Prof. Ronnie Shephard Memorial Address

31 ISMOR, 30 July 2014

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Opening

You more senior ISMORians may recall, when I would report to you in my role as liaison between the MORS (Military Operations Research Society) and ISMOR, I would often begin my brief talk with a quotation (apocryphal no doubt) from the advice King Henry VIII gave his wives: “I shall not keep you long.” In good faith, I cannot make that promise this evening. In passing, I tell you that I am surrendering the post as liaison to my good friend and colleague Ted Smyth, who is sitting at this table.

When Peter approached me during 30 ISMOR and invited me to present the Prof Ronnie Shephard Memorial Address at this symposium, I admit to a teary moment. It is an honor for me to speak to you this evening. I am at the same moment both humble and proud to deliver this address, following in the footprints of giants.

This is my 25th ISMOR; my first was 6 ISMOR; I missed 7 ISMOR but have made all from the 8th on. We named the banquet address to commemorate the founder, Ronnie Shephard after his death in 1995, just prior to 12 ISMOR. David Faddy, who took over the chair of ISMOR at that time, intended on being here this evening and did attend the earlier reception, but