the issue but may be due just as much to the UK military's traditionally platform focused attitude and generally cautious approach to new and emerging concepts. However, the forthcoming Defence Review presents the opportunity for cyber space to be reviewed in depth and allow the UK MoD to clearly state their future intentions in this domain. Furthermore, as cyber space is an underpinning domain, cutting across the 3 traditional domains, it is important that the different

services engage in this debate in a joint manner to ensure that the associated roles, responsibilities and other development issues are fully addressed and de-conflicted. Such a review would be fully supported by the Institute for Public Policy Research whose recent report states "It is necessary, in a world in which cyber-warfare will be more common, for the UK to develop offensive cyber attack capabilities as well as defensive ones. The ability to access and potentially manipulate an adversary's networks, data, and voice communications, as well as to conduct denial-of-service attacks, could help to deter possible attacks and to deliver victory quickly when conflict does occur".

Cyber can impact upon almost every aspect of modern life but it has come with a host of vulnerabilities that are systematically being taken advantage of by a number of state and non-state actors, usually for criminal gain. Several of these actors believe that cyber space has the potential to provide an asymmetric opportunity which could give them an offensive advantage over more technically advanced adversaries. Some commentators would suggest that we have already seen cyber space used to gain this sort of advantage in a military context and will undoubtedly see it again. Other commentators suggest that it is therefore time that the UK developed some form of offensive as well as defensive cyber capability.

Despite these views it must be remembered that offensive operations in cyber space are no 'silver bullet' and there are a number of issues which need to be addressed. These issues include the fact that vulnerabilities are being continually patched, security in cyber space is improving and there are outstanding legally and ethical issues which need to be resolved. It is therefore worth noting a comment made by Dr David Lonsdale who said "The man on the scene with a gun will continue to be the ultimate arbiter in war. The exploitation of cyberspace is merely a means to support that man in his role".

AFCEA (UK) SOUTHERN CHAPTER

Chapter President Commander Russell Searle

The main event which gave us sleepless nights was of course the bi-annual symposium, held once more at HMS Collingwood under the theme of Knowledge Integration. The event took place on 18 November, and attracted an excellent cast of speakers, including Air Cdre Mark Neal, and Mr Al Murray., with panel sessions chaired in his own inimitable style by Major General (Retired) Robins.

On 22 October we once more welcomed Brigadier David Meyer, a former president of AFCEA Southern, now CIO J6 DCBM in MOD, for a talk in the HQ Officers Mess, Blandford Camp on the topic of "Protecting our Infrastructure". The talk was well attended, and delivered with the customary authority and gusto we have come to expect of this accomplished performer. Although the talk raised one or two concerns, it serve to assuage others, and at very least ensured that the topic was kept at the forefront of our thinking.

The Chapter President and Lieutenant Colonel Ian Buchanan after his presentation on Cyber Warfare

On 21 January Air Commdore Peter Beange was our guest in the commodious surroundings of Chilworth Manor to talk about "The Future ISS Programme – A Portfolio Approach". Our speaker spent a full hour and a half delivering his talk and answering questions from a large audience of military, civil service and industry attendees. future. An accomplished speaker well abreast of his topic.

On 22 March, the Chapter organised their Corporate evening in the unique surroundings of the Royal Naval Club and Royal Albert Club, where Lieutenant Colonel Ian Buchanan delivered a spirited lecture based on his Cyber Wardare article above. An audience of 40 members and their guests relished the chance to hear an authoritative presentation, and share their views over the splendid meal which followed. The final two meetings of the session will take place on 20 May when Mr Mick Brown, Head of of the ISTAR PSF, DE&S will talk about ISTAR in the Millenium Hall at HMS Collingwood, and on 17 June in the HQ Officers Mess, Blansdford Camp when Colonel Alan Blackwell, Head of ERSDT, DE&S will have Joint Electronic Surveillance as his topic. All are welcome!

MULTILEVEL SECURITY - IS IT THE FUTURE?

By Lieutenant Colonel Bob Valieant, US Exchange Officer, HQ SO-in-C(A).

Bob Valieant is son of a career Army officer, and grew up at various military bases in the United States and Germany. He was accepted to Loyola College in Maryland in 1988 where he participated in the Reserve Officer Training Program. He graduated in September 1992 and commissioned into the Infantry.

In 1995 he was reassigned to the Signal Corps where he served as an Executive Officer and Battalion Motor Officer for 29 Signal Battalion. Promoted to Captain in 1996 he attended the Captain's advance course in 1997 and upon completion he was assigned to 25 Infantry Division in Hawaii in early 1998. While there he served as 25 Aviation Brigades S-6 and later as a Company Commander for 125 Signal Battalion. Additionally he served as a Recruiting Company Commander in Springfield Massachusetts from January 2001 – November 2002.

He was promoted to Major in 2003 while serving in the 18 Theater Army Engineer Brigade S-6 in Heidelberg Germany from December 02 – December 04. Upon completion of this assignment he served as the S-6 for 5 Special Forces Group (Airborne) at Fort Campbell, Kentucky from January 2005 – April 2007. His last assignment was as the S-6 for 160 Special Operations Aviation Regiment (Airborne) in Fort Campbell Kentucky from April 2007 – February 2009.

INTRODUCTION

It is 0430 hrs in the morning and The Brigade Operations Centre is quiet. The evening's operations have just finished and the morning Battle Update Brief is not until 0630 hrs. The Battle Captain rubs his eyes and gulps down his third cup of coffee as he stares blearily at the monitors and user access devices in front of him. The morning update is always painful. He shrugs as he sits down, clicks his Keyboard Video Mouse (KVM) switch to the unclassified network, and begins to pull weather, pertinent news reports and other open source information. Once complete he copies the information and transfers it over to the Mission Secret network. He then checks his UK Secret account to see if there are any updates. Finally, he checks his Centrix account for the latest information. He glances up at the clock, it is 0530 hrs now. He only has 30 minutes left to pull the information together on Mission Secret and have the operations officer scrub it prior to 0630 hrs. He grimaces and thinks there has to be a better way. He remembers hearing something about systems that can access multiple security domains concurrently, but shrugs again. He certainly does not have anything to help him now.

Does this sound familiar? Haven't we all been in similar situations and wish we had better access to multiple security domains? The problem is not new; it has been around for 60 years.[i] In fact, it is currently in limited use today.[ii] So, why aren't these systems more widely used? Why do militaries world wide use bespoke systems? These bespoke systems operate in what is called a system high mode which labels the data as unclassified, restricted, confidential, secret, and top secret. The data is then stored and accessed in accordance with its classification. This means the system is classified at the highest level classification of the data it processes. To answer the questions let's look at some of the risks associated with implementing a solution prior to discussing ramifications, benefits and concepts.

RISKS

The first major risk in connecting multiple security domains is the Cascading Vulnerability Problem (CVP). *"The CVP arises when an intruder takes advantage of the network connectivity to compromise information across a range of sensitivity levels, and the span of accessed levels exceeds the accreditation range of any of the computers."[iii]* This occurs when different enclaves are connected to the same network. For example, let's look at the figure below which has three networks called Top Secret (TS), Secret (S) and Unclassified (U).

Cascading Vulnerability Problem
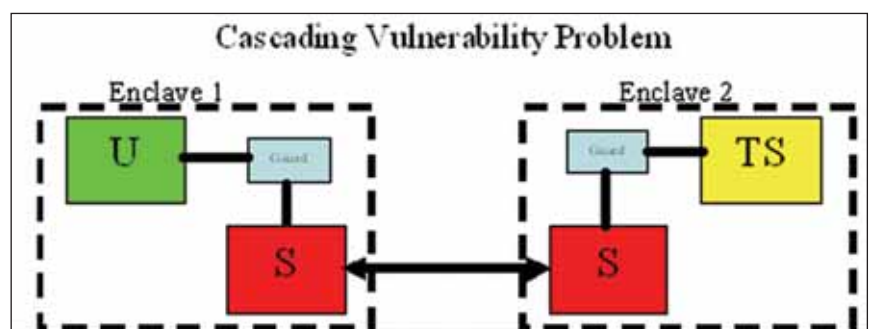
The diagram shows that enclave 1 connects the U and S networks and enclave 2 connects the TS and S networks. As depicted the issue arises because the S networks are connected. Based on this there is the potential for information or threats from U accessing TS or vice versa even though there is no approved means of connection. This occurs because TS and U are indirectly connected through S. This becomes increasingly important when we discuss the next concern, covert channels. *"A covert channel is a mechanism that was not designed for communication but which can nonetheless be abused to allow information to be communicated down from High to Low."[v]* A covert channel can take advantage of shared resources, like the operating system, processor and RAM. Even if storage areas are segmented or use separate hard drives the processor and RAM do not. These components have covert channels which can pass information from higher to lower or, potentially more dangerous; they may introduce malicious code from lower to higher. Malicious code, the final risk I will discuss, includes Trojans, viruses and root kits. It has become extremely sophisticated and damaging in recent years. If it can corrupt the operating system it has the potential of allowing an attacker full access to the network by issuing him unauthorized clearance to the system.[vi] At the very least it has the potential of slowing systems down or compromising the integrity of the data.

RAMIFICATIONS

The technical risks associated with connecting these networks have been highlighted, but what are the ramifications? Data leakage is the first major concern and is tied to the risks we discussed above; CVP, covert channels and malicious code. Neither, the military, the government, nor industry can afford leakage of classified information. Whether the information is the proprietary information from a company or highly classified information from the government, a major error or breach by any of the above risks could leak information. Once certain information is leaked it has the potential of costing millions of pounds, ruining reputations, or possibly costing lives. The potential is even there for the reputation of the business or the government to be so maligned that the business could fail or the government could be destabilized. The next concern is the disruption of networks. Malicious code introduced by human carelessness, through covert channels, or through a CVP has the potential to interfere with the operation of networks and just like data spillage this interference could cost millions, affect projects or missions, and maybe even cost lives**.**

BENEFITS

Having covered technical risks, and ramifications of connecting networks let us move on to why we should consider it. The first is data sharing or collaboration. The intelligence community has a huge requirement to pull information across multiple security domains. It takes considerable time when an analyst has to pull the information from each these different domains. A solution which would allow users to pull the information across multiple domains would greatly increase their productivity. Obviously, this would not just help the intelligence community but would also benefit the rest the Army. Additionally, it could be implemented across the MOD and other Governmental Agencies to increase data sharing within the UK Government. To take the system one step further it could be used to connect coalition partners. The increased command and control as well as the potential for shared situational awareness between nations could be revolutionary. The final benefit is the potential cost savings from increased productivity. I say increased productivity because the cost to implement and maintain the technology may be more than the technology currently employed. The gains are realized by the increase to your productivity.

MULTILEVEL SECURITY CONCEPTS

Now that we have discussed risks, ramifications, and benefits lets look conceptually at how the technology works. *"Multilevel security, or MLS, is a capability that allows information with different sensitivities (i.e., classification and compartments) to be simultaneously stored and processed in an information system with users having different security clearances, authorizations, and needs to know, while preventing users from accessing information for which they are not cleared, do not have authorization, or do not have the need to know. MLS capabilities can often help overcome the operational constraints imposed by system-high operations and can foster more effective operations. For example, systems once separated by an airgap or connected only by a sneaker net may be electronically interconnected by an MLS guard, allowing the data transferred to be current rather than merely historical in value."[vii]*

This is a major change to how the UK currently maintains the confidentiality of its networks. As discussed previously the UK uses bespoke systems to maintain the confidentiality of their data. The systems are completely separated and data is passed between them by using removable media, identified as airgapping or sneaker netting in the above definition. A multilevel security solution would merge or connect these networks which were previously completely independent networks. Therefore, the data is only accessible to users with the right clearance or to systems operating at the right classification.

It is like having all the data residing on one system. For example, Joe has a Top Secret Clearance and has access to all the information on the network up to Top Secret. Mike on the other hand only has a Secret clearance and can only access information up to Secret. See figure 2 below.
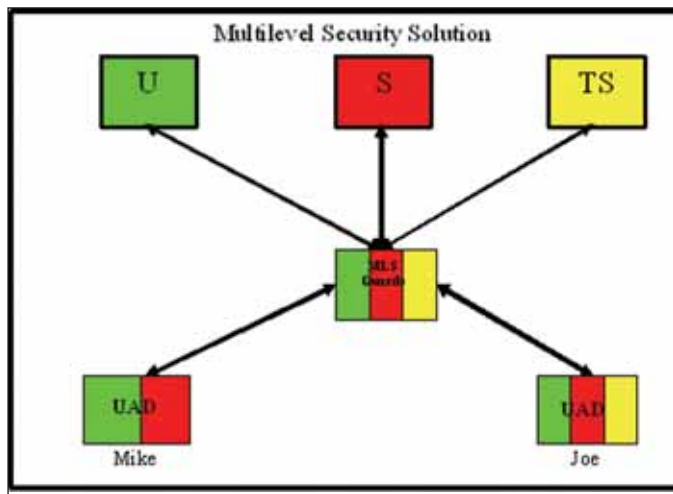
To maintain the appropriate security in the system the confidentiality of the data still has to be assured. To achieve this level of assurance the system uses a security model based on confidentiality, like the Bell La Padula model, which establishes rules for exchanging data. The Bell La Padula model was "proposed by Bell and La Padula in 1973, in response to U.S. Air Force concerns over the security of time-sharing mainframe systems."[viii] There are numerous other security models, to include models based on integrity, but for the purpose of brevity I am going to focus on the Bell La Padula model.

The Bell La Padula model initially had two major principles, a third, the tranquility property, was added later. They are:

"The *simple security property*: no process may read data at a higher level. This is also known as no read up (NRU)."[ix]

"The **-property*- no process may write data to a lower level. This is also known as no write down (NWD)."[x]
The strong tranquility property says that security labels never change during system operation, while *the weak tranquility property* says that labels never change in such a way as to violate a defined security policy."[xi]

The simple security property does not allow unauthorized users, programs, and intruders access from lower to higher. For example, a user who only has Unclassified access cannot access Secret data. *The *-property* keeps Top Secret data from being sent to a Secret or Unclassified user data terminal. *The tranquility property* was introduced based on an argument by John McLean that the user could ask the administrator to temporarily

declassify a file from High to Low allowing low users the ability to read any high file, thus bypassing the first two principles.[xii]

Another way of looking at the tranquility property is through Mandatory Access Control and Discretionary Access Control. Mandatory Access Control can be equated to the strong tranquility property and Discretionary Access Control can be equated to the weak tranquility property. The two are defined below.

Mandatory Access Control (MAC) "MAC policy means that access control policy decisions are made by a central authority, not by the individual owner of an object, and the owner cannot change access rights." [xiii]
Discretionary Access Control (DAC) "Means of restricting access to objects based on the identity and the need-to-know of users or groups to which the object belongs. Controls are discretionary in the sense that a subject with certain access permission is capable of passing that permission (directly or indirectly) to any other subject."[xiv]

Additionally, one can think of mandatory MAC as enforced by the system and DAC as enforced by the user. An example would be where Joe creates a document on his system and restricts access to the document to his team only. He does this so others who do not have a need to know cannot gain access to the document. Mike is from another section, but starts to work with Joe on the document. Joe decides that Mike has a relevant need to know and therefore under DAC rules is able to grant Mike access. If the DAC rules did not exist or allow Joe to grant Mike access, the MAC rules would block Joe's attempt to grant Mike access. Another thing to remember is not everyone in a system is granted discretionary access and the discretionary access controls cannot break the mandatory access rule established. In other words, Joe cannot take a TS document and based on discretionary access controls release that document to Mike who only has a Secret clearance. Now that we have established a security policy and the access controls for the system, how do we ensure these elevated privileges are enforced?

To attain these high assurance levels the system must use a reference monitor, also referred to as an information handling model, "which enforces the authorized access relationships between subjects and objects of a system". [xv] The reference validation mechanism is an implementation of the reference monitor and is comprised of the following three features. It must be **tamperproof**, it must always be **invoked** and it must be small enough to be subject to analysis and tests, the **completeness of which can be assured**.[xvi] These

criteria allow for the trusted computing base (TCB*). "More formally, the TCB is defined as the set of components (hardware, software, human,…) whose correct functioning is sufficient to ensure that the security policy is enforced, or, more vividly, whose failure could cause a breach of the security policy."[xvii]* To put it simply the reference validation mechanism mediates the security policy in place and ensures the policies as stated above are invoked, tamperproof and assured.

CROSS DOMAIN SOLUTION CONCEPTS

Cross domain solutions are an "Information assurance solution that provides the ability access or transfer information between two or more differing security domains. [xviii] Where an MLS attempts to merge differing domains or networks into one network or domain a CDS uses guards, firewalls and content checkers to pass data between two or more networks of differing security levels. The networks are still using multiple independent levels of security but have established a connection with the aforementioned products to pass information between them while maintaining network separation. The guards can be either one-way guards that only allow lower to higher, as depicted in diagram 3 between the S and TS network; or they can be downgrading guards which allow traffic from higher to lower as depicted between the U and S network. The content checkers can be manual, human involvement; or automatic, computer run.

Additionally, a cross domain solution is very scalable. A cross domain solution can be implemented for a specific service or across the board. For example, if the intent is to send emails across differing security domains the appropriate guards, firewalls, and content checkers are set up to just pass the email. Other traffic will not pass between the systems. Conversely, if voice and file sharing are needed the appropriate systems are set up to allow the traffic to pass between the differing domains. Cross domain solutions still have the same requirements as MLS systems; the guards, firewalls, and content checkers must still meet the reference monitor test. They must be tamperproof, always invoked, and verifiable. See diagram 3 below.
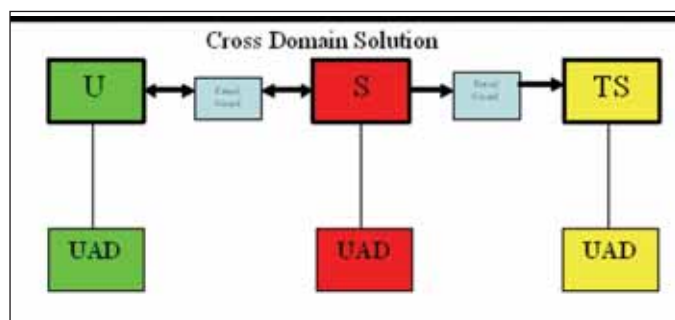
SUMMARY

MLS and cross domain solutions are not the panacea but are they the future? They hold great potential to allow increased information sharing and collaboration within the MOD, joint and coalition partners. As mentioned, there are many risks associated with using these systems and major consequences if the systems fail. Nevertheless, no matter what approach we take, segregated networks, cross domain solutions, or MLS there are inherent risks in each system. The question remains, do the benefits of information sharing, command and control and cost savings outweigh the risks or vice versa? Does the UK assume a greater risk by remaining on the sidelines of implementing an MLS or a cross domain solution, or is the risk of going forward with a solution greater

So what is the way ahead? The short range plan is to stay engaged. The MOD needs to pursue with its allies and private industry the technology to bring MLS/ cross domain solutions to fruition. This will not happen overnight. A staged approach based on priorities and feasibility using current technology should be pursued. The medium range plan should be to review and implement solutions based on the priorities and feasibility identified. Finally, the long range plan should be the implementation of an MLS solution at the appropriate levels across the MOD. If the UK continues to review and implement these solutions using the above approach it should be able to manage the security risks while providing unparalleled information sharing to the soldier across the tactical, operational and strategic levels.

[i] Cryptosmith: MLS Introduction, 20 April 2008, http://www.cryptosmith.com/multilevel/intro

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[iii] Servin Christian. Ceberio Martine. Fruedenthal Eric. Bistarelli Stefano. "An Optimization Approach using Soft Constraints for the Cascade Vulnerability Problem." Pg 2

[iv] Servin Christian. Ceberio Martine. Fruedenthal Eric. Bistarelli Stefano. "An Optimization Approach using Soft Constraints for the Cascade Vulnerability Problem." Pg 3

[v] Anderson, Ross."Security Engineering." Indianapolis: Wiley Publishing Inc, 2008

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[xi] Anderson, Ross.”Security Engineering.” Indianapolis: Wiley Publishing Inc, 2008

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[xv] Morgan, Andrew G. (SGML). “Orange Books Parts I and II: The Criteria and Rationale and Guidelines” December 1985. http://www.kernel.org/pub/linux/libs/security/Orange-Linux/refs/Orange/OrangeI-II.html#toc6

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[xviii] Unified Cross Domain Management Office (UCDMO), What is a Cross Domain Solution?, http://www.ucdmo.gov/faqs.html

FORGET THE WHEELS – DO THINGS DIFFERENTLY!

By Brigadier Steve Vickery

Now Commander of 2 Signal Brigade, this article was written when the author was the Assistant Director of Capability (Networks) at the Command Support Development Centre in Blandford. His views are based on his previous experience in DEC CCII (now Cap CCII) and his 2 years in post at Blandford. He would like to acknowledge the research conducted by Major Peter Knell AGC (SPS) in writing this article.

Introduction

Why does our procurement of communications and informations systems (CIS) lack agility? This subject has taxed many minds and was recently a theme of a Royal Signals Institution think tank[1]. The office of the Key Systems Advisor[2] has also been engaged on examining agility in acquisition. Whilst acknowledging that procurement comprises many facets, I would like to suggest one area where improvements to agility could be made. This article will argue that deep integration[3] into platforms has bedevilled a number of recent CIS projects. Perhaps, even more fundamental, has been the MoD's inability to select a platform to time, performance and cost. Adopting a more simple approach might make sense. Establishing and maintaining a CIS network in the Contemporary Operating Environment (COE) masks the aspect of manoeuvre. Given that this style of warfare is the most likely in the next decade, there is potential to trade against maneouvre. Evidence of time and cost overruns from poor integration will be drawn from SOOTHSAYER, FALCON, Cormorant and Reacher.

The Need for Mobility

What is evident from current operations is that command support is delivered to static rather than manoeuvre headquarters. The reach and breadth[4] of information, communication and services (ICS) has accelerated from formation to unit level. Operations in Afghanistan are conducted from fixed sites. Therefore, does our entire CIS equipment need to be manoeuvred? Even in conventional settings, as recently exercised by 3 (UK) Division on Ex IRON TRIANGLE 08, formation

headquarters might be expected to remain more static with a slimmed-down, mobile forward headquarters. As signallers we know the importance of maintaining a reserve. Our doctrine bible, Joint Warfare Publication 600 enshrines this as a key principle. Probably we still need this reserve equipment to be mobile (or transportable) and there might be a need to provide a commander's tactical command post. However, the lack of manoeuvre by formation headquarters in the COE drives a commensurate lack of manoeuvre for its CIS.

At some point - moving rapidly to the right – there will be a need to re-generate manoeuvre headquarters for formations[5]. However could we not reverse the current procurement paradigm? Rather than deeply integrate CIS equipment into platforms and then dismount into buildings of opportunity, could we firstly design the equipment in racks or on pallets and then be prepared to mount into a platform? There is no doubt that issues will arise, such as vibration, power, cabling, but these limitations can be overcome via the Urgent Operational Requirement (UOR) process. A temporary sacrifice against mobility will present an opportunity to reduce procurement times and costs.

Lessons Identified from UORs

One of the benefits of procurement via the UOR route is that deep integration can be traded, generally against delivery time. The rapid introduction of project OVERTASK is a good example of a commercial off the shelf procurement delivered in quick time. From an identified requirement in mid 06, OVERTASK was delivered in August 07[6]. As highlighted by the Signal Officer in Chief during his May 08 Vision statement, there is a genuine need to keep pace with Moore's Law[7]; perhaps imitating the procurement of OVERTASK gives us a fighting chance. Granted, its environmental proofing, mobility and perhaps ease of use have been traded, but lessons can be learned from its introduction. If we are serious about increasing agility in procurement, then the UOR approach to a lack of deep integration has merit.

Evidence from the Equipment Programme

The future Land EW programme, SOOTHSAYER, has unravelled in the last year and is now cancelled. The saga over the prime mover, both armoured and soft skin, merits investigation. The original requirement stated that the armoured SOOTHSAYER capability was to be delivered in the Multi-Role Armoured Vehicle by 2007. This was subsequently amended to an interim armoured platform for 2010 followed by the Future Rapid Effects System (FRES), with a delayed IOC of 2013 and a cost increase of £41M[8]. Attempting to elicit the FRES vehicle choice from DEC Ground Manoeuvre proved

impossible! Therefore the Joint Electronic Surveillance Team conducted hasty research into alternative armoured platforms. The MLRS chassis, 430 series and the US Bradley were considered, but against a rapidly diminishing timeline no decision was ever finalised. For SOOTHSAYER, the choice of a soft-skinned vehicle appeared more straight forward. The Supacat vehicle was chosen at contract award in 2003, but subsequent testing revealed serious issues with the stability of the chassis. To rectify the chassis problem, a further £14M was required and the project incurred 12 months of delay[9]. This took the unit cost of a Supacat vehicle beyond £350k.

Continuing the Supacat theme, the early planning assumption for Project FALCON was the use of the Supacat as the prime mover. Weight, volume and logistic support concerns led to a retreat from this position, in favour of the General Support Vehicle 6 Tonnes[10]. Recent trials with this GSV has revealed a potential concern with its deployment. 'Up-armouring' to meet the Theatre Entry Standard has highlighted yet another axle over-load issue[11]. Bizarrly, platforms earmarked for Op HERRICK may have to be exchanged for a different variant of the GSV truck; yet to be quantified, a potential delay and extra cost will be incurred. Of equal concern is the sparseness of palletised FALCON nodes. As a fleet designed primarily for the ARRC, 95% of the nodes are delivered in the GSV form. With continual slips to FALCON Phase 2 (a capability to deliver protected network access and network nodes), the GSV variant will have to cater for current and contingent operations over the next 10 years.

It seems extraordinary to think that one of the major provisos to successful acceptance of the Cormorant communications system was the vehicle and trailer[12]. The mitigation plan was to restrict mobility. Corrections to the braking system on the MOWAG Duro (a vehicle procured from the Swiss[13]) were made. Because of subsequent availability and training issues, the vehicle brakes were finally assessed as not on the critical path. However, this does underline once again the potential pitfalls of deep integration (especially with a low population, 'new' vehicle).

The final piece of evidence is drawn from the Reacher programme. The specified requirement forced Paradigm to design a fully integrated platform that delivers mobility, the satellite ground segment, baseband and power. However once deployed on Op HERRICK in autumn 08 (of note was the original In Service Date of 2004[14]), the initial in theatre operating capability was delayed as the vehicles' protection did not meet theatre standards. This forced a helicopter or DROPS lift. The Reacher design also prevented the dismounting of modules, making the movement of modules and rebuilds of the capability extremely difficult. In other words, the integration was so tight that very little flexibility existed.

Doing Things Differently

In this article I have sought to challenge the norm in CIS procurement. In essence, think differently. Think about the platform last. Common interface standards for power, data, cabling and equipment racking will help when the time comes to re-mount equipment into vehicles. Thinking about a range of platforms would also prove beneficial. The rapid reaction element of 30 Signal Regiment would not thank defence procurement for a FALCON switching node in a GSV 6T truck. Likewise a future armoured brigade signal regiment rehearsing a medium scale peace enforcement opearation would not be best pleased with a soft skinned 6T GSV truck. However it might fit the bill for HQ ARRC or 2 Signal Brigade. Some platforms will always be required in order to maintain a flexible reserve; but could they appear in a second tranche? And what level of environmental proofing is required and what proportion of the fleet? No answers are given, but this analysis must take place during the need and numbers study. The Army (and Defence) will then be presented with a suite of equipment, some in a variety of vehicles and optimised for various environments. The UOR process could then be used for mission specific items. Perhaps the build of network operating rooms, the 'desertisation' of modules or the armour proofing of vehicles can be added. Without such a radical approach, procurement norms will not be broken. CIS procurement will continue to lack agility. So, maybe it is high time to 'forget the wheels' and do things differently.

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[1] *RSI workshops in 2009, (Agility in ICS Acquisition).*
[2] *KSA main task list – J6 HERRICK as a Pathfinder programme.*
[3] *Deep integration – vibration smoothing, power, air-con, cabling looms, 19 inch racks, mission modules etc.*
[4] *PJHQ IER SO1 J6 Ops, Herrick Paper, dated Aug 09.*
[5] *Noting that JFHQ has an earlier need to deploy.*
[6] *Source, NAO Report, MoD DII Programme, dated Jul 08.*
[7] *'The number of transistors and resistors on a chip doubles every 18 months', Gordon Moore, Intel, 1965.*
[8] *NAO Major Projects Report 2008 in to SOOTHSAYER, Dec 08.*
[9] *D DEC ISTAR Update on SOOTHSAYER Programme Position dated 23 Nov 04.*
[10] *DEC CCII FALCON Increment A Vehicle selection 24 May 06.*
[11] *FALCON 30th CIWG dated 14 May 09.*
[12] *DEC CCII Cormorant Acceptance Situation Report Oct 06.*
[13] *Because of the procurement from the Swiss, a Parliamentary Question was raised – a PQ on the vehicle, not the CIS!*

THE IET – STANDING OUT IN THE CROWD

By Lieutenant Colonel (Retired) James Sweetman and Major Laurence Fowkes

James Sweetman served in the Corps for almost 30 years. He was widely regarded as an excellent engineering officer and was awarded the RSI Silver Medal for his outstanding work in designing and overseeing the procurement and installation of both the Falkand Islands Trunk System (FITS) and the communication package for Mount Pleasant Airfield. He always encouragied his peers to take up the CEng qualification, and was a lead advisor in the Corps on this until he retired. Since then he has continued to be a very active Professional Registration Adviser for the IET and continues to support those in the Corps seeking to obtain professional engineering qualifications in the IET. He is a Fellow of the IET.

Laurence Fowkes started his military career as an officer in the Gurkhas. Having served in CIS technical posts at SO3 and SO2 level, including at MOD and as one of the military support staff to QinetiQ in Malvern, he transferred to the Corps. He is a member of the IET and a Chartered Engineer. Although currently serving at 22 Signal Regiment, Laurence has taken up the mantle of promoting professional engineering qualifications and is now the IET focus for the Corps.

The Secretary can provide contact details if RSI members wish to contact the authors about obtaining professional qualifications via the IET.

Founded in 2006, the Institution of Engineering and Technology (IET) is the result of the merger of two specialist institutions (the former IIE and IEE which dates back to 1871) and today has more than 150,000 members in 127 countries in the world with over 100 networks of activity and offices in the UK, USA, India

and Asia Pacific. As descendants of the Society of Telegraph Engineers, the IET is the natural home for armed forces signallers enabling communications and data to flow in addition to the design and management of the information systems of today and tomorrow.

Being Europe's biggest professional institution, covering a wide range of engineering disciplines, the IET, a registered charity, is uniquely positioned to raise awareness of the role of engineering in the modern world, promote the sharing of engineering knowledge and excellence in engineering skills. It does this through its extensive base of members and in collaboration with partners in academia, industry and the Armed Forces.

It is evident that today and tomorrow's engineers, both civilian and military, will be key solution providers for the long term challenges we face, such as restoring economic stability, countering terrorism threats, energy supply and climate change. No single institution or organisation can adequately provide all that is or will be needed. It is for this reason that collaboration and partnership are at the heart of the IET's agenda. The IET's growing partnerships and agreements with the armed forces are an important element in ensuring that the skills and experiences of industry and the military work together.

A strong and enduring link exists between the IET and the Royal Corps of Signals. There is a long history of senior officers serving as Fellows of the IET, including the current Master of Signals and Signal Officer-in-Chief. In addition Corps members are active on a variety of technical panels and within local branches. Within the Corps there are Officers and Warrant Officers able to advise and assist with membership and professional engineering qualification applications.

Stand Out in the Crowd – Professional Registration

More engineers are registered each year by the IET than any other institution in the UK. This provides members with authority and credibility as professional engineers and a world-wide network of technical experts and knowledge.

Professional registration defines the level of engineering knowledge and experience that an individual has gained in their service career. This recognition enhances credibility in instances of engagement with industry and demonstrates a commitment to excellence. For those designing and providing the communication systems on the battlefield where initiative, engineering innovation, and leadership are required, the Chartered Engineer qualification (CEng) is the hallmark of professional competence. For individuals who oversee the

maintenance and repair of the systems and provide the day to day adjustments needed to solve the local needs, the IEng qualification demonstrates clearly a high level of technical competence and managerial ability.

As well as awarding the CEng, IEng and EngTech qualifications, the IET is the only body currently offering ICT*Tech* - the world's first professional qualification for ICT practitioners. ICT*Tech* was launched in January 2009 by the IET following industry demands for a competence-based professional qualification for ICT technicians.

Three of the initial eight IT professionals awarded the ICT*Tech* qualification were from the military. Corporal Dan Hunt, an ICT systems technician at the No 1 Radio School, Royal Air Force Cosford, said "*Being recognised by a professional body for the training I have undertaken and the skills I have gained is a wonderful thing. IT specialists have been overlooked for a long time in the engineering environment and the new professional recognition of ICTTech is hopefully just the start.*"

Stand Out in the Crowd – Professional Development

Whether planning to stay in the military or transfer to a civilian company, continual development and acknowledgement of experience and expertise are key. Professional body membership not only demonstrates commitment to one's chosen career, it may also increase the opportunities for promotion.

Within the Armed Forces, for those who aspire to senior positions in Defence Acquisition and CIS service delivery, it is clear that having a professional qualification is relevant and important. Competition for technical jobs amongst other arms and services and civil servants demands a recognisable commitment to engineering excellence. Membership and professional registration with the IET is the hallmark of achievement, and your competitors for the post are likely to have this already.

Transferring skills and experience into industry can be challenging. Having a method of keeping up to date with one's continual professional development (CPD) ensures a level playing field with civilian counterparts. It gives credibility, opportunities to connect with industry, helps develop a clear career path and provides a professional home for life. Anyone wishing to benefit from what the IET has to offer may join, and if working at the graduate level within the engineering profession is likely to be able to use the initials MIET after their name. Full details of all the qualifications awarded by the IET and on grades of membership can be easily found on the IET web site at www.theiet.org

THE WORSHIPFUL COMPANY OF INFORMATION TECHNOLOGISTS

Mr Charles Hughes, Master 2009-10

The Worshipful Company of Information Technologists (WCIT) is the 100th Livery Company of the City of London and has been affiliated to the Corps since 1991. Their work brings together the centuries-old livery tradition and Information Technology, the key industry of the 21st century. As well as working to promote the industry, the Comapny runs a significant programme of charitable and educational activities.

Today, around 650 leading IT practitioners belong to the Company. Members come from all sides of the IT sector - suppliers and users, hardware and software, and from established multinational companies to newly created start ups. Whatever their background all members share a desire to give something back, to the sector and to the wider community. Members give their time, resources and the contacts available through their personal networks to support Company activities.

The governing body of the ITC is the Court, which is chaired by the Master of the Company, Mr Charles Hughes, above. The Master is supported by the Wardens and a staff team headed by the Company's Clerk. As well as sponsoring prizes at the Royal School of Signals, the WCIT have offered the opportunity to the Corps for selected personnel to participate in their Journeyman Scheme, a three year progranmme of mentoring which leads to membership of the Company. The financial details of this exciting scheme are now under consideration, and full approval is hoped for in the near future.

Plans are well advanced for the Corps to participate in the historic event of the granting of the Royal Charter, due to take place in the Guildhall, London on 17 June.

THE DEFENCE SECTOR AND HEWLETT PACKARD NEW ZEALAND (HPNZ)

By Rob Hamilton

Rob Hamilton served as a Royal Signals officer from 1997-2002, before an 'overnight transfer' saw him move from 15 Signal Regiment in Lisburn one day, to RSO of a NZ LAV-3 Infantry Battalion the next! Rob served with RNZ Sigs until August 2008 and since then has been employed in the HPNZ Defence, Security and Intelligence team in Wellington.

CODED ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (COFDM)

Like any Government department, NZDF takes the opportunity to maximise functionality and minimise costs and training bills, by delivering flexible, scalable solutions which enhance existing capability. NZDF has some excellent kit in its arsenal and often with minimal modifications, existing equipment and processes can be employed to provide far greater capability.

One such equipment that is being modified is the P-3 Maritime Patrol Aircraft. Already a well proven intelligence gathering platform and currently being upgraded with a first class sensor suite under the P-3K2 Project, the aircraft does, and will continue to be, the centre-pin of NZDF's airborne surveillance assets. But there's not much point in having the best 'information hoover' in the world if you can't empty the bag! On any one mission, the P-3K2 will have the potential to gather multiple 'gigs' (Gb) of information; the challenge is getting the time-sensitive information off the platform to those who need it, in as short a duration as possible.

For the last six months, the RNZAF has been trialling a real-time imagery transmission technology. Its full title is Coded Orthogonal Frequency Division Multiplexing, but as this is rather a mouthful, it is better known by its acronym of 'COFDM', a type of modulation used very commonly in video distribution. COFDM was originally developed for high definition broadcast and is a multiple carrier digital transmission technique that operates in high multipath environments. Some of you may well be COFDM users without knowing it – if you have 'Freeview' and are receiving your signal via an internal or external UHF antenna (rather than through a satellite dish), you are in fact receiving the COFDM Digital Terrestrial Transmission (DTT). So how does COFDM differ from an analogue transmission? 'A picture paints a thousand words' and thus is probably best shown using the photos below. Both pictures are snapshots taken from video footage from a covert camera and transmitter hidden in a supermarket shopping trolley, with a receiver in a vehicle parked outside the supermarket – the one on the left is an analogue transmission, and the one on the right, a COFDM transmission. From a RF perspective, the supermarket scenario is one of the most hostile environments imaginable – both the transmitter and receiver surrounded by metal, with the signal being reflected, refracted and diffracted off every surface! So why do they differ?

Analogue broadcast equipment transmits and receives in real time – this works well where a 'clean' signal is achievable, but where the signal is prone to interference and data packets arrive out of phase at the receiver, analogue means are far from ideal. The distortion or 'clatter' seen in the left hand picture is the result – in a real time analogue transmission, the video will cut in and out and the quality of the received product will vary significantly.

COFDM on the other hand uses this interference to its advantage. In its simplest terms, the COFDM receiver has a very short dwell time, during which it 'builds' the picture to as high a quality as it can, before sending it to the monitor; the receiver actually benefits from reflection, refraction and diffraction, as more data packets received out of phase enhance the picture! Similarly, in wide area broadcasting (such as Freeview), receiving the signal simultaneously from several spatially dispersed transmitters reinforces coverage, rather than causing interference. This concept is very beneficial in many countries, as it permits the operation of a single national network frequency, and avoids the replication of program content on different carrier frequencies, which is necessary with FM or other forms of broadcasting.

Analogue picture

OOFDM picture

The purist would argue that COFDM is not a real-time transmission technique and they would be right. Typically, the dwell time can vary between a tenth and half a second – some of you may have experienced this whilst watching a rugby match on a Satellite TV station and listening to the same commentary on the radio, and noting that the audio from one source is 'out of synch.' So why use COFDM in the Defence environment? Its adoption for military use stems from the troubles in Northern Ireland, where covert British Army units tracking terrorist suspects in Built-Up Areas and using analogue systems to record their movements, would use the footage as evidence in Courts of Law. After a number of cases were dismissed because of defence claims that the analogue video evidence was of insufficient quality for prosecution purposes, the British Army realised that it had to adopt a better technology, if their surveillance work was not to be in vain. COFDM was duly selected and today, UK MoD widely uses the system on many platforms, and all 43 regional Police Forces, less the Metropolitan Police, use the same equipment. This is provided by Enterprise Control Systems (ECS) (www.enterprisecontrol.co.uk), a privately owned company based in Wappenham, Northampton (UK), with twenty years experience in the design, development and manufacture of video microwave, telemetry and Electronic Counter Measure (ECM) equipment.

COFDM Transmitting Equipment

So what form does the equipment take? There are a wide range of transmitters and receivers, from body-worn, covert solutions, to fully ruggedized solutions designed for aircraft or heavy vehicles. The P-3 fit includes a transmitter, a 10W Amp, a 256 AES Encryptor and an

antenna; attached to the surveillance camera, the COFDM equipment can broadcast up to two high definition video streams in real time for a bandwidth of 8MHz (which compares extremely well with the equivalent 25MHz required for an analogue transmission), with a planning range of 50 nautical miles at 2500ft AGL. Of course, if the aircraft flies higher, or the topography of the land is flatter, the range is

COFDM Receiving Equipment

significantly increased. At the receive end, the broadcast can be picked up at fixed site installations (in 19" racks), deployed HQs, and in manpack and vehicle borne configurations. The trial equipment fleet is shown below.

So what other mediums for transferring imagery exist? Less the analogue and COFDM broadcast options, another technology can send imagery from an airborne platform upwards to a satellite, where it is then sent downwards as a broadcast. As with everything, there are pros and cons for both. The latter is fantastic for passing imagery from one airborne platform to another and providing an 'Over The Horizon' capability; the cons are that a satellite and access to some serious bandwidth has to exist for the imagery to be passed in the first place. For small countries with limited access to satellite services and a requirement for airborne surveillance platforms to be used in domestic, multi-agency scenarios, the use of a Line of Sight broadcast solution makes better sense; for Coalition and distributed operations, the balance probably swings the other way.

With domestic operations in mind, the UK model appears an excellent one for New Zealand to leverage, as from an outside perspective, a 'Whole of Government' concept has been implemented, namely any UK Government airborne surveillance asset can support any Government agency, on the premise that the agency has access to the receive equipment. This arrangement works particularly well in joint operations. For example, the RNZAF may provide a P-3 to provide real-time imagery as part of a Customs heist against illegal fishing, but Police may need

to see the feed before they can make the arrest. A more timely response can be made if Police have their own receive equipment and can view the footage simultaneously with Customs. Such a concept is possible if a pan-agency approach is adopted from the outset, and also allows for Relief-in-Place (during refuels) and the seamless dissemination of the imagery between select agencies.

And going forward? MPEG2 and HD are already available, and MPEG4 is on the roadmap. Receive stations can be set up similar to GSM networks, allowing the feed from an airborne platform to be 'handed off' between various receivers as it moves around the country. These stations work across an IP backbone, meaning the feed can be broken out wherever Internet access can be sought and by whoever has the means to decrypt the transmission. And for New Zealand? Given its relative isolation and lack of satellite coverage, Line of Sight broadcast technologies such as COFDM make great sense. As New Zealand Police commence similar trials, the panacea would be for the implementation of something akin to the UK model, allowing video dissemination amongst select agencies, whenever and wherever it is required.

Editors Note: Hewlett Packard New Zealand (HPNZ) provide a third party consultation and integration role for those companies who cannot justify having a permanent point of presence in New Zealand in their support of the smallest member in the Five-Eyes Community. As well as being the prime sponsor of the Army Command and Control BattleLab, a practical research cell who are developing the User Requirements and de-risking various NZDF Network Enablement Projects, HPNZ also sponsor 'The Conche', the official magazine of the Royal New Zealand Corps of Signals, and provide technical articles for inclusion, tailored for all ranks to gain an understanding of the technologies being introduced into service. This article considered the trialling of real-time imagery equipment on the RNZAF P-3 Orion aircraft, which HPNZ facilitated as part of the Coalition Warfare Interoperability Demonstration (CWID) in 2009.

THE PIPE AND DRUMS OF QUEEN'S GURKHA SIGNALS

By Major Ben White, Royal Signals

In 2009 Gurkha Signals celebrated its sixtieth birthday with large and well attended events in Bramcote and Kathmandu. To help commemorate this significant milestone a history book was commissioned to record the various events and achievements of the last sixty years. One of the most frequent questions asked of the Regimental Historian by members of the Corps concerns the origins and development of the Regimental Pipes and Drums. As with so much of Gurkha Signals Regimental history these can largely be attributed to the vision and energy of Gregory Saheb, the first Commanding Officer. His book "Journey of a Lifetime" remains the definitive record of the early years of what was then 'Royal Signals Gurkha' and the formation of the Regimental Pipes and Drums. In the short article adapted from the history book it is hoped to summarise how the Pipes and Drums have developed over the following generations.

The Gurkha Signals Pipe Band made its first public appearance in September 1955 in the same month that 'Royal Signals Gurkha' was formally incorporated into the Brigade of Gurkhas by Army Order Number 102. It wore the tartan and brooch of Clan Grant, used instruments loaned by the Director of Ordnance Services in the Far East and was funded by the Regimental pig farm and subscriptions on all Regimental Officers. The precarious funding and support arrangements made for interesting early days.

The tartan and affiliation to the Grants had been one of Major Lionel Gregory's first acts in his determination to develop the identity and character of Gurkha Signals. He noted that units of the Brigade of Gurkhas were affiliated to various Scottish or Rifle Brigade Regiments and wanted to 'shortcut' the years of history some of these connections represented to ensure his new Regiment had a similar identity and colourful associations. As 'Highlanders' from Nepal he felt sure that he could develop an affiliation with the Highlanders from Scotland and in 1952, with the help of Colonel Reed and Lieutenant Colonel Murray of the 51 Highland Division Signal Regiment, an affiliation was arranged. A ceremonial khukri was sent to the Signal Regiment with the Gurkha Major, Parsuram Gurung, as one of his many additional tasks when in UK for the Queen's Coronation. He presented this to Lieutenant Colonel Hay (Murray's successor) on the 13 November 1955 and on the 20 April 1956 Her Royal Highness The Princess Royal gave her formal permission for the affiliation. Her Majesty The Queen endorsed the affiliation on 25 January 1957.

The Countess of Seafield authorised the wearing of the Grant tartan plaid to mark the affiliation. A patch of tartan was to be worn behind the cap badge on the 'Hat, Felt, Gurkha' and it remains to this day. The plaid brooch authorised for wear in 1958 was to complement the scarf in "Red Grant Tartan No 15" for the Pipe Band. This affiliation also provided the Regiment with its Regimental march: "Scotland the Brave".

Aided by one of his energetic Captains, Hamish Paterson, Gregory Saheb had set about carefully identifying any hidden pipe playing ability by leaving chanters lying about the barrack huts. His idea was that, as many young soldiers had grown up tending herds in Nepal playing on bamboo flutes, they would "recognise an old friend in the chanter!" Their goal was to one day have a 'Beating Retreat' in Lamjung camp and they now set about co-opting the initially sceptical Adjutant, Captain (later Brigadier) Able Dacre, into their plan. Thus a Regimental farm with pigs, chickens and turkeys was decided upon to pay for the Band while Pipers were to double up as Linemen on the unit establishment tables.

Lance Corporal Bombahadur Limbu was a trained piper who came from a Rifle Company having had a disagreement with their unit's Pipe Major. A 'strong character' he took the Pipe Band to Penang in March 1955 for training with the Royal Scots Fusiliers while the drummers had lessons from the 11 Hussars. This intensive programme of training took one Pipe Major, one Drum Major, nine pipers and seven drummers (four of whom doubled up as buglers and trumpeters) to a public performance in just under four short months. Its first public performance was on the 3 September 1955 as part of a massed beating of Retreat by the Royal Scots Fusiliers and 1/6 Gurkha Rifles in Ipoh. Following dress rehearsals at the British Military Hospital at Kinrara and the Lady Temple TB Hospital its first proper Regimental performance was on the Regimental Birthday on 23 September 1955. At the end of a full programme the Commanding Officer presented the Piper Major with a pipe banner. With all Regimental Gurkha Officers in Mess kit for the first time this was a very significant day. Finally on that day, to cap it all, a Piper Major's toast was instituted using the silver quaich donated to the Regiment by Signallers of 51Highland Division inscribed with details of the affiliation between the Regiments. The Pipe Major will take a quaich of whisky at the end of the Band's performance from the senior dining officer. Raising it to his lips with the words "Suk santi ra dirgaiyu hos" (effectively an exhortation to peace, happiness and long life) the officers will reply with "Tatahastu" ("So be it"). Having drunk it, he will then plant a kiss of appreciation on the underside of the quaich. A further important element of this new tradition, particularly for

Fig 1. Gurkha band practice

Bombahadur Limbu, was the opening of the new bottle of whisky to fill the quaich and the donation of the remainder of the new bottle to the Piper Major for his return to his quarters.

Gregory Saheb had one final important task to complete even though he had handed over the Regiment to Lieutenant Colonel AN Griffiths OBE at the end of 1955. He had made a promise to Captain Hamish Paterson and on his return to the UK he set about completing it with vigour. Many arrangements were made and, on the 21April 1956, Gurkha Signallers in khaki battledress from Catterick joined Lieutenant Colonel Gregory at St James Palace in London for the presentation of Her Royal Highness The Princess Royal's Pipe Banner. This was handed over to Lance Corporal Jitman Gurung after a short parade and the televised event was watched by many serving soldiers in the UK. It was then flown to Nepal to meet the Regimental Pipe Major and it was then proudly paraded through Kathmandu as part of the Coronation procession of His Majesty Mahendra Bir Bikram Shah Deva The King of Nepal on the 2 May 1956. This was a huge coup for the Regiment. The youngest Regiment in the Brigade of Gurkhas was the first to receive a banner with the Royal coat of arms and the first to display them in Kathmandu at such an event. History was made.

Lance Corporal Thimbahadur Gurung then paraded the Royal Pipe Banner in front of the Regiment for the first time on the 31 May 1956 (Her Majesty The Queen's official birthday parade). When not on parade it was stored in a special glass case within the Officers' Mess in Lamjung camp. In 1957 the Regimental Pipes and Drums had the opportunity to go to Hong Kong and were able to play for various VIPs and 48 Gurkha Infantry Brigade Signal Squadron.

Pipe Major Bombahadur Limbu was a real Regimental

character and he rose to the rank of Staff Sergeant before leaving on pension in May 1965. He was awarded the British Empire Medal in 1965 for his long service to the Regiment as Pipe Major. He led a number of demanding engagements in his final year with the Pipes and Drums parading at full strength sixteen pipers and eleven drummers. Sergeant Sanbahadur Rai replaced him as Pipe Major and was sent to School of Piping at Edinburgh Castle in October 1965 for his Pipe Major's course. At the time of his retirement the Army of Bhutan was advertising for someone to teach "bags and pipes" and Bombahadur applied for this new appointment. He had trained and developed Regimental piping well. In a competition at Terendak run by the Scots Guards, Signalman Tejbahadur Rai was the only Gurkha of twenty five entered that won a prize. Funding and equipping the Pipe Band remained problematical and it was then traditional for Officers on leaving the Regiment to present a bugle, or half a bugle, to the Band rather than purchase silver for the Mess.

1965 also saw Signalman Dhankarne Rai play with massed Scottish Territorial Army Signal Regiments Pipes and Drums at Edinburgh Castle on the 5 June. In 1968 the Pipe and Drums were playing at the Royal Tournament and Edinburgh festival as part of a long UK tour with many other engagements at County shows etc. Sadly this year saw many announcements of reductions in strength in the Brigade of Gurkhas and much of the Regimental silver/property, including that from the Pipes and Drums, was handed over in trust to the Royal Corps of Signals committee. Lance Corporal Tejbahadur Rai was still on his potential Pipe Major's course so the Regiment tried to ensure the future skills of what was to be a significantly reduced in size Pipes and Drums. To try and protect the Pipes and Drums in the drawdown of Malaya, a Defence and Employment Platoon was created within 48 Gurkha Infantry Brigade HQ and Signal Squadron in Hong Kong. They replaced the Gurkha Infantry men in the HQ Defence Platoon. Thus the tradition of tradesman first, piper second continued and the Regiment was able to retain its Pipes and Drums in a period of severe cutbacks. This battle to protect the Pipes and Drums continued throughout the 1970s in the face of many further cuts.

Once in Hong Kong the Pipes and Drums under Pipe Major Tejbahadur had numerous engagements across the Colony and also were invited on a number of international tours including to Australia and Korea to support the Regiment's Honor Guard commitment. It is Tejbahadur who was the subject of the watercolour painting by Mr Ken Howard, many prints of which were produced in 1980 and are seen in Messes to this day. 1978 saw Drum Major Narbahadur leave on pension (reputedly the smallest Drum Major in the world) and be replaced by

Sergeant Bhimbahadur Limbu who was notable for both his six inch moustache and the fact that he needed a new mace as Narbahadur's resembled a walking stick against his large frame.

Fig 2. Sergeant Mangalsing Tamang, Captain Chris Ford and Sergeant Amar Limbu on the Lo Wu ranges in Hong Kong.

1980 saw the Pipes and Drums back in UK and the presentation of a Royal Banner from Her Royal Highness the Princess Anne. This took place in Buckingham Palace on the 13 May 1980 and saw 59 members of the Regiment and 60 guests present to watch a short programme and see the presentation. The Colonel of the Regiment, Major General HAJ Sturge CB, passed the Banner to Her Royal Highness who then attached it to the bass drone of Pipe Major Tejbahadur's pipes. The short programme of music allowed the Pipes to demonstrate their versatility and included Nepalese and Scottish music. Having completed the parade the Pipes and Drums had the opportunity to meet and talk to Princess Anne.

The Royal Banner itself was a fine piece of work with a distinctive Hong Kong flavour to it. With a quote of £10,000 from the Royal School of Needlework it seemed to be beyond the finances of the Regiment. However Ah Lee the tailor in Hong Kong was able to do the job for £2000 and, once the authorities in UK were convinced the quality was high enough, this was the banner presented to the Regiment. It was soon to be on parade

fitted to a new set of silver chased pipes presented to the Pipe Major by Lieutenant Colonel Paddy Verdon OBE at the end of his tour as Commander. It has also long been a tradition that Commanders present a Pipe Banner to the Regiment at the conclusion of their tour and this continues to the present day.

The Pipe President in 1980, Major Derek Pilley of the Royal Army Education Corps (and former Bandmaster in the Royal Marines), organised a wide ranging UK tour and also took the Pipes and Drums to Canada raising large sums for charity. Within the UK the Pipes and Drums played for many military events including on HMS Gurkha in Newcastle and Portsmouth. In Canada the Pipes and Drums played for many thousands at spectators as part of a major nation wide tour. Warrant Officer Class One Tejbahadur Rai handed over the appointment of Pipe Major prior to going on pension to Sergeant Norbahadur Gurung on the 6 June 1983. The establishment of the Pipes and Drums was now set at 22. Sergeant Norbahadur had been singled out for particular praise by the Director of Army Bagpipe Music and the President of the Piobaireachd Society who commented that:

> "I personally have been associated with the final examinations at the Army School of Piping for over thirty years, and with the examination of Gurkha students for over twenty. I cannot recall any Gurkha NCO who has approached the standard attained by Cpl Norbahadur. By our own standards, he compares most favourably with the average student on the Advanced Courses and, in my opinion, could hold his own as an NCO in any of our own pipe bands. In bearing, manner, and address he is in fact superior to the usual type of Scottish NCO."

The Pipe Major and Sergeant Dipkumar Gurung were then able to run internal courses to train further Regimental pipers and they were of a standard and the necessary repertoire to play at a very successful Beating

of the Retreat with the Band of the Royal Corps of Signals in 1984. Major Arthur Merrick was President before Major Derek Pilley returned again to the Regiment in 1985. The Pipes and Drums were now generating revenue (rather than being supported by the Regimental farm in the 1950s) and contributed considerable sums to the Regimental PRI from various engagements at hotels etc. It was also able to buy new equipment while Staff Sergeant Norbahadur Gurung and Sergeant Dipkumar Gurung were composing pieces ready for special events. These included "Lieutenant Colonel MJ Lance" which was performed at Lance Saheb's dining out from the Mess, while Staff Sergeant Norbahadur took his composition "Ptarmigan" to 1 (UK) Armoured Division Signal Regiment on a tour organised by Lieutenant Colonel SMA Lee. Not content with live performances,

Fig 3. Sergeant Bahadur Gurung Narendra, the current senior player in QGS.

and to ensure their compositions were more widely available, the Pipes and Drums starting selling tapes at HK$33.

1990 saw the thirteen members of the Pipes and Drums head to the UK again for a variety of engagements and training. This also saw them play at 30 Signal Regiment in Blandford for the formation of 250 Gurkha Signal Squadron on 1 June 1990. The year 1991 saw the Pipes and Drums in the UK again for the Royal Tournament at Earls Court and for a show at the Royal Military Academy, Sandhurst. Drum Major Chattrabahadur Rai and Pipe Major Norbahadur Gurung also took the Pipes and Drums to Glasgow for a few days to play with 32 Signal Regiment (Volunteers) (which includes the remnants of 51 Highland Division Signal Regiment) and this included performing for the Princess Royal during her visit to the Regiment on 22 June.

In the early twenty first century, Pipes and Drums are now dispersed amongst the Squadrons with the Senior Piper coordinating performances on the direction of the Gurkha Adjutant. Getting Pipers and Drummers trained and equipped is often a struggle but one that is willingly undertaken. In 2009 there were eight trained pipers and two trained drummers in the Regiment spread amongst the three Squadrons. Pipers and drummers have considerable additional responsibilities above those of their trade and rank and lose much of their free time to rehearsals or events at weekends etc. They are always in demand for Regimental and Squadron occasions and continue to play a useful role on operations too.

THE BAND OF THE ROYAL CORPS OF SIGNALS

By WO1(BM) Colin Hales

Colin Hales joined the Army in February 1991 and after completion of his Basic Military Training at Arborfield, Berkshire, was posted to The Band of The Corps of Royal Electrical and Mechanical Engineers. In 1999 he applied to join the Student Bandmaster Course held at the Royal Military School of Music, Kneller Hall. Upon completion of the course in 2003, as well as being awarded his Degree from Kingston University, he gained first place prizes for Wind Band Composition, Wind Band Arranging and Brass Band Arranging and was posted as Bandmaster to The Band of The Dragoon Guards. In March 2006 he took up the appointment of Bandmaster of The Minden Band of The Queen's Division and in July 2008 was pleased to be assigned as Bandmaster to The Band of The Royal Corps of Signals in Blandford.

As most readers will be aware the Corps Band has undergone a transformation in many ways over the past 12 months. The current Director of Music, Capt David Barringer took post in January 2009 and he brought with him a wealth of musical experience from his days as a Bandmaster and from conducting and adjudicating civilian Brass Bands. He also leads the British Army Brass Band (the musicians version of a Corps football team) and his last job was as SO3 O&D at HQ Corps of Army Music, so plenty of admin advice has been readily available!

The Band rehearsal complex has undergone a much needed facelift; thought to have been the first since the mid 1970s. A new conference suite has been created and the band's internal admin cells have all relocated to an adjacent former accommodation block – Scott Block. The Band is now more effectively self sufficient in the Band's Quartermaster, Recruiting, Training (Musical, Military and Adventurous), Transport and Security, Accounting and Public Relations departments. Small rooms previously used as office space have now reverted back to rehearsal facilities. The acquisition of Scott Block has also enabled a former changing room to become a permanent rehearsal resource for the Pop Group and any other small ensemble as required. An enormous debt of gratitude is extended to the Quartermaster and his staff at Blandford Garrison Support Unit for allowing and enabling us to accomplish this progression.

It has been mentioned on several occasions by members of the Corps, ranging from the SOinC himself, to Signallers on Medal parades that the band sounds different to how it did 12 months ago. Without wanting to go into too much depth (we are techies too but in our own way!), music is an art form in which exists an opportunity for expression in numerous different ways. Throughout the year, Corps Band musicians have been encouraged to develop a bigger sound with more depth. There are no real methods for measuring 'size and depth' in music other than by ear. There are a variety of techniques available for musicians to increase both; using more air is the most basic way of imparting a 'bigger'

The New Boss – Captain David Barringer CAMUS

The Ayios Nikolaos Fete

sound. We are essentially a Wind Band after all; no jokes about hot air thanks! All personnel have been advised to consider the length of notes, which has, in general terms made the most significant improvement to the overall sound.

In recent months, readers of the Summer 2009 edition of *The Wire* will remember the band spent a very challenging 3 month period in the run up to August's Sovereign's Parade at The Royal Military Academy, Sandhurst. In particular, the final week is widely regarded as one of the busiest an Army band can experience. 2009 was no exception, only in our case, the final 5 days' regular rounds of parade rehearsals before the big rehearsal, re-shows, more rehearsals and final farewell Dinner Nights, were supplemented by farewell Dinner Nights (and their associated rehearsals), each preceded by a short Beating Retreat, in both Offs' and SNCOs' Messes for both the Commandant and the Old College Commander! Needless to say the band performed admirably, bouncing straight from parades to dinner nights with rousing performances on every occasion. Without the 'wilco' attitude that all personnel displayed, the consistently high performances would not have been possible.

September witnessed a two week tour to Cyprus. Spectacular performances in a variety of locations around Episkopi and in Ayios Nikolaos were interspersed with some well earned adventurous activities. The band returned to Ayios Nikolaos in March to play for the presentation of the Firmin's Sword of Peace to personnel in JSSU.

The year was completed with a recording session in the theatre of nearby Milton Abbey School. The tracks in

Viva Musica! were laid down in three days at the beginning of December. It's an excellent recording that the band are rightly proud of and it showcases several personalities who have been featured as soloists throughout the year. We are please to announce that it is now available, priced at a very reasonable £12.00 each (+p&p). If you would like to order your own copy, please write to: *LCpl Simon Lindley, Royal Signals Band, Blandford Camp, Blandford Forum, Dorset DT11 8RH* or alternatively through the Museum – in the shop or on line.

The non-musical roles of musicians are not widely known across the Army – but we have them. In addition to deploying Individual Augmentees to current operations, CAMUS bands also fulfil one of the least attractive wartime roles. The size of a service band is ideal for the set up and manning of a Chemical Decontamination Area – mainly used to clean up casualties before they are admitted to a medical facility in the field. In Feb 2010, the Corps band attended the training course at Winterborne Gunner. Although the course is clearly something very different to the normal working routine, although quite challenging at times, it was strangely enjoyable. Most personnel had taken part in previous courses as bands are mandated to undergo training every 3 years and the Director had been lead desk at CAMUS for the role in his previous job.

Experience predicted a frantic, painful and confusing time unnecessarily spending very long periods in full Individual Protection Equipment (IPE). In actual fact, the hours spent in full IPE *were* necessary to understand the difficulties which may be expected whilst operating in a potentially contaminated environment. The course instructors were, as one would expect, truly excellent and treated all personnel with a great deal of respect. The Band remains one of the primary public faces of The Royal Corps of Signals, performing to troops and entertaining both civilian and serving personnel on countless occasions worldwide. With the usual round of Corps engagements and some 30 or so concerts planned for 2010, mostly in and around Dorset, the Band is looking forward to another excellent year in the spotlight.

YUGO CULTURE……LOLLIPOPS TO FOLLOW

By Lieutenant Colonel (Retired) Roger Batho.

Roger Batho was the first resident UK Defence Attache in Sarajevo. He retired last year and now lives in Montenegro where he is a cultural consultant and property developer.

Fig 1. Mourning a golden era.

The explosion rattled around the valley below. It was Christmas Eve in the Balkans. Not the catastrophic days of the 1990s but 6 January 2010. Christmas in January? Yes, Orthodox as opposed to "katolik". The place - Montenegro. The explosion - some sort of ordnance left over from the 90s.

This is my fifth year of living in former Yugoslavia, a region that takes a while to understand. But, it is oft said that when you think you understand the Balkans you patently don't! Generalisation is unavoidable in a short overview such as this but I believe the thrust of my observations extends throughout former Yugoslavia, albeit stronger in some places than in others. I suspect many reader's view of this region will have been formed whilst playing their part in trying to sort out the conflict and chaos of the 1990s. My experience here has been gained during a period that could be categorized as aspirations towards Euro-Atlantic integration. In other words a strong political desire to join NATO and the EU. This piece contains my personal view of aspects of Jugo culture and where I think its going

Let us return to the Christmas explosion. It was probably a mine safely detonated to start a family celebration literally with a bang. The following 24 hours were punctuated by other celebratory explosions and gunfire. This almost casual dealing with arms and ammunition is not surprising given the widespread armed conflict of the 1990s. during the disintegrtaion of Yugoslavia. Research has revealed that there are thousands of personal weapons in the region, the vast majority of which are unlicensed. Following many campaigns and amnesties there has been a marked reduction in fatalities at celebrations, particularly at New Year, but this risky practice continues especially in rural areas. Last year at a local wedding reception a guest sitting next to my wife pushed back from the table, held his arm outside of the makeshift marquee and emptied the contents of his pistol in the air. Earlier, the arrival of the happy couple had been announced by another of the ubiquitous mines. On this occasion the host offered reassurance that the mine was only a small one. Inspection of the spent cases from the pistol later revealed blank rounds, so maybe the campaign message is getting through!?

The weapons thing is consistent with the regional psyche in which strength is all important. Take for instance driving where often the Highway Code is replaced by the Law of the Jungle. One local remarked to me that if "lollipop ladies" were ever introduced here their lifespan would be measured in minutes! Courtsey and compromise are often considered a weakness in this part of the world. This is well demonstrated by the brusque attitude of many minor government officials stemming from former socialist times. Female bureacrats can be particularly officious, probably a direct reaction to male chauvinism which is alive and well here. Inherent pride and strong conviction abounds in Yugoslavs. Beware of any "discussion" on regional history as it can quickly become heated and animated. Here, shouting should not be judged as aggressive but merely a sincere way of getting your point over. Similarly, poking one in the chest is common place. Oblivious to the notion of it being considered assault in many societies, I have seen policemen do it in the street and had it done to me. When it first happens it feels alien and bordering on the surreal just like the pistol at the wedding.

With so much national pride and passion particularly for past greatness, we should not be surprised that it took Tito's iron grip to consolidate Yugoslavia after WW2. This eventually led to the golden years of the 1960s and early 70s which many senior citizens in this region crave today. It was a period of unprecedented prosperity within the non-aligned movement which gave Yugoslavs much

Fig 2. The former Yugoslavia.

more freedom to travel than at present. Such sophistication led them to view their Soviet dominated neighbours as rather inferior and today many still cannot believe that Bulgaria and Romania have forged ahead and are in the EU. But despite these prosperous years, as events in the 1990s showed, nationalism was never far below the surface.

The new sovereign states of former Yugoslavia have hijacked language in the name of national identity. Pre1990 the recognised language of Yugoslavia was Serbo Croat. Now, each former republic claims to have its own language but in truth, with the exception of Slovenian, they are only slight variations of Serbo-Croat. Being a Slavic language, Slovenian is similar to Serbo Croat as I found out to my delight and relief during language training when my posting was switched first from Ljubljana to Zagreb and finally to Sarajevo. However, these subtle variations of Serbo-Croat pose a problem for foreigners as it is difficult to work out the mother tongue of the Serbo Croat speaker. The potential risk is that you accuse a Bosniak (Bosnian Muslim) of speaking Serbian or even worse tell a Serb that he is speaking Croatian. A cunning ploy when asked "What language do you speak?" is to reply "Your language".

Hence avoiding a politico-linguistic gaff. However, this technique is not fool proof as for some in the region these variations of Serbo Croat are very much second languages and not their mother tongue. I discovered this when I proudly told a domiciled Hungarian from Vojvodinia (Serbia) and a Kosovar Albanian in my finest Serbo-Croat that I spoke their language. They told me in no uncertain terms that I did not.

Compared to language, religion in the region is relatively straightforward. In general terms, Croats and Slovenes are Roman Catholics, Bosniaks are Muslims, whilst Serbs, Macedonians and Montenegrins are Orthodox. In fact, the term Bosniak was readopted in the early 1990s and refers to the slavic muslims on the territory of former Yugoslavia who identify themselves with Bosnia and Herzegovina (BiH) as their ethnic state. Bosniaks make up the majority of the population in BiH but there are muslim slavs elsewhere in former Yugoslavia who may not consider themselves. Bosniaks per se. Islam as practiced by the indignous muslims in the Balkans is relatively very moderate. Visitors to Sarajevo are often amazed by the number of mini skirts sported by women of the largely muslim population. The most significant religious struggle in the region is not between the main

Fig 3. Boka Kotorska in January

faiths but probaby that between traditional Bosniaks and the newly arrived Wahhabis who are regularly and forcibly shown the door at traditional Bosnian mosques because of their hard core form of Islam. With this one exception there is widespread mutual respect for all faiths within former Yugoslavia. I witnessed this in BiH, and in Montenegro amongst my close neighbours who represent all three main faiths. One thing is for sure, my neighbours are certainly united in the use of surplus munitions to spice up celebrations, religious or otherwise!

So what has former Yugoslavia got going for it today? In a word, adventure tourism. One feature that all former republics share is stunning natural beauty. The exotic blue Adriatic, majestic mountains, fast flowing sparkling rivers, and beautifully tranquil lakes are natural assets that Slovenia and Croatia are already actively promoting. But the wild beauty of Montenegro, the untouched uplands of BiH and the rich diversity of Serbia and Macedonia need to be exploited for their future prosperity. It will take further encouragement of their governments by the international community to press on with the reforms needed to fully capitalise on the outdoors here. The reform benefits that Slovenia now enjoys as part of the EU are all attainable by the other former republics, albeit at different rates of progress. I believe even politically troubled and complex BiH will get there eventually. This Euro-Atlantic drive should shake off many past ills of the region and remove the sense of isolation that progressive Yugoslavs feel. Who knows, it may result in a the coming of what's seen as a second golden era. But for sure, reforms driven from the top leading to changes in attitude are vital if the rump of former Yugoslavia is to join "Euro World." I ponder the consequences of joining "Euro World "as I survey the Boka on a warm January morning. ....celebrations will be less explosive; transactions in the Post Office will be jolly, and lollipop ladies will know no fear. Yugo culture will have received a severe body blow. ...... Life will be far less exciting but I will just have to knuckle down to it!

CORPS PRIZE ESSAY

Traditionally, the RSI arranged an annual essay competition for Corps officers. Prizes were funded from a legacy by the late Brigadier Chenevix-Trench CB OBE MC. The competition continued until about 10 years ago, when the money was re-allocated. It is intended that the competition be re-branded and re-launched. A proposal was presented by AD Nets CSDC at the meeting of the Executive Committee of the RSI Council in January this year, and approved by RSI Council in March. Much of the process of running the Prize Essay competition is well known and it is intended that a similar process should be followed in the future. This will include a notice placed in the RSI Journal, copied in the Wire, and reinforced by correspondence to units, that outlines the rules of the competition, states the title, and stipulates the timeline. Entries will then be submitted to RHQ R SIGNALS and filtered before the RSI decides on the winners.

Re-branding the competition in the name of a prolific leader whose operational exploits are 'legendary' is thought to be appropriate, particularly with the Corps and the Army on a campaign footing. The intention is thus for the re-branded competition to be called ' The RSI Deane-Drummond Prize Essay Competition', after Major General AJ Deane-Drummond CB DSO MC and Bar. In order to re-launch the competition successfully an incentive in the form of a cash prizes of £1000, £500 and £250 for first, second and third places has been agreed, with the competition being open to all serving officers of the Corps. The following title has been proposed for 2010:

In the contemporary operating environment (COE), where the delivery of ICS is generally from static rather than manoeuvre HQs, the role of the Royal Signals troop commander has evolved. Post operational tour reports have indicated that troop commanders have been used in a variety of leadership and signalling roles. At the same time, as written in the Signal Officer in Chief's (Army) Vision, 'we will offer every man and woman [soldiers and officers] a life filled with purpose and challenge'.

Explain how to make best use of a Royal Signals troop commander in the contemporary operating environment.

It is hoped that many younger officers will enter the competition and will be encouraged by their Chain of Command to do so. The closing date is 1 October 2010.

ROYAL NEW ZEALAND SIGNALS

By Lieutenant Colonel Jim Dryburgh RNZ Signals

Some readers may remember me; I joined the parent Corps in 1975 as an Army Apprentice and following 30 years with the Corps I retired from my last post at the Royal School of Signals in 2005. I then joined the New Zealand Army and I am currently serving in The New Zealand Army General Staff, in Wellington. Via previous posts, as SO2 C3 and SO1 C4EW Capability Management, I am now the Chief of Staff of Army Capability Management, reporting directly to the Assistant Chief of the General Staff Capability.

The reason I am here has much to do with Bernard Redshaw, then Head of Publications at Regimental Headquarters Royal Signals, and a chance conversation at lunch in the Blandford Officers Mess in 2003. This took me, via a meeting with Bernard's cousin, Russell Marshall, the then New Zealand High Commissioner in London, to the New Zealand Defence Staff in London, and on to a second career in the Royal New Zealand Signals, into which I was commissioned as a Major on 1 November 2005.

Bernard followed me home to his native New Zealand the following year 2006. A short time after I arrived in my new post, I suggested to the then Regimental Colonel RNZ Sigs, the NZ equivalent to SO-in-C(A)) Lieutenant Colonel Karyn Thompson that we should get a Corps magazine going and that I knew just the man to edit it. It took nearly another two years to find a sponsor, HP New Zealand, and we eventually launched the magazine 'The Conche' to coincide with a visit by HRH The Princess Royal, who is also our Colonel in Chief, and the formation of 1st New Zealand Signal Regiment in December 2008.

In all of that time Bernard had provided his services for no payment as a service to the Cap Badge. His mission has been to elevate our magazine to the same status in New Zealand as *The Wire* has in UK – to quote Brig John Thomas when SO-in-C(A), to be "a window on the Corps". Bernard has brought to this new publication all of the enthusiasm, creativity and innovation that were his trademark with *The Wire* and he has succeeded in getting a strong following from junior rank contributors – always one of his driving aims.

At the beginning of 2009 the current Regimental Colonel, Lieutenant Colonel Kent Collard and I launched a campaign to get Bernard's New Zealand commission in RNZ Sigs reactivated. Bernard's commission as a Captain was confirmed by Chief of the Defence Force, Lieutenant General Jerry Mateparae, on 17 December 2009. Bernard's duties are to continue as Editor of the Conche but he will also work for Army Communications as a writer and he will be the Regimental Secretary RNZ Sigs. It is a feature of a force the size of ours that we all wear many hats!


Bernard Redshaw visiting Iraq when Head of Publications

Bernard has always been very proud of his association with the parent Corps and like me has never forgotten or underestimated the power of the family of Royal Signals. I am sure that in his new capacity, RHQ Royal Signals will have a re-opened and traffic heavy communication channel with Capt Bernard Redshaw and RHQ RNZ Sigs and that our association will grow ever stronger in years to come.

'THE C TROOP IS TO BE FORMED AT CHATHAM FROM THE 1ST PROXIMO'

By Lieutenant Colonel (Retired) David Mullineaux
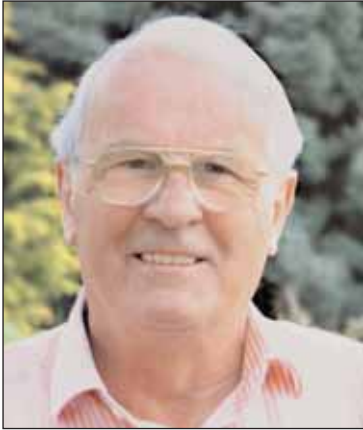
David Mullineaux spent a full career in the Corps before retiring to a second career in industry. Following his second retirement, he pursued an interest in military history and in signalling in particular. He has contributed many articles for the Journal, of which this is his latest.

The title is an extract from a regimental order issued by the Horse Guards on 24 August 1870 – and on 'the 1st proximo', that is 1 September 1870, the Troop was duly formed. In stages, as most readers will surely be aware, it grew into the Royal Corps of Signals in 1920. [1]

This article is a little historical miscellany about what are perhaps some lesser known aspects of the Corps' roots - the contemporary events in history that caused 'C' Troop to be formed, its equipment, some of the personalities, its early activities, and how subsequently it never carried out the role envisaged for it at inception. A primary source is the 'C' Troop Record, held in the Corps archives, a manuscript journal containing a wealth of information.

Procrastination and Politics

The period 1865-69 had seen much-needed stirrings in British military signalling – not before time, as electric telegraphy had been developing in Europe and the United States since the 1840s. It had been used for military purposes in the Crimean War in the mid-1850s by the British, as well as their allies on that occasion, the French, and also their opponents, the Russians; and then it languished. Subsequently the American Civil War (1861-65) had demonstrated the successful use of telegraphy, and several continental armies had introduced telegraph units, notably those of Prussia and Austria. The Royal Engineers had established a small telegraph department at Chatham early in the period, and inspections of the roles, equipment, and method of operation of other European countries had been followed closely. Both visual signalling and telegraphy had been used by the British in the Abyssinian Expedition, 1867-

68. [2] In 1869 a Review of Signalling had been held; as a result, signal sections had been formed in infantry and cavalry regiments, and a Signal Wing was formed at Chatham alongside the Telegraph Wing.

Yet by 1870, despite plans and representations having been made, there was still no permanently established army telegraph unit even though it had been clear for some years that it was needed. Why? The answer is not unusual – money. Considerable investment of resources in army 'engineering' had been made in about 1864, when the Royal Engineer Field Train was established. This was an organisation set up to provide field engineering support to the Army Corps – the fighting element of the British Army, stationed at Aldershot, and at the time principally intended for a role in European warfare. It consisted of 'A' and 'B' Troops, the former being responsible for pontoon equipment, and the latter for field engineering equipment. (In those days a Troop was equivalent to what is now a Squadron.) The funding for yet more 'engineer' troops and equipment was simply not forthcoming. The engineers had had their ration.

It was also the time when a new Liberal government under Mr Gladstone came into power. From 1868 to 1874 Edward Cardwell was the Secretary of State for War, responsible for much-needed reforms of the organisation and administration of the moribund early-Victorian army. On entering office, Cardwell's immediate task was to prepare the Army Estimates, and significant reductions in military expenditure were being demanded. It was not an auspicious time to try and introduce a new unit. [3]

'... We have no organisation except on paper ...'

In May 1870 the Instructor in Telegraphy at Chatham, Captain Richard Stotherd, addressed a meeting of the Royal United Service Institution on the subject of Military Telegraphy and Signalling. [4] (The contemporary usage was that 'telegraphy' referred to electric telegraphy, and 'signalling' meant visual signalling.) He reviewed the advances in signalling, particularly the work of Captain Philip Colomb RN and Captain Frank Bolton, 12th Regt, who from the early 1860s had worked together under the auspices of the Royal Engineers at Chatham, attempting to get a 'unified' (the word used at the time) signalling system compatible between army and navy. [5] The main thrust of their work had been communications between ships and coastal fortresses by visual signalling. Their scenario was defence in the event of an invasion of the south coast of England – something that perhaps a few of today's readers might have forgotten was the contemporary threat, and a far cry from what soon afterwards turned out to be the real operational requirement for army communications in the late Victorian era.

As he addressed the RUSI, Stotherd reviewed the advances in telegraphy and its method of use in other European armies, and outlined the proposal for a British unit. He ended up venting his frustration:

> ..... In this country we are undoubtedly slow in taking up any new question connected with the art of war; the sort of idea that active operations are a remote contingency, combined with the views of economy under which the Army Estimates are always drawn up, act prejudicially against the introduction and effectual development of any improvements, and the electric telegraph is no exception to this rule. Almost every European nation, except Great Britain, has now a properly organised field electric telegraph; even the small powers such as Bavaria, Belgium, Denmark, &c., have their properly constituted equipments. We have the most authentic information concerning the Prussian equipment; this consists of six complete units of field telegraph, or in other words 18 travelling offices and 180 miles of wire, these are in charge of the Engineer Corps at Berlin, and are ready to take the field at a few days' notice. ..... We have no organisation except on paper.

It was all quite outspoken stuff from a Captain to his senior audience in days when officers were generally more circumspect, but as it was a military audience they probably all agreed with him. He subsequently enjoyed a successful career, eventually to become Director General of Ordnance Survey, retiring in 1886 as Maj Gen R H Stotherd CB. Things weren't quite as bad as Stotherd made out - it wasn't all paper. The Telegraph Wing at Chatham had experimented, and had a few wagons which took part in trials. An exercise simulating an 'attack' on Dover took place at Easter 1869, and field communications were provided. A description was given in the *Illustrated London News*, reproduced above which rather grandiloquently referred to the few participants as 'the Field Telegraph Corps'.

A description of the field telegraph that was provided for the Volunteer review at Dover. Originally published in the Illustrated London News on 10 April 1869.

Thanks to Bismarck

The stimulus for change came a few months after Stotherd's little outburst, when in July 1870 the Franco-Prussian war broke out. Earlier that year the Prussian chancellor, Bismarck, put forward a candidate for the vacant Spanish throne, with the deliberate intention of provoking the French emperor, Napoleon III, into declaring war. With the help of the infamous Ems telegram (when Bismarck tampered with the contents during its transmission), that is just what Napoleon did. The Prussians defeated the French at Sedan, and then besieged Paris. The British government became alarmed about Bismarck's predatory intentions and their own military strength and defence capability. Orders were promptly issued to the naval and military authorities to place everything ready for immediate action, and purse strings were loosened. Here was the opportunity that had been awaited. Substantial funding was requested by the

SIGINT being gathered in 1870, during the Franco-Prussian War. The sketch shows the Prussians tapping French telegraph lines. Originally published in Illustrated London News

army and navy and hastily obtained from a nervous Parliament. The details of the scheme for the addition of

C.R.E., Aldershot.

With reference to special Army circular, dated 24th inst., will you have the goodness to inform the Officer Commanding the R. E. Train that the Establishment of the Troops is to be as stated in the accompanying Return.

The C Troop is to be formed at Chatham from the 1st proxime, inclusive, and it is intended at present only to raise it to the strength stated in Red Ink on the Return.

The Officer Commanding R. E. Train is to be directed to submit the necessary promotions and transfers, and before doing so, to place himself in communication with the Commandant S. R. E., Chatham, in order to ascertain the names of the N. C. O's. and men, and the horses that Officer is desirous of having transferred to the C Troop.

Lieutenant Tisdall's section of B Troop will form the nucleus of C Troop.

Sd. H. FANE KEANE.

D. A. General.

The order sent by Horse Guards to form "C" troop.

a Telegraph Troop to the Royal Engineer Field Train were already worked out, and a case was at once put forward for its establishment. Captain Robert Home, the Secretary of the Royal Engineers Committee, was responsible for its staffing. The plans were agreed, and the third Troop of the Royal Engineers Field Train was formed - 'C' Telegraph Troop. Thanks to Bismarck, we had arrived!

The Formation of 'C' Telegraph Troop

The regimental order issued from the Horse Guards, reproduced opposite, is hardly the way that staff-trained officers today would write such a document, but in 1870 the staff college, set up in 1858, was also still languishing. It was regarded with disdain by leisurely officers who up to then, when Edward Cardwell was busily reforming things, purchased their commissions in

1	Captain.
3	Lieutenants.
2	Staff Sergts
9	Sergeants.
8	Corporals.
9	2d Corporals.
9	Lance Corporals.
1	Farrier Sergt
1	Artificer Sergt
1	Telegrapher Sergt
2	Artificer Corporals
3	Telegrapher Corpⁿ
12	Telegraphers.
6	Shoeing Smiths.
2	Collar Makers
2	Wheelers
2	Carpenters.
3	Trumpeters.
56	Sappers.
92	Drivers.
234	Total.

An extract from the "C" Troop record, showing the Troop establishment at one stage. It was later raised to the full strength of five officers, and 245 WOs, NCOs and men.

infantry and cavalry regiments. Things were different in the Royal Engineers. Along with the Royal Artillery, then the two 'technical' arms, entry to and training at the RMA Woolwich was a much more competitive and professional matter.

As instructed, the new Telegraph Troop was raised at Chatham on 1 September 1870. Its establishment, shown above, was fixed at five officers, 245 WOs, NCOs and men, and 150 horses, although the strength authorised on

The Troop's Role and Equipment

A description of the Troop's role and equipment is given in the 'C' Troop Record and is reproduced below. Some elaboration of this description might be interesting.

'The duties to be performed by the Troop consist in the carriage, charge, and working of 36 miles of insulated cable, with all the necessary stores; supplemented by visual signalling, for which purpose a body of the drivers, 20 in number, are equipped as mounted signallers. These men are equipped with telescopes and signal flags; their use is to prolong the line of communication and obtain the information which the regimental signallers may furnish, transmit it to the Office Wagon, from whence it is telegraphed to Head Quarters.

The number of carriages is as follows: Wire 12, Office 4, Pontoon 1, Forge 1, Store 6, Total, 24.

The wire, office, and pontoon wagons are constructed with springs, a novelty in military carriages, and are lighter than those in general use at this date for military purposes.

The pontoon wagon, which carries a bay of super-structure 15' and a pontoon boat of the new pattern for putting the cable across a river; the bay is for crossing a small opening.

Each wire-wagon carries 3 miles of insulated wire, this wire is made up of 3 No 20 B.W.G. copper wires, tinned over: the diameter of the conductor so formed is .064 inch; and by the addition of the insulating material, which consists of vulcanized India-rubber, the diameter is increased to .206 inch; a layer of strong canvas is laid over the India-rubber; and the whole is bound round with two thicknesses of tape, primed with India-rubber, the cable thus formed has a diameter of .3 inch. The junctions of the wires are made with Mathieson's ebonite jointers.

Each wire-wagon has six drums, and each drum has ½ mile of cable wound on it. These drums revolve on pivots fixed in the sheers of the carriage. The wire is reeled up on the drums placed in the two rear pivots by a driving band worked by the revolution of the hind wheels of the carriage, each drum being moved to the rear in its turn. This method of reeling up the cable is the invention of Troop Sergeant Major Williams, who has been assisted in the mechanical details concerning the disconnecting gear by Corporal Wheeler Knight. As originally designed, the cable was reeled up by hand, and this method of using the wagon's own motion to do the work has very much increased the efficiency of the Troop and reflects great credit on its authors.

The boxes of the wire-wagons carry the necessary small stores, such as jointers, pliers, knives, &c, and the arms and kit of the detachment who lay out and reel up the cable.

The cable is generally laid out along roads; the place selected is the fence, or side of the road. When a road has to be crossed, iron telescopic poles are put up, and the cable is thus raised high enough to allow of carriages passing underneath. The cable is not easily cut by carts passing over it; indeed a battery of artillery has gone over it very often without doing harm.

The office wagons carry the instruments, writing materials, &c, and their roofs and sides are made of Clarksons patent material.'

The "C" Troop Cable Wagon. The pulley attached to the "hind wheel" for reeling in the cable is visible.

formation was limited to two officers, 135 WOs, NCOs and men, and 55 horses. Over the years the numbers were to fluctuate slightly as changes were made. Captain Montague Lambert, Lieutenant George Tisdall, Troop Sergeant Major R Williams and Sergeant Dockrell, who was promoted to Quarter Master Sergeant, were all transferred from 'B' Troop.

' ... The wire wagon ... '

The 'wire wagon' is shown above and the arrangement for reeling up the cable by a belt connected to the 'hind wheel' is evident in the picture.

' ... The insulated wire ... '

The 'insulated wire' was a militarised version of what was then known as Hooper's core, with the outer wrapping of canvas providing additional physical protection. What was 'Hooper's core', and how did it get its name?

Insulation for telegraph cable had first been made from gutta percha. This was a product of the isonandra gutta tree found in the Malay peninsula, and examples were brought to Europe and exhibited at the Royal Society of Arts in London in 1843. In 1845 S W Silver & Co of Stratford, East London, invented a means of extruding it to cover wire. The discovery of gutta percha and the method of extruding it were keys to the development of submarine cable, and thus 19th century international telegraphy. However, there were disadvantages to gutta percha in other situations – it was not very flexible, and contact with air and movement tended to dry it out and cause it to crack. This made it quite unsuitable for land line. The only recorded British army use of gutta percha insulated cable was in the Crimean War, 1854-56, when the army first used the electric telegraph. The buried cable proved unreliable (not helped by the fact that ignorant soldiers dug it up and used the gutta percha insulation for pipe stems).

In 1849 Mr William Hooper, a chemist of some distinction, turned his attention from gutta percha to rubber, and discovered that when vulcanised (a process involving heating the rubber in a sulphur solution to about 250 to 300 degrees Fahrenheit, causing the two to combine), and after curing, the treated rubber physically changed its characteristics. While retaining its flexibility, it was impervious to changes in temperature, did not oxidise in air, and absorbed less water. Until Hooper discovered this process, rubber had been no use as an insulator because of its unsuitable physical, mechanical, and durability characteristics.

Early tests on Hooper's core, by leading engineers of the day, Charles Bright, Latimer Clark, and Sir William Thomson (later Lord Kelvin), were all favourable. As well as its insulating qualities it was found to have lower electrostatic capacitance than gutta percha, thus enabling a higher working speed for telegraphy over long submarine cables. When submarine cables had to be raised and repaired, it was found that Hooper's india-rubber compound was better than gutta percha to restore the insulation around the cable. But its great advantage for military use was that it was more flexible, did not dry out and crack when exposed to air, and could take the rough handling it was going to get in army service.

The first operational use of field cable by the British army appears to have been in January 1868, in the Suru Pass, during the Abyssinian Expedition. Records of the expedition show that fifty miles of Hooper's core, specified as 'three strands of copper wire, of not less than 85 conductivity, covered with india-rubber &c, including drums and packing', with 3% added for testing by Mr Latimer Clark', was to be obtained from Messrs. Hooper, 7 Pall Mall East, at £45 per mile, total £2,250. Each wooden drum carried about half a mile of cable, the combined weight of drum and cable being about 140 pounds. Two such drums constituted a mule load. After the Abyssinian expedition a version of Hooper's core, further physically protected by an outer canvas binding, was issued to 'C' Telegraph Troop.

' ... The office wagons carry the instruments ... '

There were to be four telegraph office wagons in 'C' Troop. The telegraph wagon, shown at *was* described by Stotherd in his RUSI lecture:

> ... It is simply a small omnibus mounted on springs, drawn by two horses, carrying two Morse recording telegraph instruments on a small table, always ready to commence work the moment the earth and line wires are attached. Two telegraph batteries, of a form designed by Quartermaster Sergeant J. Mathieson, R.E., a modification of Daniel's form, are always in position under the table carrying the instruments, and

ready for work. Four spare Morse telegraph instruments, two recording and two sounding, and two spare batteries are carried in each travelling office. ... Besides these, a set of visual signalling apparatus, tools of various kinds, ...

The Morse recording instrument or 'inker' was based on a design invented in 1854 and used in civil telegraph offices, where the ability to receive messages by relatively unskilled (and therefore lower paid) operators was an advantage. A paper tape was moved through the instrument by a clockwork mechanism. As the Morse code signal was received an electromagnet responded to the current being keyed on and off by the sending telegraphist. When the current was 'on' it operated a lever which dipped the moving tape into an ink trough. When the current ceased the lever was restored to the 'rest' position by a spring. Thus the dots and dashes of the Morse code were inked, or recorded, on to the paper tape. Although it provided a permanent record of the message it was not generally popular with its military users due to weight, fragility, the need for copious amounts of paper tape and ink, and subsequent time-wasting transcription on to a message form.

The sounding instrument, or Morse sounder as it was generally called, was preferred by skilled telegraphists for its simplicity. It used an electromagnet which 'clicked' as the current was keyed on and attracted an armature, and distinctively 'clacked' when the current was off and the armature returned to its rest position by the action of a spring. It had developed from the recorder, which also used an electromagnet and clicked and clacked as it inked. Experienced telegraphists then realised, as they heard messages being received by the recorder, that they could aurally unscramble the short or long intervals between clicks and clacks (a method quite alien to latter day Morse operators - if there are any left these days - who listen to the tones of oscillators or buzzers), translate them into the dots and dashes of the Morse code, and write the message on to a message form as they received it, doing away with all the inking rigmarole. The best telegraphists were those who learnt the skill while in their 'teens, and they could achieve speeds of up to about 25 words per minute or more with the sounder.

`'... The Wire, Office, and Pontoon wagons are constructed with springs, a novelty in military carriages ... '`

A trial of the telegraph office wagons had been carried out and Stotherd revealed that 'a travelling office complete marched from Chatham to Canterbury, a distance of 27 miles, in 5¼ hours, without distress to the pair of horses drawing it.' It was the wagon's springs that did it, or words to that effect, he claimed at some length in his lecture, envisaging some future wartime trot along European roads. Little did he know, as he spoke in 1870, that the telegraph office wagons would never leave Britain on operations – Chatham to Canterbury was nothing like Durban to Zululand or Cairo to the Sudan. In the real world yet to come, the telegraph instruments and associated equipment were dismounted and the ungainly office wagons left behind.

The fully formed "C" Troop at Brompton Barracks, Chatham, bnefore moving to their permanent base at Aldershot in 1871.

The batteries designed by QMS Mathieson, and consisting of zinc and copper plates in a copper sulphate solution, with a special design of cap to prevent spillage, had been trialled against the Prussian type and found superior. They were specially made by the India Rubber, Gutta Percha, and Telegraph Works Company of North Woolwich and, said Stotherd, 'are extremely well finished.'

'C' Troop reaches full strength

The Troop, still at Chatham, continued to grow. On 12 November 1870 Lieutenant Bindon Blood, previously in charge of No 1 Section of 'B' Troop, was posted in. Later to be General Sir Bindon Blood GCB GCVO, Chief Royal Engineer, Colonel Commandant RE 1914-1940, he was born in November 1842, a member of an old, landed Irish family, one of whom, Colonel Thomas Blood, involved himself in much skulduggery and even attempted to steal the Crown Jewels in 1671! Bindon Blood had an outstanding career, much of it in India, and in his nineties wrote his autobiography *Four Score Years*

The "C" Troop lines in South Camp, Aldershot. The map is dated 1882.

Aldershot

On 14 August 1871 the fully-formed Troop left Chatham and, as the Troop Record tells us, ' **...** proceeds by march route to Aldershot ...', duly reached five days later on 19 August, to colocate in South Camp with the two other Troops of the RE Field Train and the Army HQ they now served. It was to be their base for about thirty years. For those familiar with Aldershot, 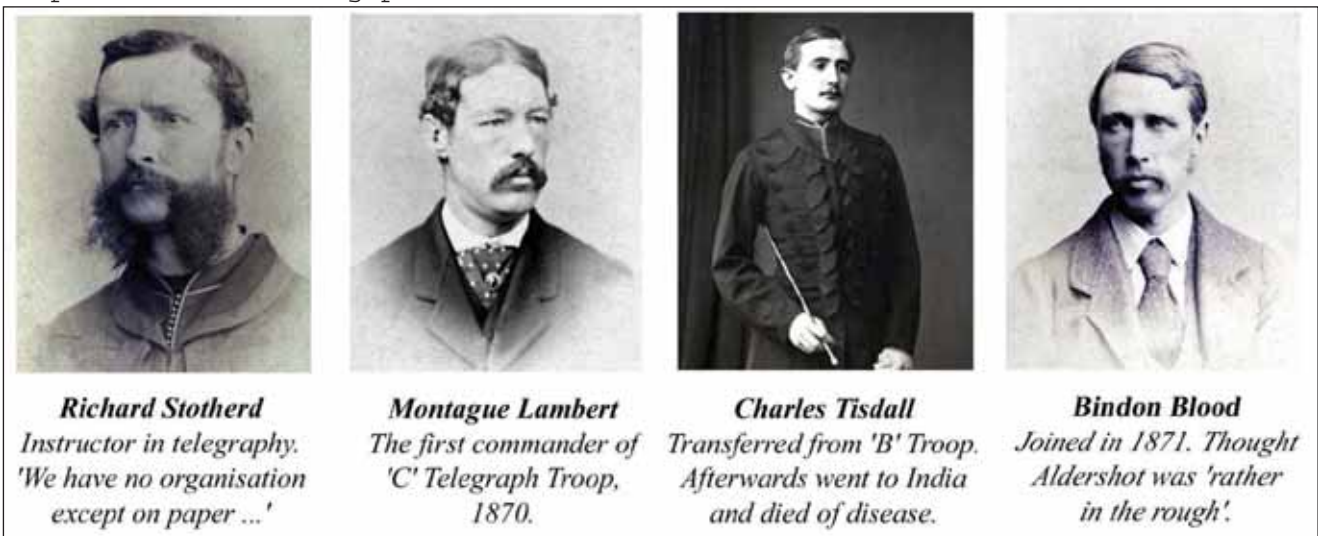an 1882 map of the area is reproduced opposite and shows their lines. It is interesting to muse that some ninety years later the Corps that grew from 'C' Troop won numerous Army Rugby Cup competitions in the stadium only a few hundred yards from their original lines. A *Guide to Aldershot*, written in 1885, described the scene:

> At the north side of South Camp – end of A and E lines – and abutting on the Basingstoke Canal, is the Royal Engineer Train Establishment, comprising stables for 44 officers' horses and 388 troop horses; an infirmary for sixteen horses, pharmacy, collar makers' and wheeler's shops, waggon sheds, forge, armourer's shop, &c., boat house and guard house. On the parade is the park train arranged with military precision and care.

> ... Quarters are provided in I, K, N, and O lines for the officers, non-commissioned officers, and men of two troops, pontoon and telegraph; two companies and detachment of postal telegraph company; .....

The description shows, as did the establishment reproduced earlier, what a disproportionate amount of the resources were needed for transport.

Bindon Blood, when he arrived there, described Aldershot in those days as ' a very pleasant place in spite of being rather in the rough. ' It is no longer in the rough. Aldershot has subsequently seen numerous phases of redevelopment. In 1871 the area of South Camp occupied by the Royal Engineers Train, including 'C'

and Ten. (The number of tigers he describes shooting would meet with some opprobrium today.) He died in 1940, aged ninety-seven.

On 1 February 1871 authority was received to complete the number of men in the Troop to the authorised establishment of 245 men and 115 horses. Then the first exercise took place, nothing too complicated, entered in the 'C' Troop Record as:

' ... 29th May 1871. First extended exercise of the Troop is carried out. A Telegraph Line is laid from

Richard Stotherd
Instructor in telegraphy.
'We have no organisation
except on paper ...'

Montague Lambert
The first commander of
'C' Telegraph Troop,
1870.

Charles Tisdall
Transferred from 'B' Troop.
Afterwards went to India
and died of disease.

Bindon Blood
Joined in 1871. Thought
Aldershot was 'rather
in the rough'.

"C" Troop at Blandford in 1872. An exercise, or a far-sighted reconnaissance? And where in Blandford?

Troop, was a collection of huts. Aldershot continued to develop as a military camp and the huts were replaced by more substantial buildings in the 1880s. These buildings were in turn demolished and became what many readers today would know as Browning Barracks, which until a few years ago was occupied by the Airborne Forces. That is about to change again in yet more redevelopment plans which, in South Camp, have already seen a housing estate and a large Tesco superstore built on the site of the former infantry barracks, and a Retirement Village set up in the former cavalry lines, the pensioners housed in revamped loose boxes and the horses replaced by electric wheel chairs, seen tethered in lines at night to electric sockets for recharging. Bulldozers, cranes, and bricklayers remain active on sites around the area. In yet a further development soon to come, the site of the former 'C' Troop lines - a 'brownfield site' in modern parlance - will become a dense civilian housing estate as the south-east of England continues its relentless transition into an overpopulated ghetto.

But back to olden days. After their arrival at Aldershot in August 1871 'C' Troop was quickly into the swing of things. Some selected extracts from the Troop Record give the flavour:

' ... 9th to 21st September 1871. Autumn Manoeuvres. The Troop is employed keeping up communications between Head Qrs Aldershot Camp and the Camps of the Divisions in the Field. Lieut Tisdall is detached with the signallers and joins 1st Division. ... During these manoeuvres 80 miles of wire are laid and reeled up, and communication is maintained daily. ...'

With a little whiff of things to come, the Troop went on exercise to Blandford, and in the Corps archives there is a photograph of this event, shown on page 52. Blandford, like Aldershot, has changed considerably, but it appears as though this photograph was taken near the site of the present car park on Mudros Road, looking towards the Roosevelt Memorial Garden and the

Headquarters Officers Mess - some readers might have other suggestions.

The Troop Record continues its chronicle:

' ... 24th November 1871. Lieut Tisdall is struck off the strength of the Troop having been appointed Instructor in Signalling to Bengal Engineers. ...'

The unfortunate George Tisdall, a founder member of the Troop, duly went to India where, like so many in that debilitating climate and without the benefits of modern medicine, he died of disease.

' ... 8th December 1871. Telegraphers are ordered to London to assist in putting down strike of operators. 8 N.C.Offrs and men under Sergt. A Lewis proceed at once and are employed in Dublin until the end of strike. ...'

The privately owned telegraph companies had, under the Telegraph Act of 1868, been 'nationalised', and in 1870 the country's telegraph network formed part of the Post Office. The subsequent shortage of skilled men had caused the formation of the two army RE Postal Telegraph Companies (22nd and 34th), to augment the civilian workforce in peacetime and be a skilled army reserve in wartime. It had taken only a few years for the civilian element of the new organisation, under government control, to decline into strike mode. Sergeant Lewis, clearly an outstanding NCO, later became the Troop Sergeant Major of 'C' Troop and saw active service in that appointment in Zululand and Egypt.

The Troop Record maintains details of postings in and out. Other early comings and goings were:

' ... 1st December 1872 Captn. Durnford took over command of the Troop from Captn. Lambert, who embarked for Barbadoes [sic] as Assistant Military Secretary on 17th December 1872. ...

23rd April 1873 Lieut Jelf RE is struck off the strength, on appointment as Adjutant, and is replaced by Lieut. Kitchener RE. ...'

Arthur Durnford was the fourth generation of his family to serve in the Royal Engineers, and was the brother of Lieutenant Colonel Anthony Durnford RE, a somewhat controversial character, who was killed at the battle of Isandlwana during the Zulu War of 1879. Arthur later became Colonel Durnford, Deputy Inspector General of Fortifications. Montague Lambert, the first 'C' Troop commander, having returned from Barbados and taken up a major's appointment at Shoeburyness, died in 1880. A memorial tablet was erected in the northern transept of
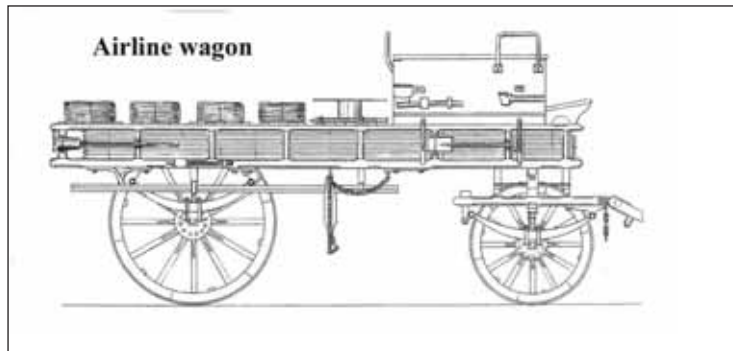
The airline wagon, introduced in 1877. Thirty miles of line and the poles were carried on four such wagons, each drawn by a team of six horses.

Rochester cathedral. Richard Jelf was later to command the Telegraph Battalion, as 'C' Troop became in 1884. His son, Dickie, also joined the Telegraph Battalion and died of exhaustion and mental stress (he shot himself on a ship during repatriation to England) after commanding a detached Section during intensive telegraph operations in Natal to relieve Ladysmith during the Boer War in 1900. Herbert Kitchener later became Field Marshal Earl Kitchener of Khartoum. There is much history in all these personalities, but not the space to expand here.

Some years later Major C F C Beresford offered this little insight into what many in Aldershot might have thought during those formative years:

> In our Army for some years the Field Telegraph Troop at Aldershot was regarded by many as harmless amusement provided for engineer officers at the expense of the taxpayer, but it was much admired as it marched past in the Long Valley [Aldershot]. For all that it was quietly doing good work in training officers and men, and the result of that training has been fully recognised by Generals who commanded in late expeditions. (6)

Charley Beresford was another Irishman, and it was he who originated the proposal to adopt Mercury as the crest for the Telegraph Battalion.

Reorganisation in 1877

A reorganisation of 'C' Troop took place in 1877. This was essentially to change from thirty-six miles of cable as previously described, to a combination of cable and 'airline' as it was called. Again this followed Prussian practice, for the Prussians had never had the benefits of
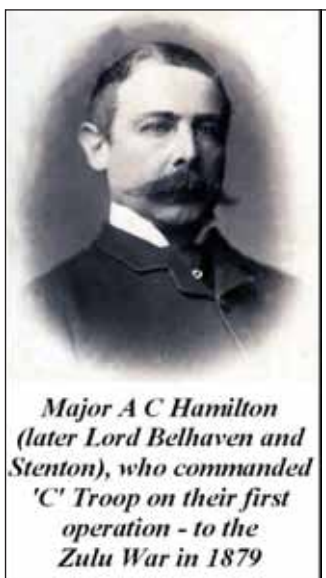
Hooper's rubber-insulated cable, instead having disastrous results with gutta percha insulated cable. It was unsuitable for the reasons stated earlier, and so they had adopted poled telegraph lines using uninsulated wire. The change to a mix of cable and airline gave some flexibility to match the circumstances, each method with its pro's and con's which need not be elaborated to the present readership. Whilst the line itself was lighter, the poles added considerable weight, and the quest for the perfect field telegraph pole was never satisfactorily resolved.

The reorganisation saw a reduction in the number of cable wagons, the exclusion of the original pontoon wagon (an oddity in a Telegraph Troop, but copying the Prussian telegraph unit, the rationale having been that it would make the Troop self sufficient when it needed to lay cable across rivers), and the introduction of airline wagons, leaving the total at twenty four wagons. The overall length of line was thus increased from the original thirty-six miles of cable on twelve wagons to thirty miles of cable carried on ten wagons and thirty miles of airline carried on four wagons, each drawn by a team of six horses. (7) Equipment changed little from then until early in the 20th century and so that, essentially, was what they communicated with for the next twenty years or so. One instrument, invented by Captain Philip Cardew in 1880 when he was Instructor in Telegraphy at Chatham (and known as 'the Edison of the Engineers'), was the vibrating sounder or 'buzzer'. Extremely sensitive, it could overcome many of the deficiencies of field telegraph lines and was frequently used. Many innovations in civilian telegraphy were, however, unsuited to the more robust military environment and were not introduced to army service.

History Changed Course – the Scramble for Africa

When the Troop was formed in 1870, at the time of the Franco-Prussian war, the threat to Britain can most tactfully be described these days as from across the English Channel, and had been for many years. The Troop's original *raison d'être*, its equipment and its organisation, were all geared to the requirements of 19th century European warfare. Its intended role was to connect into some convenient nearby point in the European civil telegraph network that had been developed since the 1840s, and bring the telegraph to the Army HQ, wherever that might be – just as the Prussian and Austrian telegraph units did. The 22nd and 34th Postal Telegraph Companies, formed in 1870 and 1872, after the nationalisation of private telegraph companies, would be mobilised to provide any line of communications work.

But no sooner had this role been decided than history changed course. Along with other European countries, Britain entered an era of imperial expansion, often

Major A C Hamilton (later Lord Belhaven and Stenton), who commanded 'C' Troop on their first operation - to the Zulu War in 1879

described by historians as the 'Scramble for Africa', so that for the next thirty years, until the end of the Boer War in 1902, all 'C' Troop operations (and those of its successor, the enlarged Telegraph Battalion, formed in 1884) were conducted in Africa, where the communications scene was quite different.

In 1873 an operational requirement for the telegraph arose in Ashanti (now southern Ghana). The task was unsuitable for 'C' Troop's mounted equipment, and soldiers from the two Postal Telegraph Companies provided the telegraph for that expedition. 'C' Troop's first operation was the Zulu War of 1879, when they were belatedly sent to South Africa with other reinforcements after early British army setbacks, and in 'C' Troop's case they were specifically requested by the commander, Lord Chelmsford, to rescue something of a signalling debacle. There they ended up improvising greatly. On the voyage, in an unsuitable ship, twenty-seven of their horses (nearly a quarter) were lost as a result of storms; there was of course no telegraph in Zululand into which they might connect; they were unable to take sufficient line for the task because of the distances involved, weight and transportation difficulties, and grass fires damaged much of their cable. Some of the telegraphists quickly had to learn to use the heliograph because of shortage of skilled regimental signallers; and numerous other problems. It might also be added that there they used the telephone, invented in 1876, for the first time in British Army operations. [8]

That set the pattern. For the most part, with their heavy equipment, the early problems in providing field telegraph communications were more logistical than electrical. Improvisation and resourcefulness were to be recurrent themes in all the early operations - as they still are, despite sophisticated technology. And with those observations it is a convenient point to bring to an end this little ramble around the Corps' roots, and how it started -

` ... from the 1st proximo ...`.

Notes

1. In 1884 'C' Troop was amalgamated with the two Postal Telegraph Companies to form the Telegraph Battalion. The 'TB', as it was known, was expanded during the Boer War, 1899-1902, and further expansion and organisational changes took place during the decade afterwards. In 1912 the RE Signal Service was formed, taking responsibility for communications down to regimental level and thus reversing the unfortunate separation between visual and electrical in 1875, and saw duty in World War 1. After that war, on 28 June 1920, the Corps of Signals was formed, becoming the Royal Corps on 5 August that year. The need for a separate Corps specialising in communications had been proposed as far back as 1886 when a committee under Lord Sandhurst had considered the expanding role of the Royal Engineers. Maj Gen Sir Redvers Buller, then DAG at the Army HQ at Aldershot, who had participated in the Zulu War of 1879, the Egyptian Campaign of 1882, and the Nile Expedition of 1884-85, and had seen their work, suggested that the Telegraph Battalion should form a separate organisation, but his idea was rejected by the Committee.

2. *The Abyssinian Expedition, 1867-68*, Journal of the Royal Signals Institution, Vol XXV, Summer 2005, pp 119-125.

3. A useful book which gives a good background to the army at the time is *The Late Victorian Army 1868-1902,* by Edward Spiers, pub 1992, Manchester University Press.

4. *Military Telegraphy and Signalling*, by Captain R H Stotherd RE, 13 May 1870. RUSI Journal, Vol 14, pp 312–333.

5. Both gave lectures to the Royal United Service Institution, Colomb in May 1863 (*Naval and Military Signals*, RUSI Journal Vol VII, pp 349-353) and Bolton in 1864 (*On Telegraphy for Naval and Military Purposes*, RUSI Journal Vol VII, pp 268-291). The reports of these lectures contain great detail of early methods.

6. *The Field Telegraph; its use in war* by Maj C F C Beresford, 9 April 1886. RUSI Journal, Vol XXX, pp 573-600.

7. Described in a lecture to the RUSI on 15 February 1884, entitled *Our Field Telegraph; its Work in Recent Campaigns and its Present Organisation*. RUSI Journal, Vol XXVIII, pp 329-355. The lecture was given by Lt Col A C Hamilton, who as Maj Hamilton had commanded 'C' Troop during their deployment to the Zulu War 1879. He explains the weight and transport problems of taking sufficient line to Zululand, and how the initial plan for reinforcement by a Postal Telegraph Company, bringing with them 100 miles of additional line, was later countermanded.

8. A description was given in *Signalling in the Anglo-Zulu War, 1879*, Journal of the Royal Signals Institution, Vol XXIV, Spring 2003.

Copies of all the quoted RUSI Journal articles have been placed in the Corps archives.

CORPS NINETIETH ANNIVERSARY

The above article will have underlined that the Corps this year sees its ninetieth anniversary, and it is intended to mark this with a special Autumn edition of the Journal. Articles with a historical flavour are particularly sought, and should be with th Editor by the 20 September deadline.

GERMAN RADIO RECONNAISSANCE IN WORLD WAR TWO

By Lieutenant Colonel (Retired) Richard Skaife

Richard Skaife served in the Corps until 1991, when he retired to pursue a technical consultancy career, at the same time maintaining an intrest in military history.

"I refuse to acknowledge the appropriateness of this general staff activity. Only men of genius can recognise the enemy's intentions and draw the proper military conclusions, and such men would never stoop to perform this kind of petty routine."

Adolf Hitler June 1944

With these words, Hitler dismissed over 15 years worth of painstaking intercept, direction finding and analysis of Allied radio communications which proved conclusively that the Allies had committed their main effort to the Normandy landing and simply did not have enough uncommitted forces to make a second landing elsewhere. The story begins in the First World War. The Germans had no effective intercept capability at the outbreak of WW1 but soon learned the value of radio intercept, particularly against the Russians when at the Battle of Tannenberg in 1914 a Russian divisional commander gave his entire battle plan over radio in clear text. Unfortunately the German newspapers published this scoop and the Russians rigidly enforced codes and secrecy in ensuing operations. The incident however woke the Germans up to the value of radio intelligence and by

the end of the war they were routinely breaking the Russian ciphers, observing British ship movements and targeting U boats with the intercepts. At a tactical level they were able to give warning of an impending Allied attack in the Western Front by intercepting artillery fire orders, artillery op orders (especially airborne spotter reports) and intercepting line communications.

After World War One the Versailles Treaty conditions and the manpower ceiling of 100,000 men under arms meant that the provision of dedicated radio intelligence units was not feasible. What they did though was to use the major military radio stations serving the five military districts and some of the division HQs as radio intercept stations. Each station had one officer, three NCOs, 15 male and five female intercept operators dedicated to intelligence gathering. A concerted effort was made against British, Polish, Russian and Czechoslovak traffic but they soon found that straight intercept in an uncoordinated manner was not practical and a separate intercept service has born. Between 1924 and 1939 this intercept service grew in strength and capability. By 1939 the German Radio Reconnaissance Service had built an extensive electronic database of British, American, Russian, French, Polish and Czechoslovakian military capability including a comprehensive electronic order of battle together with details of personalities and tactics. Specialist intercept and DF receivers were developed and personnel trained for intercept and analysis. They were capable of intercept and DF in the medium and short

Fig 1. German strategic radio intercept stations - Pre 1939.

Fig 2. Intercept receiver - external view

wave bands. In addition the static sites had a long wave intercept capability. They were under Army command, and the Luftwaffe and Navy had their own intercept services to support their operations. Notably though the training and equipment procurement programme was closely coordinated under direction of the German High Command with common equipments in service across all three services. Indeed the development programme had demanded common modules within the various sets as far as possible. There were seven intercept radios covering wavelengths from 30,000 metres to one metre although the short wave set did not get into service until 1940. The sets were technically excellent, using high selectivity crystal filters and high sensitivity receivers specifically designed for intercept. They were quoted as having up to 30dB better selectivity than normal communications receivers due to a high selective front end employing crystal filters. There was a 10% overlap in frequency coverage between sets and maximum standardisation between individual modules, DF and intercept receivers. All sets had the same operating characteristics to ease training operation.

This excerpt from Dr David Kahn's article "German Comint Organisation in World War II" amply describes the organisational development of the German capability: "In only one place does the Treaty of Versailles mention intelligence agencies. Its table listing German infantry division strengths allowed the signal detachment to include an intercept section. The German army did not use the men for the low-level work that had been

intended, but assigned them instead to the army's 12 major radio stations. In 1925, with Germany increasingly departing from the Versailles restrictions, the army set up six posts specifically for interception. Each had three or four receivers served around the clock by about 20 radiomen. The difficulty of following foreign manoeuvre traffic from these fixed locations led in 1928 to the erection of mobile direction finders near the borders, and two years later to the creation of mobile interception units which evolved into mobile intercept companies. Directing this work was first the Cipher Centre and then the new agency organized by about 1939 in the army command: the Main Intercept Post.

The intercept organization was part of the signal corps, which was headed by General Erich Fellgiebel. He was subordinated in wartime to the chief of the general staff; and served simultaneously as head of armed-forces communications, making him also the superior officer of OKW/Chi. A bespectacled, kindly, well-liked officer in his early fifties, divorced and remarried, and a former chief of the Cipher Centre, Fellgiebel won high praise from the OKW chief, Keitel: "In his field a pronounced leader type with broad vision, a gift for organization, full energy, , , satisfied even the most unexpected and difficult requirements." But Keitel added that Fellgiebel inclined to an "unconsidered mania of criticism" towards Nazism. And indeed Fellgiebel participated in the 1944 attempt to kill Hitler. His hesitancy in sealing off communications to the Fuhrer headquarters after the bomb went off contributed to the failure of the plot, for which the conspirators, including himself, paid with their lives. He was succeeded in both his army and armed forces offices by General Albert Praun, 49, a short, pleasant, extremely capable signal officer who had also led an infantry division, and who was, Chief of Staff Guderian wrote, a "good National Socialist."

These two men, especially Fellgiebel. presided over the remarkable expansion of German army communications

Fig 3. Intercept receiver - internal view

intelligence in World War Two. It provides a classic case history of how an intelligence organization develops in response to the requirements of intelligence consumers and its success in satisfying them.

At the start of the war, army communications intelligence operated on four levels: the Main Intercept Post at Zossen, 10 fixed intercept posts that passed their information to Zossen and to the army groups, seven mobile intercept companies attached to armies, and intercept platoons within the divisions. But communications intelligence scored only minor successes during the Polish campaign. Fellgiebel traced this in part to the distance of the Main Intercept Post from the action. But bringing control closer to the front implied a dispersal of control, and all the lessons of radio reconnaissance taught that strong centralization was essential for success. Fellgiebel compromised. He created commanders of intercept troops to handle communications intelligence for each of the three army groups getting ready to attack France.

This organization worked well on the higher levels in the French and Russian campaigns. But the tactical results continued to be poor, So in 1942 Fellgiebel centralized this work. He pulled men out of the intercept platoons of the divisions, which were left with only a squad, and assembled them in short-range communications reconnaissance companies. He gave one to each army headquarters. The company scattered its platoons throughout the army's area: two platoons for message interception, two for short-range direction finding, five for wiretapping. To rationalize the terminology, Fellgiebel renamed the armies' intercept companies "long range communications reconnaissance companies," the Main Intercept Post the" Main Post for Communications Reconnaissance," and the commanders of intercept troops "commanders of communication reconnaissance." Each army then had a short-range company and either a long-range company or a fixed intercept post. Again centralization promised improvement. On 15 December 1943, FellgiebeI united each army's organs into a communications reconnaissance battalion. The 17 that existed were in turn grouped into 8 regiments for communications reconnaissance, each under a commander of communications reconnaissance at army group or theatre command, Finally, early in 1944, the only field level that did not have its own agency, corps, set up small, 10-man units to evaluate the material that came in from the divisions and from any nearby platoons of the short range companies.

In the fall of 1944, Praun carried all this to a logical conclusion. At the very peak, he created a general of communications reconnaissance to assure cooperation among the various units and to improve personnel and equipment. Genera! Fritz Boetzel, a man of some charm

and broad cultural interests and a one-time head of the Cipher Centre, was named to the post. This gave communications intelligence its sixth and final level and completed its evolution into a highly articulated organization that effectively served all commands and delivered the most valuable enemy intelligence that came to German army generals during World War Two."[i] At the beginning of 1940 Germany had invaded and annexed Poland and had. secured a pact with Stalin, and was therefore secure on her eastern border. In the west, France was prepared for invasion as were Holland and Belgium; and of course the British Expeditionary Force was on the continent.

The German strategic objective was to secure channel ports and to annex France. Intelligence gathering operations had been going on for some time prior to 1939. German intercept had built up a picture of French radio activity; orders of battle were deduced and they had observed a number of defence exercises, particularly those associated with the Maginot line. All intercept units were thus well familiar with their targets. They were able to break the high level French ciphers as the French used war ciphers before outbreak of hostilities and one station when reprimanded over the air about this repeated the same message using the old codes. The intelligence tasking for the radio intercept organisation was to identify the BEF, to assess the reactions of the BEF, to identify and follow the movements of the First French Army and to identify and follow the movements of the Seventh French Army. By December 1939, the German Radio Reconnaissance claimed to have obtained the following intelligence entirely from intercept and DF:

> The reorganisation of French Forces North East of Paris.
> The concentration areas of the BEF and 1st and 7th French Armies prior to move to defensive positions.
> The entire disposition of the French armies along the Eastern German border down to division level. (Note the parallels with Cold War Germany and the Warsaw Pact forces —- only 200 km east.)

By early 1940 the BEF orbat had been established as:
> Army HQ, located in Hasbrouck NW France;
> 3 Corps;
> 5 regular motorised divisions;
> 1 armoured division;
> a number of as yet "undefined 2nd and 3rd wave forces".

The German intelligence collection plan hinged around the definite intentions and orbats of these forces, the
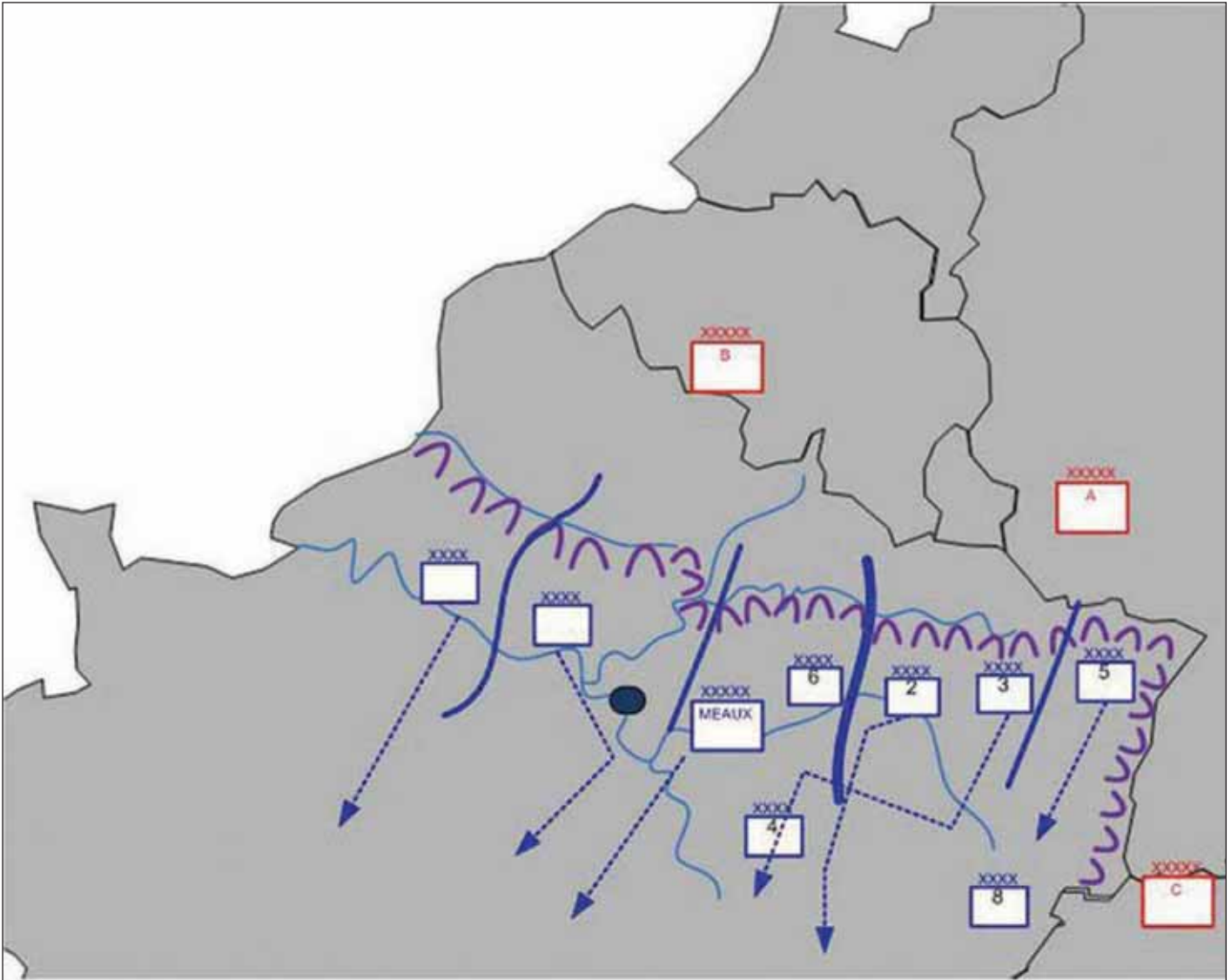
Fig 4. German Radio Picture - 1940.

intentions and locations of the French 1st and 7th armies (L'armee d' intervention de Belgique). In addition Army Group C was tasked to identify any transfer of forces opposite their front to the NW front. The German radio picture was as shown in Figure 4 above. The Germans had a very clear intelligence picture of the French dispositions and withdrawal plans. Through observations of tactics and procedures gleaned from observation of exercises they also had a very good idea of how the French would react to invasion.

It must be borne in mind though that the radio reconnaissance organisation did not claim to have the monopoly on intelligence and the intelligence staffs made good use of all sources, creating a fused picture. The intercept staff did claim to have deduced the entire French orbat and that of the BEF, as well as locating Lord Gort's headquarters in Hazebrouck.

On 11 May the Dutch intention to withdraw into fortress Holland was disclosed; the Belgian intention to defend the Albert Canal as a main defensive line was identified

as was the move of the French 7th army into Belgium, grouped with elements of the BEF.

By 12 May the French main defensive line of the River Dyle was identified. After the Dutch and Belgian capitulation in May the Germans seized the initiative and made a major offensive through the Ardennes to Boulogne which as you are well aware effectively cut the French and British forces in half and led to the BEF evacuation and capitulation of France.

What part radio intelligence played in the decision as to where the Germans placed their main effort "Schwerpunkt" is open to debate but going by their accurate and timely capabilities prior to their invasion of France it is reasonable to deduce that it played a major part. Radio Reconnaissance showed where allied forces were strong, and more importantly where they were weak; identified inter formation boundaries and international boundaries. It is interesting to note that one of the commanders in the France campaign was Erwin

Rommel, and radio intelligence played a fundamental role in his remarkable success in Africa. I would suggest that he observed and understood the value and reliability of this source of intelligence in the French campaign. The following lessons are described in the report —-these are German observations written in 1948:

> *"Radio intelligence is good for preparatory intelligence collection and in support of certain operations at a particular level. It did not work at all in fast moving operations over large distances because the rapid movement of forces did not permit the relatively long analysis process to take place and the communications between the radio intercept organisations were not flexible enough to keep up."*[ii]

Once the enemy command structure was broken down, radio intelligence was limited to what we now call tactical tip offs, i.e. short term targeting material. The lack of structure in target formations did not allow any fundamental analysis to take place.

Secure codes were broken time and time again, not by analysis of the originator's traffic, but by retransmissions of messages by allied nations and by other services. British operational intentions were given away regularly by air liaison nets. So much so, that the Germans thought it a deception plan until experience proved otherwise! They commented that they were amazed that there was no control over RAF communications by the Army Headquarters (what we would now call a Joint HQ), and that the radio security of the Royal Air Force was significantly inferior to that of the other services[iii]. Army field codes were broken with monotonous regularity by listening to the air liaison nets and to air to ground traffic where the pilot would give a recce report in clear and the ground station would then encode that same information and transmit to Army HQ.

After the BEF was evacuated, and it is worth noting that the BEF was evacuated through two ports - Dunkirk for one element which was cut off by the German encirclement - and Cherbourg by 25 June for those forces outside the pocket, German intelligence naturally turned its attention to the UK mainland, and allied intentions. The USA of course, was not yet involved in the war.
The intelligence tasking was:

> Location of former BEF units
> Organisation and disposition of regular and territorial units in UK
> Transfer of units in UK to overseas theatres especially Balkans and near east theatres.
> Defensive measures initiated by permanent

coastal forces and mobile defensive forces.
Coverage of the southern coastal strip — the operation Sealion objectives.

These tasks were allocated to Army Group A with the following resources as shown in Figure 2 below:

> Munster intercept station — now moved to the Hague
> The Husum fixed intercept station from October 1940
> Euskirchen intercept station — now located near Boulogne
> 26th and 56th mobile intercept companies positioned at St Malo and Etretat.

Only the intercept staff from the Munster and Euskirchen stations had any experience of British traffic so there was a learning curve for the mobile companies, one of which had been raised and employed for operations in the East.

The results were considerable but took time to analyse and assemble. The British and Canadian troops were noted for the comparative excellence of their radio discipline but lapses began to occur which gave away place names in clear, unit designations were given away and the picture began to develop. By early 1941 the Germans had deduced the entire British ORBAT down to infantry and artillery unit level, their divisional affiliations as well as the entire Territorial Army and coastal defence organisation and deployment. Observation of coastal. defence exercises showed the

Fig 5. Interecepyt andf DF operations against UK Mainland - Post Dunkirk 1940.

strategy and major lines of defence along the entire south coast and the location of the major training areas were plotted as were the units that trained there and the type of operation the training was for.

Perhaps most remarkable of all was the way they followed Canadian units by intercepting traffic originating in Canada, identifying the unit and then picking it up again in UK. Training areas became a priority target and by spring 1941 there where upwards of 150 receivers permanently targeted against the British Isles with something like 600 staff involved.

The BEF were not found and the deduction was (correctly) that the BEF had been disbanded and reorganised. Most of the British cryptographic systems in field use were claimed to have been broken by end 1940 although there is no claim to have broken any of the high level. allied codes in the same way as ENIGMA was broken.

When Operation Sea Lion was abandoned in 1941 the intercept effort against Britain was reduced. The 56th intercept company was transferred to Africa, the 26th to eastern Europe and Army Group D was given responsibility for intelligence operations against UK — as they had assumed command in France - with the fixed stations at Munster, The Hague, Husum and Euskirchen. The British were now regarded as a soft target as they were "easy in intercept because they changed frequency at regular predictable intervals, the callsign system and order of answering made the net structure simple to identify, and "despite the excellent procedural radio discipline the usual breaches of security — place names, unit identifications, locations and individual names — were all periodically mentioned in clear thus making the mosaic straightforward to complete"[iv].

When the US entered the war in 1942, operations against Britain began to take up again and an additional intercept station at Bergen in Norway was assigned to cover traffic emanating from the UK. A large scale operation in Spring 1942 "Operation Tiger"[1] gave a significant amount of orbat away. A prime intelligence requirement was to ascertain the US ORBAT. US units were intercepted on the American mainland and followed to Europe. This was greatly facilitated by following the assignment of army post office numbers. The state of training of US units as they were raised was followed as these units progressed round the various training camps in USA as formed bodies. Another source of information was the US promotion system whereby the officer being promoted would be asked (by signal) "The President intends to promote ——· to the rank of —, do you accept?". These promotion messages as they were known provided a large amount of location information. If a unit location was not

known "it was a simple matter to follow the promotion notices for individuals in the units with the APO number".[v]

A major setback came in Spring 1942 when the Germans lost an intercept station complete with its records to the British in N Africa and the extent of the intelligence gained from radio sources dawned on the Allies. A complete overhaul of allied operating procedures took place but as these new procedures were not instituted simultaneously across the allies the Germans in Europe were able to keep up with the changes, having been warned off and able to observe the new procedures in Africa. (Recall the way in which the UK voice procedure changes in the 1980's were trialled in Canada, UK and Germany before being adopted Army wide?.........!)

The result of the changes — irregular frequency changes, callsign changes and new codes - invoked a much closer relationship between the German intercept organisation and their DF systems, as location information had to be used to create a full picture and traffic analysis became more important. What in fact started as an Allied intention to become more secure had a counter effect by increasing the analysis capability of the Germans.

Dieppe came as a complete surprise, as radio silence had been maintained up until contact was made during the actual landing and the preparations were not observed. When the allied withdrawal plans were intercepted the Germans deduced that the operation was limited and not any attempt at a full scale invasion. This had a major impact on the (limited) German reaction. The other important point about Dieppe was the allied code system for designating beaches by colour codes was used. Colour codes were always a significant indicator of an allied beach landing — they were used in North Africa for Operation Torch, in Sicily and in Italy. It was only by the Normandy landings that this was changed but even there, individual beachheads at battalion level were still coded in colours. A point worth noting is that both the Dieppe and Africa landings were intercepted first by stations well outside the theatre of operations in which the landing took place due to the skip distances involved; Dieppe was first intercepted by the Husum station in Schleswig Holstein and the N African landings were first intercepted in Norway. The radio intelligence assessment was well ahead of the chain of command in notifying the German High Command of allied strategic activity where surprise had been achieved. Despite the technical excellence of the German equipment I got the distinct impression that the intercept commanders did not fully understand HF propagation, as there were several comments expressing surprise at the poor reception by stations about 100-200kms from the target yet the ability to intercept several hundred kms away was "difficult to

comprehend"[vi]. What these episodes do demonstrate however is that the intelligence staffs at the analysis centres had a clear understanding of the strategic picture and had the ability rapidly to pass strategic intelligence to German High Command across theatre boundaries.

In Africa Rommel made extensive use of radio intelligence. As he was operating under air inferiority he was denied his own air recce therefore radio reconnaissance assumed a much higher profile as it was probably Rommel's only long range intelligence source. His chief of staff always had 2 dedicated (i.e. redundant) radio circuits to the intercept, DF and evaluation centre. The other point was that radio was the only means of communications in the desert and it was as dangerous as it was flexible and valuable. The Germans regarded the British use of radio prior to the capture of the intercept station as careless. They had the complete orbat of the Eighth Army, its state of morale and its plans, throughout the campaign up to the reversals after El Alamein.

They captured the high level theatre codes on a ship and used them to target submarine attacks on the Lines of Communication and had a particularly successful time until the codes were superseded. This is the only reference I found regarding German attacks on theatre level allied traffic and there is no evidence Germans "broke" Allied theatre level codes – they were compromised and the Allies took rapid steps to counter the compromise.

Radio intelligence played a significant part in the German's fighting withdrawal in Italy; Allied intentions, major axes and timing of operations being regularly deduced throughout the Italian Campaign. Normandy June 1944. The precise timing and location of the invasion were not known to the German High Command nor to the radio reconnaissance organisation. The comment is recorded that tactical and strategic surprise was achieved and excellent radio discipline was demonstrated up to the time of the landings. However the Germans had a very clear picture of the orbat, tactics and procedures of the invasion forces gleaned from the extensive targeting mentioned earlier. Unit locations had been plotted throughout the war and the German radio intelligence analysis of the forces in Normandy quickly enabled them to build up the radio order of battle of the landed forces. There was no doubt in the mind of the radio intercept analysts that Normandy was the main landing as there were simply not enough troops left to support any other landings — you will recall that the German High Command was convinced that the main landing would take place around Boulogne Calais and there was an allied deception plan to support this. Although not specifically mentioned in General Praun's report I got the impression that the allied deception plan of the First US Army Group (FUSAG) in East Anglia was not believed by the radio intelligence evaluation teams,

as the electronic order of battle simply did not fit. Radio intelligence orbat had accounted for all troops landed in Normandy.

There appears to have been severe disagreement between the German High Command particularly General Jodl and Hitler, and the intelligence community over this, as Hitler insisted that Normandy was a feint. Hitler

Fig 6. Field Marshal Erwin Rommel.

eventually attacked the radio intelligence organisation with the quotation I used at the beginning of this article. As in North Africa, the Axis forces were operating in an environment of air inferiority therefore radio reconnaissance probably became the prime source of formation level intelligence. This was eased by the Allies sense of confidence which grew into overconfidence resulting in the usual lapses in radio discipline. Unfortunately I have been unable to obtain any detailed source material relating to the German intelligence activity in the withdrawal from France but I am confident that many of the significant defensive engagements which slowed the Allied advance were heavily "steered" by intelligence gained from radio sources.

There are some interesting points which came from the Eastern Front operations. The Germans found the Russians to be a relatively easy radio target due to the poor standard of Russian operator and the inflexibility of Russian tactics — there was broad stereotyping of procedures and callsign systems which led to much intelligence being gleaned. The other interesting technical point is the disclosure that the Russians used radio controlled mines in street fighting as an ambush weapon and the Germans tasked some radio intercept troops to counter this threat — unsuccessfully it might be added.

There is a marked similarity of the observations made by the Germans 60 years ago about the effect of radio reconnaissance to what we have all been familiar with in

our time despite the technological advances we have seen. The same old lessons are as valid today — look at the position of the Germans in retreat in Africa or Europe, operating under enemy air superiority and denied the usual sources of reconnaissance — and the dependence on communications intelligence. Allied superiority led to overconfidence which led to drops in radio security and the vicious circle which fed the interceptors. Look at the coordinated approach to equipment design, procurement and service, to the joint training and technical effort involved. I will leave the readers to draw their own conclusions.

[i] David Kahn "The German Comint Organisation in World War II"

[ii] German Radio Intelligence in World War 2 – Lieutenant General Albert Praun, March 1950.

[iii] ibid pp

[iv] Ibid pp

[v] Ibid pp

[vi]

A SIGNALMAN IN INDIA 1936 – 1940

By AD Brown, C Eng, MIEE

The following account of the careeer of a young soldier serving in pre-war India is indicative of the life and times of that period. Unfortunately, we have no further knowledge of the author, or what became of him aferwards. His account survives of an age fast becoming forgotten.

My association with India began quite unexpectedly at mid-day one day in early January 1936. My Instrument Mechanic AIII Course was on its last week and we had taken our last test. All of us were looking forward to being posted to a field unit in UK. Would it be Aldershot, Bulford, Canterbury, Scarborough, Northern Ireland? We hoped not the last one.

On this day, we came up, as usual, from the Workshops to D Company lines in the Training Battalion at Catterick Camp. Battalion and Company Daily Orders were on the Notice Board so we joined the crowd around the board to see if we were on guard or any other duty before going to the Messroom for dinner. As I joined the crowd, one of my friends was coming away: he said "Lofty, you're on an Indian draft". Three of us from the Course and a Sergeant Instructor were on the draft for which E Company were responsible for making the arrangements Next morning we reported to the MO for medical examination and inoculations, followed by 48 hours excused duty. After seeing the MO we went to the tailor's shop to be measured for our khaki drill tunics and trousers. Once we had been measured, we stood talking around the coke stove in the tailor's shop, the weather being cold and frosty, when suddenly Dowse collapsed in a heap on the floor. The inoculations had started to take effect! At the end of the 48 hours we were posted to E Company and sent on embarkation leave. By this time I had been told I was being posted to B Corps Signals, Karachi. All four of us were joining different units in India.

On return from leave we received our KD uniforms and Wolseley helmets and were soon on our way to Southampton and the troopship HMT Dorsetshire, a ship belonging to the Bibby Line. The voyage was generally uneventful. It was very stormy in the Bay of Biscay, many men were sea-sick and some didn't recover until we reached the Suez Canal at Port Said. Those of us lucky enough to avoid sea-sickness had to do more than our share of guards on the ship. At Port Said we were disembarked and marched through the City to a beach. There we had about an hour to stretch our legs and have a paddle in the sea, while Egyptian

Mounted Police kept the hoard of hawkers and beggars from getting to us.

Then on through the canal to the Red Sea - by this time it was getting very hot. Next we entered the Gulf and went up to Basra where a large RAF draft were disembarked. On again to Karachi where we all landed. The ship went on to Singapore and Hong Kong with Navy, Army and RAF personnel for those stations. The journey from Southampton to Karachi took three weeks so we were glad to be on land again.

On arrival at B Corps I was posted to 2 Company and put in one of the wireless sections, 5 LMA, which was equipped with Wireless Sets 120 watt Mk II. These were long-wave telegraphy only sets designed around 1920. Each station had two 48 ft high masts which had to be erected just over 100 yards apart. The aerial was two 300 ft lengths of copper wire with a 12 ft spreader at each end. The sets had a nominal range of 100 miles I think, but would work reliably over 200 miles if there were no high mountains in the way. While I was at Karachi I remember we would attempt to make contact with any RN ship which was coming to Karachi. We always managed to establish communications when the ship was between 400 and 350 miles away at sea. Apart from electrostatic interference the long wave sets gave reliable round the clock communications.

B Corps Signals was at that time commanded by Lieutenant Colonel AW Roberts MC. The Adjutant was Lieutenant KH Treseder, the Quartermaster Captain BH Capel and RSM Kingman. OC 1 Company was Major Smitherman (an Indian Signal Corps Officer); OC 2 Company Major Dent. The OC LMA Sections was Lieutenant JR Beeton. B Corps Signals had been in Karachi since 1935 having previously been stationed at Rawlpindi. 1 Company consisted of Unit HQ, Workshops Section under CQMS (FofS) Clements, and Line Construction and Cable Sections commanded by Jemadars (Viceroy-commissioned Officers) and were all Indian ranks. The Cable Section had cable wagons drawn by horses (The Corps Museum at Blandford Camp has a cable wagon which many readers will have seen).

2 Company had the Corps Signal Office Section (O Section) equipped with line telegraph and telephone instruments, mainly Double Current Duplex Telegraph Boards, telephone switchboards including 100-line Field and Fortress, 10-line Magneto, 10-line cordless and Buzzer Switchboard 7+3. The telephones in use were the Trench Telephone 110 and the Buzzer Telephone D Mk III. O Section also had some Fullerphones which were very useful for working over long lines where the current was too low to operate Double Current Boards.

The other Sections in 2 Company were Wireless Sections. Nos: 4,5 and 6 LMA Sections, 120 watt sets carried in 30 cwt Morris Commercial Technical vehicles; No: 8 Pack Section. Wireless Set C (Indian Pack) CIP for short, carried on mules; No 9 LMB Wireless Set C Mk II carried in 30 cwt Morris Commercials having bodies usually called "gin-palaces". When I joined B Corps, the Pack Section were in Burma with a League of Nations Commission sorting out the frontier between Burma and China. In 2 Company, the Operators (Operator Signals at that time), Electrician-Fitters, Instrument Mechanics, Linemen and Despatch Riders were all British ranks and the MT Drivers and Mule Drivers were Indian, roughly half Punjabi Musulmen and half Sikhs.

I soon settled in to the Unit and enjoyed the work in the workshops and with my section, but as a 20-year old found India a bit of a culture shock. As the Pack Section was in Burma the Unit was short of men so guards came frequently, one or two a week. British ranks mounted guard on Monday to Wednesday and on Friday, and Indian ranks on Thursday, Saturday and Sunday. They also provided the stable picquet every night except when it was an Indian holiday, in which case the British took over.

A few weeks after I arrived in Karachi I had an incredible stroke of luck. It happened that in B Corps there were six AIII IMs, some of whom had been waiting 3 or 4 years for the chance to go to STC(I) Jubbulpore for an up-grading course for an AII rating but there were never enough places available on the courses. Because of this, Colonel Roberts had obtained permission to hold an AII course in the Unit during the 1936 Individual Training season. When the course started I was put on it, although I had only just got my AIII rating.

The instruction was done by the Foreman of Signals, CQMS Clements and Corporal McNair. They were both excellent teachers and I learnt a lot more line and wireless theory than I had absorbed at Catterick. We also did a great deal of practical work, filing, turning, coil-winding, as well as keeping up with the routine repair and maintenance of instruments in the workshops. At the end of the Course I was up-graded to AII. Company training followed the Individual Training season. 2 Company went off and set up camp in Sind some miles from Karachi, my first experience of field training. Before we went to Camp, Corporal Bartlett, the my Detachment NCO, explained to me that as IM my duties would be varied. If the Electrician Fitter wasn't with us, I would have to charge the batteries for the 120W set. If the Cook (an Indian enrolled

follower) was not there, I would have to cook. If anything went wrong with the set, day or night, I would be expected to locate the fault and put it right. Otherwise I could pass the time away how I liked. Then he said that someone to do Signal Office work as Counter Clerk, would be very useful and he would teach me registration and handling of Signal traffic. This he did and it enabled me to do a wider range of duties when I eventually became an NCO.

One day during the time we were in camp, the Officers held a cocktail party in the evening to which they invited the CO and other Officers of the Unit and their wives. It so happened that my section, 5 LMA, was on stand-by for a scheme which would start that evening or early part of the night. Soon after our evening meal, the CSM came round and told me the Officers wanted someone to put records on their radio-gram so they could have music at their party and I was the lad for the job. I protested that I was dressed ready for the scheme but he told me to keep my boots, hose-tops and puttees on and just change into best tunic and slacks and get myself over the Officers Mess quick.

When I arrived at the Officers Mess, the junior Officer in the Company, Second Lieutenant Thorp, showed me what they wanted me to do. He had the job of keeping everyone supplied with drinks. The party went very well but after a while the guests were not drinking so much, probably thinking of their drive back to Karachi in the dark over a very rough track. Mr. Thorp kept plying the 2 Company Officers with drinks and any left over on the tray he was dividing between himself and me. After the guests left I was told to go back to my tent but I had only gone a short distance when I was called back. Maj Dent and the other Officers had decided to keep the party going and I was asked if I would stay and put more records on, so I stayed. We were soon all quite drunk. Mr Thorp had three Indian clubs which he used for juggling - we all had a try with them mostly completely unsuccessfully. I also remember Maj Dent in very high spirits swinging himself round and round one of the tent poles. I eventually made my way back to my tent where the other lads helped me change my clothes ready for me to go on the scheme. Then I just went to sleep. Several hours later I was awakened and helped to where our vehicles were waiting and stood, propped up by two others, while Lieutenant Beeton inspected us. He made no comment on my condition which I suspect was similar to his own.

After the Camp we got on with Unit Training, then near the end of October came news that a routine "showing the flag" column in Waziristan had been ambushed by the local tribesmen. There had been trouble in the area caused by failure of crops, and agitation by the Faqir of Ipi, a fanatical Muslim leader. Post Offices and Banks had been raided and Mail vans robbed. In Karachi All India and Western Command Wireless Groups went on continuous watch. Then one evening around 1900 hrs the CSM came round with a list of names of NCOs and men about 50 altogether, with me among them. The orders were to take our personal belongings to the Company Stores, pack up our Army clothes in our kit-bags, dress in Field Service Marching Order and stand by to leave the Cantonment Station at 2130 hrs on the Frontier Mail. We were issued with our Part 2 Pay Books and changed from Peace to War accounting. We marched to the station and when the train came in we found that a troop carriage had been added on the end of the train. Indian Troop carriages were far from luxury. We were on our way to Rawlpindi as reinforcements for A Corps and 1 Indian Division Signals. On arrival we were attached to A Corps, quite a number from the group were sent on to Waziristan. The remainder of us stayed in Rawlpindi and did guards, stable picquets and any other duties required by A Corps. I spent most of the time in the Instrument Workshop repairing instruments sent back from the operational area. Soon after we had settled down in Rawlpindi came the shock news from Blighty that Edward VIII had abdicated. We had not had the slightest hint that there was any problem.

We remained in 'Pindi until February 1937 when we returned to Karachi. Waziristan had quietened down by this time but a few months later trouble broke out again. This time B Corps sent the whole of O Section to Waziristan. When eventually operations were over all those who served in the operational area were awarded the Indian General Service Medal with clasp Waziristan 1936-37. This was the first issue of the new medal with George VI's head on it. I didn't qualify.

The next thing of importance for B Corps was preparation for the Staff College Exercise which was to be held in the Quetta area about May. These exercises were held at the end of the Staff Officers' courses and occurred every two years. The last one was in 1935 and A Corps had serious problems apparently, which resulted in their being moved to Rawlpindi where they would be involved frequently in NW Frontier operations. Naturally, Colonel Roberts wanted B Corps to give a good performance and we all worked hard on schemes so we would get it right on the day.

The Unit was to camp at Quetta for about a month to give time to make preparations for the exercise and clear up afterwards. A number of officers, NCOs and men went to Quetta as an advance party, including our Section Officer, now Captain Beeton, and Sergeant

Healey, Corporal Dennison and Lance Corporal Carlyon, leaving Corporal Bartlett in charge of 5 LMA. By this time our Electrician Fitter, who was also Section Storeman, had gone home and I had been given the Storeman job in addition to working in the Workshops. Just before the main party was due to entrain for Quetta, Corporal Bartlett went down with malaria and went into hospital.   I was then told I was in charge of 5 LMA during the journey to Quetta.

The first part of our journey was across Sind to Jacobabad, where the railway divided, one line going on to Lahore and NWFP and the other going through the Bolan Pass to Quetta.   Apparently, the railway company charged too much for taking a troop train through the pass, so we had to unload the train at Jacobabad and drive up through the mountains to Quetta.

The drive through the pass was long and very slow, with the vehicles in low gear all the time. The engines were running very hot and as we climbed higher the radiators boiled at lower temperatures, which meant frequent stops to top up with more water. When we set out from Jacobabad all our water tanks (pakals) were full, but eventually we used all the water in them and had to start using water from our water-bottles.

By the time we arrived in Quetta it was dark so I couldn't see what the country was like around our camp site. I was really surprised next morning to see the snow-covered mountains glistening in the morning sunshine: I thought they looked beautiful.
When we had settled into camp, the Unit carried out schemes in the area where the Staff College Exercise was to take place. On one scheme 5LMA was sent out to set up stations nears Quila Abdulah. A new young Second Lieutenant was put in command of us. During the two or three days the scheme lasted, he sat by his tent reading and didn't involve himself much with what we were doing.

Before we set off on the return journey the drivers refilled the vehicle petrol tanks from 2-gallon petrol cans we had brought with us. Unfortunately some of the cans had grit in them so it wasn't long before three of the 30 cwt lorries started breaking down with blocked carburetter jets. As I had been keen on motor cycles before joining the Army and we had no electrician-fitter with us, I was soon busy clearing jets.   After two or three stops our young Officer got fed up with the slow progress, so he ordered everyone, except the three drivers and me, into the vehicles which were running OK and set off for Quetta, leaving me to limp back as best I could with three dodgy lorries.

Eventually the day for the start of the Exercise came

along. I can't remember what time it was due to start, but overnight we had got to our starting places and Signal Offices and wireless stations had been set up. Communications had been established quickly in the B Corps network except for one of 4 LMA sets which had not been heard. This set was at one of the Divisional HQs and at the start of the exercise was the only link with Corps HQ.   Obviously Colonel Roberts was not happy with the situation, so after some discussion with Major Dent and Captain Beeton, it was decided to send me with one of the Indian drivers to find out the cause and put it right. I had just finished washing up after making breakfast for the Detachment when Captain Beeton and Sergeant Healey came and told me to get my tool kit and avometer, gave me a map and a map reference and ordered me to get there as quickly as I could.

After a journey of some 20 to 25 miles over rough tracks we arrived at the place where 2 Division Signals had set up a Signal Office.   Just as I got to the vehicle with the set in it, Corporal "Abdul" Fox was shakily getting out looking very pale. He had just had a shock from the 1200 volt EHT Generator.   The IM who had a HND in Electrical Engineering, was in with the set. When I got in he stood aside to let me have a look and when I did, I couldn't believe my eyes. A short lead was hanging loose on the panel behind the AT100 transmitter valve. On connecting this to the anode terminal on the top of the valve the transmitter worked, this was all that was wrong.   I tuned it in to the required frequency and asked Corporal Fox to let me send the first call in my slow morse. We got an immediate reply from the control station which concluded with the unorthodox operating signal TOF (Try Other Foot) from one of my operator friends. Corporal Fox was worried about what I was going to say when I got back to Corps HQ, so I thought up a fault of a broken wire on the EHT capacitor behind the transmitter panel. No-one really cared so long as we were in contact!

The Staff College Exercise went smoothly with B Corps and 2 Division providing all that was required by the students.   B Corps then returned to Karachi, this time the journey through the Bolan Pass being downhill, the Government was able to afford the cost of the whole journey by train. Soon after we got back to Karachi trouble broke out again in Waziristan. This time the whole of O Section (Corps Signal Office Section) were sent to the operational area to help A Corps.   A Detachment from 4 LMA Section was sent up to Quetta in case the Waziristan trouble spread into Baluchistan. The All India and Western Command Wireless Groups were put on continuous watch, this time I was put on the third watch as I.M. in the Control Room which was

another new experience for me.   It also meant no guard duty as it involved a night shift every third night.

Being on the Group brought me into closer contact with some of the old soldiers in B Corps. These were men who had been posted to India in 1919 or 1920 and had opted to serve there continuously, returning home for six months leave every five years. They were excellent operators and very professional.   Some of their names that I can remember: "Guts" Murray, "Aggie" Fletcher and "Sparrow" Webb.   They took great pride in clearing all their traffic at the end of their shift and any fault in transmitter or receiver which might prevent them from doing this annoyed them very much, and it was God help the IM who couldn't clear a fault quickly.

Soon after I started on the Group an incident occurred which put me quite high in the opinion of the old sweats.   One afternoon I left the Control Room, which was about a quarter of a mile from the Signal Office in the Western Command HQ Building, to go for my mug of tea in the Signal Office. When I got there I found a proper flap was going on. Two Officers from the CSO's office were present.   Interference was preventing the operator on the Western Command Group station receiving anything. Suspicion that the source of the interference was a Japanese cargo ship in Karachi harbour had caused a call to be made to the civil police, and they were organising an armed police squad to board and search the ship.   Curiosity caused me to put on the headphones to listen to the interfering signal. After listening for a few moments I thought I recognised the sound, so I turned the receiver reaction control down and sure enough the interference stopped. The operator had turned the reaction up too high and so the receiver was oscillating. Not wishing to get him into trouble, I got my little screwdriver and fiddled with the grub screw on the reaction knob pretending to tighten it up, then said it had been loose so that the knob turned without moving the variable capacitor.
Everyone was pleased and the police boarding party stopped before an international incident happened!

Also in 1938, the I.M. in the 4 LMA Detachment in Quetta was due to return to the UK causing me to be sent there as his replacement.   A few days after my arrival, 2 Division Signals were due to set off for their annual training camp at Bostan, some 30-odd miles from Quetta. Except for the vehicle drivers, everyone had to march there. 4 LMA were going with 2 Div so I had to march there with them. What I didn't realise at the time was the effect which a change from sea level at Karachi to an altitude of between   5,000 and 6,000 feet would have on my breathing and endurance. The march took 2 days, the first night we camped near Pishin which was about half way to Bostan.   I managed

to keep up on the march until we were only a mile or so from the camp then my legs gave out and I had to join the stragglers and limp slowly into camp.   Strangely enough, next morning I felt fit again and managed to complete the march without dropping out: I must have become more accustomed to the altitude.

Easter weekend came while we were at Bostan. Several of us in 4 LMA decided to try to climb to the top of a nearby mountain about 11,000 feet high, which had snow on top,   Early on Good Friday morning we set off taking food and warm clothes with us.   We also took a mirror with us so we could flash it when we got to the highest point we could reach and those back at camp could see how high we had got. We climbed by following goat tracks and reached summit by the easiest route we could find. We had no climbing equipment or experience so what we did had to be simple.   While at the top we wrapped snow up in handkerchiefs in the hope that it would not melt away before we had got back.

During my time at Quetta I visited some of the stations in the Baluchistan District and the Zhob Brigade Area doing various maintenance jobs, places such as Chaman, Fort Sandeman and Loralai.   One day I had to go to the Fort at Shelabargh to repair a faulty indicator on a l0-line Magneto Switchboard. A Battalion of the Royal Gurhwal Rifles was stationed there. On arrival I was taken to a large room used by the Regimental Signallers. While I was getting my tool-kit ready to start on the job, I heard the sound of marching feet coming along the verandah then through the door came the Regimental Signal Platoon with their Signal Officer.   He got them all sitting on the floor round the table where I was working, and asked me to tell him what I was doing and why, so that he could interpret it to his men.   The fault proved to be an open circuit in the indicator coil so I had to partially unwind it to find the break, solder the ends together, then rewind the coil.   The signallers were very interested in everything I did, especially the re-assembly and testing of the indicator after I fitted it back into the switchboard. Afterwards I was asked many questions about the Telephone 110, Telephone D MkIII, the Heliograph and the Signal Lamps which they used in the Regiment.

Another unusual job came up one evening when a civilian lorry carrying a load of tree trunks got entangled in the remote control lines connecting the Signal Office with the control room at the point where they crossed the road.   The permanent line poles carrying the wires over the road were just not high enough for this particular load to pass under safely. The B Corps Linemen in the Fixed Communications Section quickly repaired the line but unfortunately

someone had disconnected some of the wires in the Signal Office without identifying them so there was confusion when re-connection was attempted.   The 2 Division Orderly Officer had got involved because the accident occurred after normal duty hours and the OC Fixed Communications and his IM were out of barracks. The Orderly Officer tried to identify the wires but got confused because he didn't know some were connected to batteries in the Control Room, so he disconnected more wires, and eventually gave up and sent the Orderly Sergeant to try to find me.   I was in the Canteen, completely unaware that there had been an accident. One of the UHQ IMs was with me and offered to help me sort things out.   We went first to the Signal Office where I showed him what I wanted him to do so that we could restore the telephone line. Then I went to the Control Room and was soon able to talk to him on the phone link, from then on it was plain sailing to get all the wires correctly connected.   While all this was going on "Guts" Murray, who I have mentioned earlier, was grumbling loudly because traffic was piling up. He had worked with me on the Group Station at Karachi so was pleased when I arrived on the scene, announcing very loudly for all to hear, "Now we'll get something b——y well done"!

REMEMBRANCE

COLONEL DB EMLEY OBE

Derek Brereton Emley was born on September 15th 1921, the only son of Colonel MW Emley OBE TD, who as a Territorial Army Signals Officer had the distinction of commanding the first TA Signallers (GG Airline Section) to go to Flanders in 1915. His impeccable military family background extended to his grandfather who was Colonel of 1st Newcastle Volunteers, a regiment in the Royal Engineer Signal Service.

He was educated at Lancing as a scholar, and joined the Army Class with a view to entering Woolwich in September 1939. However, the cadet entry was discontinued that summer and instead he presented himself at the London University recruiting centre. There he was told that his qualifications were insufficient for consideration as a Signals Officer; nevertheless a letter which he happened to be carrying from Brigadier Rawson one time Chief Signals Officer persuaded the Recruiting Staff to make an exception and in due course on September 9th 1940 Sigmn Emley reported to the Depot Battalion at Catterick.

In August 1941, he was commissioned from 152 OCTU and posted to 55th (West Lancs) Division Signals in Sussex. Active war service began with 78th Division at Algiers in November 1942 and took Emley through thNorth African and Italian campaign~as and the final withdrawal from Palestine in 1947, with the 1st Armoured Division.

Selected for further education at. Cambridge University, he entered Queens' College in 1949 where he obtained a "Two One" in the 1951 Mechanical Sciences Tripos Part I and the next year a Pass with Distinction in Part II. This was followed by a tour as Instructor at the School of Signals where his lectures on Line Communication were frequently enlivened with thunderflashes and other pyrotechnics.

On a second tour at the School he was a member of the newly created Planning Wing and was co author with Lt Col Norman Porter of the 1970 Plan (Hobart) which gave rise to both the Ptarmigan and Clansman ranges of equipment and he was personally responsible for defining the Military Characteristics (the precursors of Staff Requirements) of the latter.

This plan stemmed directly from Derek Emley's sound engineering logic and foresight. The importance of this plan was reflected in the Corps' history in The Vital Link thus:

"Looking back at this time, it was a real moment of inspiration and the decisive point at which the right or wrong turning might have been taken…….Emley concluded that the plan was the only possible way to proceed"……

He always remained at heart a practical soldier and was immensely proud of commanding 14 Signal Regiment. At that time 14 Signal Regiment was responsible for the UK stations of the Commonwealth Communications Army Network (COMCAN) which provided long range wireless links to stations around the world. While commanding the regiment between 1963 to 1966, the Army's UK main Terminal Tape Relay Centre was converted without break in service from manual operation by some 250 military,WRAC and civilian operators to full automation by STRAD a large, valved, computer built and installed by STC. In 1966 the Regiment was granted the Freeedom of the City of Gloucester in recognition of a long and happy association. Yet he displayed this soldierly pride with immense modesty and dismissed his significant contribution "as only doing my job". This was not the view of his seniors officers as he was awarded the OBE at the end of this tour.

The width of his experience at regimental duty was exceptional, having served at various times in Gunner Regiments, Brigade, Divisional and Corps Signals; L of C, AA Command and Air Formation Signals; in COMCAN and as Commandant of the RAC Signal School Bovington. He spent the last years of his service within the MOD as Head of Signals 37, latterly OR 22, responsible inter alia for the introduction into service of the Clansman family of combat net radio with which he

had earlier been so closely associated.

On retiring after thirty six years' service, Emley immediately joined the Marconi Company in Portsmouth and spent ten years as an active consultant travelling extensively round the world promoting the company's military communication equipments, including the Clansman VRC 353. This involved visiting twenty two foreign countries in his first three years with the company, lecturing on three occasions in French.

Derek Emley was a keen athlete and a high hurdler of some style, having been Sussex Junior Champion in 1940 and Northern Command Champion and Army finalist in 1954. While in BAOR he worked successfully to advance the status of the Morrison Cup Athletics. On, becoming athletically retired he qualified as a judge and on several occasions referreed the Army Inter Unit and Individuals Competitions. He was Chairman of the Inter Service Officers Milocarian Athletic Club from 1974 to 1975.

A Fellow of the Institution of Electrical Engineers, he was a clever an engineer with a sharp brain who was always fascinated by semi mathematical puzzles and was the author of several of the Brain Teasers published by the Sunday Times during the 1950's and was someone who regularly completed The Times crossword before breakfast.

He married in 1948, Georgina (Gina) Lovelace and they had two sons and a daughter. On his final retirement they remained in Dorset where he was able to indulge his pursuits of fly fishing and playing the bagpipes but not at the same time. He became President of the Wessex Highlanders. After Gina's death in 1996 he married again, to Una Thomson and they continued to live in the thatched cottage in Marnhull. He became one of the mainstays in Marnhull village life. As a man Derek Emley was always a gregarious individual and generous host, especially with his famous concoction of vodka and ginger beer called the Emley Moscow Mule.

Derek Emley died on 10 December 2009 after a comparatively short illness. He was very open about it which made it very much easier for everyone else to deal with. In the event, his end came much quicker than expected and one of his friends said that "he met his end with his usual stoicism and bravery – a reflection of the man". He never lost his mischievous, infectious and boyish sense of humour. He remained extremely proud of his Corps and followed closely its performance in operational theatres, knowing that they were benefitting

BRIGADIER P J EVANS CBE ADC

Patrick Joseph Evans was born in Kent on 16 March 1928 and after a grammar school education joined the Army in the Queens Royal Regiment in 1946. Following training with 150 OCTU he was granted a Regular Commission in the Royal Signals in 1947. After Parachute training he was posted to Palestine. A bad eye injury caused his return to the Depot Regiment in Pocklington but once fit again he saw service with 20 then 14 Field Regiment RA , the latter in Korea, where he was Mentioned in Dispatches. Following promotion to Captain, he was attached to the Australian Forces in Kure, Japan. He returned to UK and married Pat in 1953; this happy marriage was blessed with 3 sons.

His next posting was as Adjutant to 56 (City of London) Sig Regt TA and then on to Catterick as Adjutant to the OTW of the School of Signals. He attended the Staff College, Camberley in 1958 and then became GSO2 (DS/Ops) to HQ 1 Division Salisbury Plain District. In 1960 he was seconded to Singapore Military Forces to command their Signal Squadron and when the confrontation with Indonesia began, he became Commander of 4 Federal Infantry Brigade Signal Squadron. He was appointed MBE for his services to the Singapore Government in 1963.

Back in UK he served in the MOD for 2 years as GSO2 in Signals 36, followed by a year as 2IC of 4 Div HQ & Sig Regt in Herford. On promotion to Lieutenant Colonel in 1968 he became the first CO of 34 (N) Signal Regiment (V) welding together 50 (Northumbrian) and 49 (West Riding) Sig Regts and the Royal Signals Reserve Army Band. A tour as GSO1 CD/OR Wing at the School of Signals at Blandford followed and on promotion to Colonel in 1973 he returned to Signals 36 – this time as Colonel GS. In 1976 he attended the Senior Officers War College at Greenwich and was posted as the Senior Army Representative to the Defence Operational Analysis Establishment at West Byfleet.

Promoted to Brigadier in 1979, he returned to the MOD as BGS (Signals) and was appointed ADC to HM The Queen. In 1980, his Signal Officer-in-Chief (Army), Major General Chris Bate died in office, and Paddy stood in for 3 months until the arrival of Major General Archie Birtwistle. In 1982 his appointment changed to Deputy Signal Officer-in-Chief (Army) C and he was awarded the CBE. During his service he boxed for the Army Officers and also played rugby. He retired in March 1983, returning to the family home in Broadstone, Dorset.

For the next 10 years he was Director of the British Ceramic Plant & Machinery Manufacturers' Association and also Director of Interceramex, a bi-annual exhibition of ceramic machinery and supplies. Pat was the Assistant Director and together they travelled extensively in the USA, Europe and Asia taking Trade Missions overseas. Paddy also retained his Army and Corps links as a member of the Control Board of the Army Benevolent Fund, Vice Chairman of the Royal Signals Association, Chairing the monthly RSA welfare meetings in Blandford and was one of the 'Founding Board of Trustee's' of the newly developing Royal Signals Museum. He was Chairman of the RSA Poole Branch for over 20 years, and rarely missed a monthly meeting or social event.

He was also Chairman of the Finance Committee of St Anthony's RC Church in Broadstone. Everyone respected him; he always had a smile, a twinkle in the eye and with his quiet kind way he was a joy to be with and few knew of his outstanding talent at painting, sketching and tapestry. Paddy died at home, on 22 September and his funeral took place at St Anthony's on 1 October followed by cremation. The church was packed and among the mourners were several senior officers including Major Generals Chris Last, Ian Sprackling and Alan Yeoman and Brigadiers Cedric Burton and Keith Olds as well as members from both Regimental Headquarters Royal Signals and the Royal Signals Museum staff. Pat was a tower of strength to Paddy in over 56 years of marriage and gave him great comfort and support in his short but savage battle with cancer, which he bore with great dignity. He died on 22 September 2009. Our sympathy goes to Pat; sons Simon, Adrian and Patrick all of whom pursue careers in the theatre – writing, directing, stage management and administration, and to daughter-in-laws Krassie and Bettany and grandchildren Sandy, Sorrel, May and Danny.

BRIGADIER TIG GRAY

Compiled from memories provided by Major Generals PD Alexander, PF Pentreath and others.

Thomas Ian Gordon Gray was born on 21 January 1921. Known to his family and civilian friends as Ian, he was invariably called "Tig" by his Service colleagues. He attended Alleyn's School in London, before enlisting as a Signalman in the Territorial Army in 1938. He qualified as a dispatch rider, operator wireless and line, and operator keyboard and wireless, and at the onset of war, was swiftly promoted to Corporal and then Sergeant. In 1940 he attended 151 Officer Cadet Training Unit, gaining an emergency commission in May 1941.

Initially posted to 8th Armoured Division in Egypt, he soon transferred to 23 Armoured Brigade Signal Squadron, and served with them at the battles of El Alamein and Alam Halfa. After being evacuated to Palestine with jaundice and sinusitis, he was posted as OC 1 Beach Signal section at the Combined Training Centre, Kabrit, for the training of Beach Bricks for the invasion of Sicily in support of 231 (Malta) Independent Infantry Brigade Group, where he was subsequently appointed Brigade Signal Officer. As such, he took part in two further assault landings, at Pizzo in Italy in September 1943, and in Normandy in 1944. His wireless orders for OVERLORD survive as models of their kind. He was appointed an instructor in tactics wing at the School of Signals in November 1944, an appointment he held until the end of the war. He was married in 1944 to Joy, with whom he was to have two daughters.

In January 1946 he was granted a Regular Commission, and served as Adjutant of the School of Signals until May 1948. From 1948 to 1950 he was SO3 Telecomms at HQ BTE, and went on to the Staff College, Camberley in 1951. His postings continued to show range and variety with a two year stint at the War Office as GSO2 SD7 until 1954, when he was sent to SHAPE Signal Squadron at

Fontainebleau, France, and thereafter to HQ MELF in Cyprus as MA to the Chief of Staff, a time which included the Suez crisis. He returned to Staff College as DS with the temporary rank of Lieutenant Colonel in 1958, where he supervised the rebuilding of Alanbrooke Hall. He became CR Signals in Aden in February 1962, with responsibility for Squadrons in Aden and Bahrein, and in January 1964 he returned to the MOD as GSO1 in the Directorate of Plans. On promotion to Colonel in 1965, he was sent to Scottish Command as CSO, a post he held for less than a year before being selected for promotion to Brigadier and appointed CSO Southern Command, later Strategic Command. At the end of this tour he went to HQ Far East Land Forces in July 1969 as the last BGS. Prior to his next appointment as Director of B Division of the Defence Policy Staff in MOD, he attended the NATO Defence College, and was leader of the UK delegation for various Anglo-Allied Defence Staff talks.

On taking early retirement in 1973, he became Secretary of the Royal College of Defence Studies, an RO post he held for ten years. He was a well-known and respected "character", and made the acquaintance of many officers who went on to hold senior rank in the three services. In final retirement, he was a chairman of Civil Service selection boards, including Retired Officer appointments boards, and became an Honorary Steward of Westminster Abbey. He was on the Committee of the Officers Association from 1974 to 1979, a Vice-Chairman of the Royal Signals Association, a Tax Commissioner in 1984 and a Joint Chairman of the Officers Association Benevolence Committee.

Tig Gray wore his Corps tie with pride. He was a well respected officer with a firm, quiet grip: he was meticulous and set high standards, and although he could be mildly irascible, he was ever kindly, courteous and interested in people. He was a keen churchman, having served as Warden and Vice Chairman of the local Parish Church Council, and proud to have been born and to have ended his days in South London. He kept in touch with a wide circle of friends, took life calmly, and was always prepared to help anyone who called on his assistance, particularly ex –Service charities. His sporting interests included cricket (for which he was awarded Corps colours), tennis, rugby, squash, golf and hockey. He was an admirer of the arts, attending cinema, concerts and theatre, as well as being a self-confessed inveterate tourist, and enjoyed some philately and country sports, when time allowed. He died on 30 March 2009, aged 88.

BRIGADIER KD GRIBBIN

David Gribbin was born in 1919, the son of a Manchester clergyman, a fact which accounted for him being educated at Marlborough, where like many others, he became interested in signaling. Despite having no private means, and indifferent at games, he defied his housemaster's advice and was allowed to join the Army, provided he went to university first. After a year at Cambridge, war broke out, and he accepted the offer of an emergency commission to join 4 Division Signals in Canterbury. Having to his name no "Shop", Sandhurst or OCTU, far less a Q Course, he was probably the least qualified Royal Signals officer at the time, a handicap he readily admitted, and which dogged him in diminishing degrees throughout his career.

There were advantages in being "in on the act" early, however, even though his light wireless section was obliged to return from France four days after landing at Cherbourg in May 1940. His unit subsequently provided ship-to-shore communications between the beachhead and the rescuing naval forces during the evacuation. His section was later attached to 1 HQ Signals, and took part in large wartime exercises and air-raid relief work. He was appointed adjutant of 6 Air Formation Signals in 1942, and embarked for Iraq shortly afterwards.

In 1943 he took over a company of 3 Air Formation Signals providing ground communications for the RAF in the Canal Zone, but was swiftly ordered to rejoin his unit for the reoccupation of Cos, an operation which had to be abandoned in the face of strong German resistance, and he and some of his unit were fortunate to evade capture. His unit moved to Italy in March 1944, and after some months on operations, he was selected to attend the six month course at the war College, Haifa. The co-location with the RAF Staff College made circumstances

fairly congenial, even though the small groups of civilians seen carrying out tactical exercises in the desert during TEWTs proved to be members of the Jewish underground in training.

After a short staff appointment he returned to the UK in March 1946, and took up the post of GSO3 in Military Operations. This was a fascinating period of the immediate post-war era, and he was kept busy. He was able to rejoin his Cambridge Mathematics course in 1948, and graduated in 1950. An appointment as Instructor in Signal Wing of the School of Signals inevitably followed, where by dint of just keeping ahead of the students he was supposed to teach, he became Chief Instructor, an appointment which went some way towards remedying his lack of signals knowledge.

There then followed a unique posting to Woomera, Australia as Signals officer for the atomic bomb tests in 1953. He was returned early however, when a routine X-ray revealed apparent tuberculosis, then a very serious illness. Happily, this turned out to be scarring left from an earlier bout of pneumonia. A month's sick leave saw him restored to full fitness, but he remained in UK, and was subsequently able to inform personally the Minister of the success of the tests. He was sent to Singapore in 1954 as DAQMG in GHQ FARELF, but returned to UK to attend Joint Services Staff College.

On completion, he welcomed the long overdue return to service in a Corps field unit in BAOR in 1957, a year of wide-ranging defence cuts. In 1959, he was selected to command Cyprus District Signal Regiment, only for this unit to be disbanded and him to be diverted to command the future 16 Signal Regiment in BAOR. After barely two years he was back again in UK, as AA&QMG Q(Ops) in the War Office. This turned out to be another curtailed appointment, as twenty months later he was posted in July 1953 as Colonel GS Planning Wing at the School of Signals. In 1955 he returned to the newly reorganized Ministry of Defence as Deputy Director (Signals), where he found himself deputy to a Rear Admiral in the new central staff, with particular responsibility for the Defence Comcen.

His final posting was to Hounslow as CSO Eastern Command in the rank of Brigadier. Shortly afterwards this became Southern Command, and was a most congenial appointment. It was from this post that he took early retirement at the age of 50, with the view that civilian employment would be much easier to find than waiting another five years. Taking advantage of resettlement management training courses meant that he was able to secure a worthwhile post-military career, until his second and final retirement. He died on 1 May 2009.

BRIGADIER OJ PECK OBE

Oliver Jasper Peck was born on 23 January 1922, and enlisted in the army in 1940, attending the first short Course at Oxford, and was commissioned the following year into the Corps and 3 Division Signals. During the rest of the war he served in North Africa and the Middle East with Armoured Divisional Units.

He was adjutant of 1 Infantry division Signal regiment from 1946 to 1948, and during the next 11 years attended courses and filled staff appointments in the UK and FARELF, including the Staff College, Camberley, the Officer Training Wing, School of Signals and the Joint Services Staff College. He also saw regimental duty with 1 Signal Regiment and 212 Signal Squadron in BAOR.

In 1964 he was appointed Commanding Officer of 9 Signal Regiment, during a particularly active time in Cyprus, a post he held until 1967. On return to UK, he served for a short time as AQMG at HQ Eastern command, before moving on promotion to become Colonel GS at DI24(A) in February 1968. On promotion to Brigadier the next year, he was appointed to DACOS CANDE at SHAPE, a post he held until 1972, when he returned to UK as Commander 12 Signal Group, where his tact and bonhomie rapidly gained the respect and confidence of the TAVR units under his command.

He retired in June 1975, to spend 12 happy years as Bursar of a girls' school near Guildford. Jasper Peck always had the ability to appear solid and unflappable, and had a dry sense of humour which endeared him to all who met him. He was a keen golfer, being secretary of the Corps Golf club from 1952 to 1954, and Captain during the last three years of his service. He died on 12 September 2009.

COLONEL MJ PICKARD

Martin John Pickard had a career spanning nearly 40 years, both as an officer in the Regular Army and as a retired officer. He was a fine leader with an easy rapport with soldiers, an accomplished sportsman who boxed for the Army, and a staff officer with a sharp analytical mind.

Martin was proud to be among the wave of post-war grammar school boys to go to Sandhurst in 1954. The traditions of military service ran deep in the family veins. Martin's father, a Major in the RA, served with distinction in the second war, leading a daring escape from the Japanese after the fall of Singapore in February 1942. Martin's grandfather was a military bandsman.

Having initially considered serving as an infantry officer, Martin arrived unexpectedly in Royal Signals after being assured at Sandhurst that the Corps needed good leaders as much as technical boffins. A natural intellectual, Martin enjoyed the particular challenges presented by military communications and in signals intelligence where his analytical skills were a particular asset.

He served both in the UK and in BAOR during the early years of his career. In May 1962 he was posted to Malta for a tour with 234 and 235 Signal Squadrons before returning to the UK in 1964 to take up a staff appointment at the MOD (Signals 36). After attending Staff College in 1966 he was appointed to a Grade 2 Intelligence staff post in HQ BAOR. In 1969 he moved to the highly interesting command of 253 Signal Squadron in Hong Kong, where Martin and his Squadron received the award of the Wilkinson Sword for overseeing the electrification of deprived Chinese villages. In 1971 Martin returned to the MoD (AG11) and this was followed The National Defence College.

In 1974 Martin's career entered what he considered a particularly rewarding phase when he was appointed 2iC of 9 Signal Regiment in Cyprus. This was followed in 1976 by command of 13 Signal Regiment, 9 Regiment's sister unit in Germany. Staff jobs followed at HQ BAOR and R Signals Manning and Records, before Martin moved to DI24 (A) on promotion to full colonel in 1983. He retired from regular service in 1988.

Martin was fiercely loyal to the Corps and always said that his career had afforded him wonderful opportunities. Although in some ways an independent spirit who had little truck with some of the more rigid military formalities, he believed strongly in the ethic and traditions of army service. It was in this spirit that in retirement from the Regular Army, he continued to serve as an NRPS Major with the Territorial Army until 1995, unconcerned about questions of rank, and committed to doing a good day's job.

In full retirement, near Reading, Martin was as industrious as ever supporting local charities, including Cruse and the Lions and as an active supporter of the Royal Signals Association. He was a talented raconteur and public speaker, who gave many memorable and hilarious after dinner speeches at Mess nights and other gatherings. He was also an irrepressible teller of jokes and in all things, military or otherwise, he was acutely aware of the comic dimension. His final words, spoken with a smile and a wave were 'cheerio chaps!'

Martin will be very dearly missed by all in his family and wide network of friends, but most deeply by his wife Ann, and sons Hugh and Alex. He died on 27 September 2009.

COLONEL P WEBB

Paul Webb was born on 13 November 1937 in Altrincham, Cheshire and attended Beckenham Technical School before going to Welbeck College and subsequent commissioning into the Corps in 1958. His first postings were to 244 Signal Squadron and 22 Signal Regiment, before joining the Junior Leaders Regiment in 1961.

On completion of this tour, he commenced in 1964 a Loan Service tour with the Malaysian Armed Forces, initially as a temporary Captain in the Ministry of Defence, and then in the signal regiment. On his return, he joined 12 Infantry Brigade Headquarters and Signal Squadron in 1968, and left on promotion to M6(A) in the Ministry of Defence.

In June 1972 he assumed command of 2 Squadron, 7th Signal Regiment, where his passion for exercises and colourful leadership were given full play. Establishing communications in extremis from an autobahn layby was not unknown. Return to UK followed and the post of DAQMG at HQ North West District. In 1977 he was selected for promotion and appointed GSO1 Communications and Electronics at the Joint Warfare Establishment. He assumed command of 28 Signal Regiment (NORTHAG) in 1979, where he did much to integrate the unit into the local community and strengthen Anglo-German relations.

His BAOR experience was utilized in his next appointment in 1982 to HQ BAOR, where he joined the then Lieutenant Colonel John Almonds as one of two SO1s on the staff of CSO BAOR. Despite the potential for a clash of egos, the two officers got on well together, and were reunited in their next postings as Commandant and Chief Instructor respectively at the Royal School of Signals. There he took a particular interest in developing and mentoring young officers, both on and off duty, and was instrumental in implementing many HQ Mess improvements which saw the advent of the Dorset Room, the elegant green leather furniture and the magnificent corner display cabinet made by local craftsmen.

His final post in the Army was on the staff of ACDS (CIS) in the Ministry of Defence, which initially he avowed to dislike. Typically, by 1992, the end of his tour and his time in the Army, he had left behind a happy and productive organization. He was married first to Loni Bettina, and then to Margaret Mary, who survive him together with two daughters of his first marriage. Paul Webb was a large personality, whose bonhomie and embracement of all aspects of military life was underpinned by a commitment to high standards, both technically and tactically. He died on 23 November 2009.

D-DAY: THE BATTLE FOR NORMANDY

By Antony Beevor
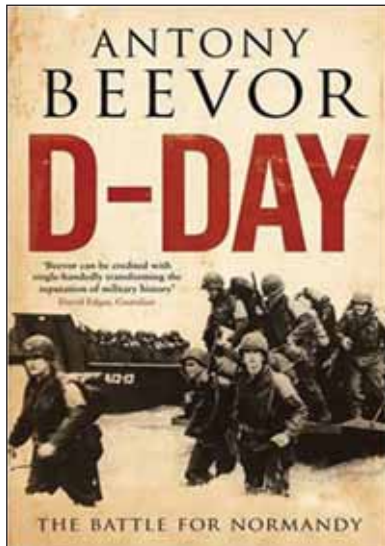
The work of Antony Beevor will be well known to many readers of the British Army Review. His previous books, which include histories of the Battle for Crete, the siege of Stalingrad and the fall of Berlin, are now modern day history classics and the latest addition to this stable seems destined to be so too.

The main title of the book, D Day, is somewhat of a misnomer and one has to look to the subtitle, The Battle for Normandy, to understand its full scope. Indeed the story of D Day itself fills only 151 pages with the remaining pages covering the rest of the campaign, including the fighting in the *bocage*, the breakout from the bridgehead and the liberation of Paris in late August 1944. This is not a criticism rather it highlights the scope of this book.

The story Beevor relates is wide-ranging. He covers the political and strategic aspects of the battle thoroughly, in particular the tensions between Hitler and his senior commanders and that within the Allied high command – including De Gaulle's own, very French, agenda! It is also clear that Beevor is no great fan of Montgomery and the tensions amongst the senior leadership of the Allies during this campaign make for interesting reading. However, the book is much more than a dry history of generals and strategy. It also brings out very vividly the nature of the combat during the campaign. Starting with the early success in the establishment of a foothold on French soil, the battle is then followed through the savage hedgerow to hedgerow fighting in the *bocage*. Finally, the highly attritional nature of the breakout battle, and the

pitting of British and American tanks against the might of the German panzers and the feared 88mm anti-tank gun, makes for fascinating and eye-opening reading. Equally the part played by the French Resistance in disrupting the German forces in Normandy is also not forgotten.

As well as tracing the story of the campaign Beevor also highlights sometimes forgotten or unpalatable aspects of the period such as the often brutal treatment of both male and female French collaborators, and the bloody impact on the French civilian population. It is a sobering and often overlooked fact that 19,890 French civilian were killed during the Battle for Normandy with many more casualties. Indeed, as Beevor highlights, some 70,000 French civilians were killed by Allied bombing in the Second World War more than all the UK casualties from German bombing!

Beevor draws on a wide range of sources to construct his story, and follows the style used in his previous books. Official records, existing histories and the personal accounts of senior officers and politicians help to construct the story of the campaign. This is then interspersed with the reminiscences of ordinary officers and soldiers, to provide a very detailed account of the progress of the battle and lend colour and authenticity to the narrative. He ably outlines the twists and turns of the Battle for Normandy, highlighting both the successes and where things did not always go as planned - despite Montgomery's post-war claims that his portion of the battle had been conducted as part of his overall 'master plan'!

This is generally a well-produced volume and includes a good selection of pictures. Unfortunately the accompanying maps do not do the book justice. Whilst they are numerous (19 altogether) in many cases they lack the detail necessary to effectively illustrate the, often a very complex, action concerned, which is a pity. Books that relay the stories of battles need good detailed maps to aid the reader in understanding the action.

In summary this is an excellent, entertaining read and if there is any question in the mind of the reader as to the importance of the Battle for Normandy, this book will leave them in no doubt. Indeed the book's final paragraph is perhaps the best encapsulation of this:

> *'The battle for Normandy indeed did not go as planned, but even the armchair critics could never dispute the eventual outcome, however imperfect. One must also consider what might have happened should the extraordinary undertaking of D Day have failed: for example, if the invasion fleet had sailed into the great storm*

of mid-June. This raises the possibility that the Red Army might have reached not just the River Elbe, but even the Atlantic Coast. The post-war map and history of Europe would have been very different indeed.'
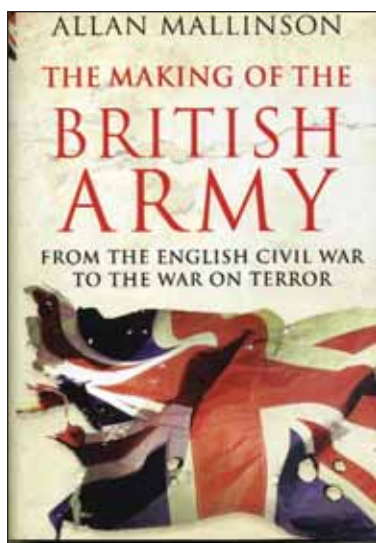
Highly recommended.

Published by Viking, 2009, 608pp, Hardback, ISBN 978-0-670-88703-3

Colonel Iain Standen

THE MAKING OF THE BRITISH ARMY

From the English Civil War to the War on Terror

By Allan Mallinson

The author, a retired Brigadier, noted newspaper columnist and successful author of military fiction, has been driven by the how and why the Army has come to be what it is to produce an eminently readable and wide-ranging history of its last 450 or so years. The author has chosen to cover certain episodes in depth, including much detail which points to the research underpinning the narrative. The narrative starts with an account of the early Civil War battles, particularly Edgehill, the first pitched battle in the country for 130 years. The analysis of the tactics and weapons used, the description of the personalities and the political background involved all serve to capture the reader's attention at the outset, thus setting the tone for the remainder of the book.

The account continues from the era of Cromwell through the campaigns of Marlborough, the battle of Dettingen and the Jacobite rebellion to the North American campaign and the revolutionary war with France. These campaigns are interpreted uniquely, in the sense that the historian is also an experienced soldier, able to apply the microscope of modern day tactical and strategic thinking to the conduct of these most significant of historical conflicts. At each stage the lessons for the development of the British Army are identified and clearly elucidated.

This leads on in time sequence to the campaigns of Wellington on the continent, and the course of the Napoleonic Wars. As ever, the account is brought to life with descriptions and observations of the general conditions of military life at the time, as well as the predilections of the general officers involved. Waterloo is given a fresh treatment, drawing on contemporary accounts to produce an authoritative description of the course of events starting with Napoleon's unexpected arrival in force on the battlefield on 15 June 1815.

In the Victorian period, the Crimean War, Indian Mutiny and Boer Wars are accorded balanced and thoughtful treatment, even more so than earlier conflicts, perhaps because of their comparative proximity to the present day, and the increased amount of reference material available. The reforms of Cardwell and Haldane are discussed fully, and their impact on the army organization in the years leading up to the First World War. Again, the generals and their campaigns are systematically dissected, sometimes with surprising conclusions.

The inter war years are then skipped over to take the reader up to the Second World War. The buildup is particularly well documented, with full recognition of the key role of the future Lord Alanbrooke in this and later stages of the war. Again, free use is made of eye-witness accounts at Alamein, Normandy and Arnhem to convey fully the atmosphere of the time. The author uses the latter operation to examine the particular ethos of the Paras, and goes on to draw parallels with the future conflict in the Falklands.

The author gathers pace in the post war years, with one quarter of the book being devoted to this period, and is particularly interesting reading. The situations, personalities and events will still be fresh in the minds of many readers. In the final chapters the author addresses the changes in attitudes from the Army which fought in Korea, Aden and Malaya and prepared for the Cold War in Europe to that called upon to act in the wake of the 9/11 attacks. He underlines the jarring disconnect in the attitudes of UK government and media with the change in American strategic thinking which that day brought about. The final chapters bring us fully up to date. The

author counsels against seeing technology alone as the ultimate battle-winner, even though the infantry of today numbers less than a quarter of the army's strength, as against over half in 1918. The contention for resources can only be properly settled, he believes, once the debate on the likely nature of a future conflict has been resolved. The author's conclusion that the army is very much a work in progress, will give cause for thought.

This is a well-produced work, with very welcome appendices on notes and further reading, and numbering and naming of regiments – that on the anatomy of a regiment is possibly rather less essential. The account is much enlivened by the copious use of footnotes, which enlighten the reader on the background to the events described. This is an excellent volume for the reader interested in taking up military history – the significance of the various stages are well set out, with clear direction to further reading to fill in the gaps.

Published by Bantam Press 2009, 550 pages, £20. ISBN 9780593051085.

Colonel (Retired) Tom Moncur

DANGER CLOSE

By Stuart Tootal
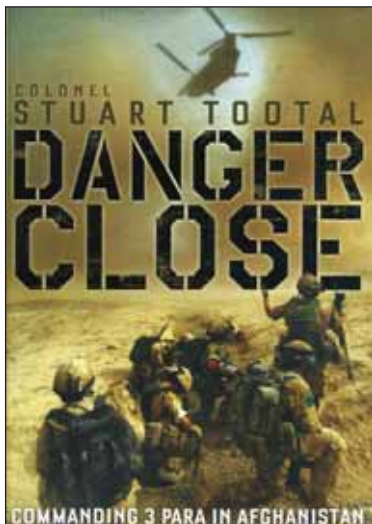
This is a book about the deployment of 3 Para Battalion Group on what was ostensibly a Peace Support Operation to Afghanistan, in 2006. It quickly transpired that the operation was anything but peace support in nature with the Battalion finding itself in a situation where it was fighting the Taliban on a daily basis. The author, Stuart Tootal, commanded the Battalion throughout the deployment and as such you get a blend of detailed description of the actions and also his personal thoughts.

If you are looking for something that gives you an insight into the tough, dirty and deadly, day to day reality of an infantry battalion on operations or, a perspective of what it is to command in such an environment, this book has it all.

The author offers that the apparent miscalculation of role resulted in a hugely over-stretched battalion, attempting to control an area of ground the size of Wales, with insufficient resources, and constrained by a convoluted and confusing chain of command. Thus the Battalion was in effect a series of small groupings of soldiers with leadership, necessarily and readily, being exercised at the lowest practicable level. However, as is often the case with the British Army, it also results in acts of immense individual bravery and a professional determination to win in the face of huge adversity.

It provides a captivating and detailed insight into 3 PARA actions at isolated Platoon and Company bases whilst overlaying the Commanding Officers' personal views, fears and frustrations in respect of often very finely balanced battles. Any member of the armed forces, serving or retired will find this book professionally gripping, whilst those who have no connection with the military will be struck by the descriptions of personal valour shown by young soldiers and officers, often barely out of school or University. Tootal also captures the unique bond that occurs between soldiers and officers regardless of rank or background when subjected to the experience of battle. The book is brought to life by being liberally laced with descriptions of actions and comment that reinforce these views. His narrative of Company level actions and activities during the operation makes the reader wonder at the ability and responsibility put on the shoulders of young men and women in the British Army. This is particularly stark during his descriptions of the work of his Company Commander's. The immense efforts of 'A' Company Commander, Major Will Pike, in Sangin during the initial stages, makes one wonder how he didn't gain formal recognition, whilst Major Huw Williams, with his hotchpotch of an ad hoc 'Easy' Company group at Musa Qaleh, rightly gains recognition. The book also describes the circumstances surrounding the sad deaths of Corporal Peter Thorpe and Lance Corporal Jabron Hashmi, at Sangin.

Unlike many books of this genre Tootal also offers a fascinating insight into the psychological aspects of commanding a battalion on operations and in battle. He exposes his own feelings throughout the book providing a fascinating insight into the doubts, balances, and deliberations that a commander faces and how there is a constant requirement to keep thinking about 'what if'. It

is also evident in his writing that he trusted, respected, and empathised with his fellow officers although the responsibility of command made friendship a luxury. However, the strong personal and professional relationship that he fostered with his Regimental Sergeant Major provided him with a non-judgemental and open friendship that he valued immensely.

There is a combination of frustration with the operational and strategic situation, and pride in his Battalion's achievements that is a consistent thread throughout Stuart Tootal's book. The one negative aspect is that it does sometimes, rather unfortunately, result in the author, at times, being less than positive about those who were not in the 3 Para Battalion Group, or in direct support of it. However, it should be remembered that the book is about his views and perspective and therefore the comments should be read from this standpoint.

In summary, this is a fascinating read for soldier, officer and civilian alike and it leaves the reader with nothing but admiration for the efforts, determination, and humour of young men and women in such demanding circumstances. It would be interesting to read a more up to date Commanding Officer account to see if many of the circumstances and context of highlighted by Tootal in 2006 have been addressed. However, whether or not this is the case, Tootal leaves the reader with the comforting view that regardless of the operational and strategic situation the personal bravery and determination of the soldiers and officers of the British Army will 'win through'.

Murray, 2009   £18.99 (proportion of proceeds to the Afghan Trust Charity).

Colonel Garry Hearn

THE DEFENCE OF THE REALM
The Authorized History of MI5

By Christopher Andrew
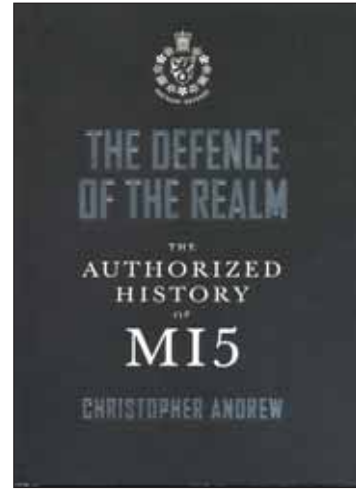
To mark the centenary of its foundation, the British Security Service last year opened up its archives to the author, an established independent historian, academic and authority on security matters. This unique happening among the world's such agencies results in a fascinating compendium of accounts through the decades of the unbelievable, little known and astonishing dealings of the Service and its agents.

In a Foreword, the current Service Director frankly admits that the History contains some material which is embarrassing and uncomfortable to the Service. He also emphasises that it took many hours of detailed discussion with the author to arrive at the correct balance between openness and the protection of national security. The book also includes material from other sources, and the conclusions and judgments are those of the author, and not necessarily those of the Security Service.
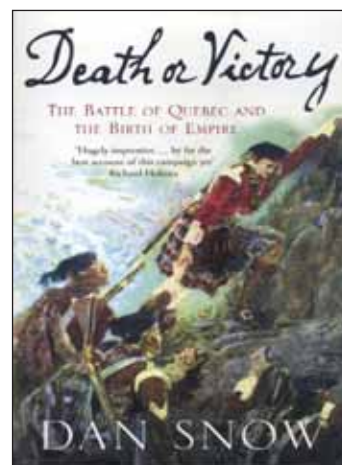
From the very beginnings of the Service, when it consisted of two officers sharing one room, the author traces the increase in size and complexity of the organisation as it dealt with the First World War and the national obsession with the German spy threat. It was directly involved in a new Official Secrets Act being passed in 1911, the use of Home Office warrants to intercept suspect mail, and internment for aliens, the latter with variable success.

Post-war, the Service vigorously opposed the inevitable attempts to cut its budget, despite its successes, and sought to demerge from the Intelligence Service with whom it had been grouped. Its first Director, Vernon Kell, who was to remain in office for 31 years, was a doughty battler, and used the imminent threats of Fascism, Communism and even the French to protect his Service.

The inter-war concentration on the activities of Germany, Spain and the Soviet Union moved up several gears with the declaration of war in 1939, and the Service moved from its less than salubrious headquarters in Wormwood Scrubs prison to the splendour of Blenheim Palace in 1940, much to the relief of the staff. Although initially almost swamped by requests for clearance and vetting of individuals, the Service pulled through and ended the War with its reputation enhanced, not least through some of the most successful deception activities ever known in warfare.

The author goes on to describe the Service involvement through the stages of the Cold War and up to the present day War on Terror. The transformation of the Service after the fall of the Berlin Wall in 1989 was profound, as it coped in turn with the activities of PIRA and then Al Qaida. The author concludes by quoting the Nobel laureate Elie Wiesel that the challenge for the Service will ever remain the same: how to cope with fanaticism armed with power. The book includes many revelatory and interesting illustrations, and a full index of references and further reading. The Appendix detailing the organisation of the Service at various times in its evolution is of particular interest. This is a model history, comprehensive, readable and authoritative, and is highly recommended.

Allen Lane, 1032 pages, £30.
ISBN 978-0-713-99885-6.

Colonel (Retd) Tom Moncur

DEATH OR VICTORY
The Battle of Quebec and the Birth of Empire

By Dan Snow

The battle for Quebec in 1759 was to alter the course of history, and change the world for ever. It was arguably of more significance that the American Revolution which followed, something the author styles as a squabble for the fruits of the British victory over France and its allies. Victory in Quebec broke the French empire in North America, and set the pattern for a continent which would over the next two centuries become the dominant economic, military and cultural force in the world order.

The author, as well as being the son of the television presenter, Peter Snow, is an established television performer in his own right, and a respected historian and newspaper columnist. He unselfishly acknowledges the work of many advisors, researchers, archivists and translators in assembling the primary source material to produce an authoritative, well presented and absorbing account of an encounter often discounted by military historians. The author in his Introduction makes the point that British victory over France in the Seven Years War owed as much to favourable credit ratings as anything else. An unprecedented level of government borrowing funded the men and ships needed to clear the French navy from the oceans, while its army remained bogged down in a European war against enemies kept in the field by British loans. Military leadership was still essential, however, and in selecting the young, acerbic General James Wolfe to assume command of the expedition force of over 100 ships and 20,000 men, the officers of Horse Guards made an inspired choice.

By the mid-eighteenth century the quarrels between European powers had spilled over to their colonies in the Americas. Britain claimed the entire continent as far as the Pacific, but natural mountain barriers and the

antagonism of the native tribes made this difficult to realise. The French saw British aims as a threat to their strategic line of communication from Canada down to their colonies in Louisiana. The British in turn had no intention of being confined to the narrow coastal strip of the eastern seaboard, and representations were made to the French to cease marauding activities. Rejection of this approach, and the skirmishes which followed in 1754 marked the beginning of outright warfare.

Initial encounters did not go well. The terrain, weather and the fearsome tactics of the native tribes who were allied to the French were to inflict spectacular casualties. The defeat of General Braddock's troops at Monongahela ranks as a particular tragedy in British military history. It was with something like desperation was it realised that 1759 would be a decisive year. Failure to retain North American possessions would be disastrous for the government of the day. Vast resources were thus devoted to the Quebec expedition. The initial phase involved the Royal Navy in blockading French supplies to the St Lawrence river, an action rendered hugely difficult by the lack of accurate charts, ignorance of currents and the long, cold Canadian winter, which kept Captain Durrell and his squadron in Halifax until early May. Back in England, Wolfe was desperate to start, as the campaign season was short, and much had to be done. His acidic exchanges with Admiral Saunders in charge of the fleet started before they had left Portsmouth, and continued throughout the campaign. With little justification, as Saunders' fleet was to accomplish what had been seen as impossible, navigation upriver of the St Lawrence.

Arriving in Halifax on 30 April, Wolfe was incensed by the poor condition of his troops, delays in implementing the blockade and the resulting escape of a French supply convoy. He was placated when on 13 May the force set sail for the St Lawrence. The convoy of supply ships numbered almost 140, and had to be controlled by an intricate system of flags and gunfire, essential if it was to negotiate the fogs, shoals and reefs of the treacherous St Lawrence seaway. The battle for Quebec was to depend as much on good seamanship as sound military tactics.

Quebec in 1759 was the nucleus of Canadian life, and the natural location for the French Commander-in-Chief to set up his base. The Marquis de Montcalm was the scion of an aristocratic military family, with a history of distinguished service to the throne. By 27 June, the British fleet had navigated the river against fast running tides, reefs and currents to anchor off the Ile d'Orleans, across the river from Quebec. This strategic landmark was taken after a fierce battle, in which unseasonal gales, fire boats and floating batteries were just some of the obstacles to be dealt with. Once established, the British were able to bring artillery fire to bear on the city and its defences, and start the battle in earnest.

Wolfe had to decide where best to land to launch his ground attack. Much exploration, reconnaissance and planning was needed, all the while denying the beseiged garrison the supplies they were becoming desperately in need of. Laying waste the properties of loyal French farmers was the most direct, if unpleasant method. The battleground finally decided upon was the Plains of Abraham, a flat area of ground west of Quebec. When it came, the battle was to last only about fifteen minutes. British discipline held Wolfe's troops from opening fire until the French advance was forty yards distant, and the first double-shotted volley from the Brown Bess muskets tore the attackers to pieces. Further volleys served to stall the attack, when it became the turn of the British to advance and give chase. The Highland regiments drew broadswords and roared onto the enemy with a dash and elan that was to seal their reputation for years to come. Victory was achieved not a moment too soon. Montcalm's deputy had arrived in the British rear with a force of 2000, but not seeing any sign of support from Montcalm, decided to withdraw. Had he arrived 15 minutes earlier, the outcome might have been different.

Neither Montcalm nor Wolfe survived the battle. Wolfe's body was returned to England, to be buried in Greenwich with only five mourners present. His family had been left in dire financial straits by over-generous bequests made in his will, and the government refused to make payment of his salary to his mother while he was in Canada . He was nevertheless held up as the embodiment of every military virtue; England needed a hero, and he was it. Poems, articles and paintings followed. Montcalm was buried in the Usuline chapel in Quebec, eventually to be ceremonially reinterred in 2001 in the General Hospital. French and Canadian resistance held on through the winter of 1759, and Quebec actually had to be retaken, but it was a much depleted force that eventually surrendered in September 1760. Canada was at last under British rule.

It is seldom that a serious work of history turns out to be both authoritative and readable. The author and his collaborators have succeeded in producing a tour-de-force which is fully recommended to every reader of military history, whatever their depth of interest. The book includes excellent maps, essential to follow the narrative, as well as relevant illustrations and a full set of references and explanatory notes.
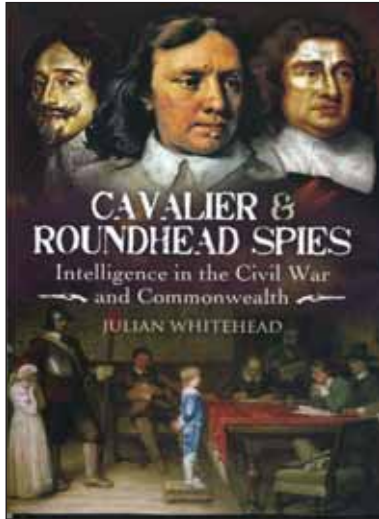
Colonel (Retired) Tom Moncur

CAVALIER AND ROUNDHEAD SPIES
Intelligence in the Civil War and Commonwealth

By Julian Whitehead

In this book the author addresses a subject which has been much ignored by historians. The period covered is that from the beginning of the civil wars through to the Restoration, and describes how the need for intelligence on both sides led to the use of scouts, reconnaissance, informants, mail interception and cryptography.

To understand the nature of these dangerous times and uncertain destinies, it is essential to have an understanding of the backgrounds of the main characters and something of the nature of the times. The author rightly takes us back to 1642 and the start of the formation of the Royalist and Parliamentary forces, and goes into much detail on the personalities involved. The early Royalist successes are described, and the steady rise of the Parliamentary opposition, all the while bringing out the role played by intelligence.

Intelligence was therefore appreciated at an early stage, and although deemed the responsibility of senior officers, the most brilliant early cryptanalyst proved to be a devout Puritan chaplain and mathematician who went on to be styled the most famous decipherer in Europe. He and others were widely employed by the astute John Pym in the Parliamentarian cause. Sir Edward Walker, the Secretary for War, also carried out the function of head of intelligence for the King, and although he made promising early progress, he was to prove no match for Pym and his colleagues. The Royalists did have some successes, however through another cleric, Michael Hudson, who was also Scoutmaster for the Northern Army.

Although the use of scouts, spies, casual contacts, informants and agents of all kinds was widespread, intelligence tradecraft had atrophied since the times of Walsingham, and both sides therefore had to start from scratch in developing their information gathering networks and practices generally. This was given added importance by the need for each to find out about the other's outside alliances, primarily from Scotland and Ireland, but also from the Queen's continental relatives. In the end, although intelligence affected many of the important events of the Civil War, it did not really affect the outcome, but it did lay the foundation for an intelligence structure in the immediate post-war years.

The most prominent figure of the Cromwell years was John Thurloe, a lawyer who moved through the levels of government steadily gaining influence until he became personal solicitor to the Protector and his family. He proved to have a gift for intelligence, and was soon appointed by Cromwell as his intelligence controller. He was to exercise great power until after the death of his Protector and the restoration of the monarchy, when he suffered the fate of many who eventually found themselves on the wrong side and was thrown into the Tower.

The transitional years leading up the Restoration were characterised by Charles II himself, who is depicted as a "shrewd unscrupulous survivor who knew the value of intelligence". Among his initiatives in support of his claim on the throne was a projected long-shot chance of getting French and Spanish backing for another invasion. It was however, Sir Edward Hyde who discretly sounded out Sir George Monck, the former Royalist turned Parliamentarian general about once more changing sides. Monck cannily guarded his options, however, continually guauging the public mood on his way from Scotland until coming down on the side of a new parliament. His support was to prove crucial. The Royalists had a landslide victory, and some 90% of members eventually supported the return of the monarchy. Monck then moved to make contact with Charles in Brussels and set in train the events leading up to his triumphant arrival back in England.

The author is a former Intelligence Corps officer who read history at Oxford and has pursued a second career in the security arena since retirement. This is a comprehensive survey of a little known area, with helpful appendices and notes which will be of interest to all historians, serious and otherwise.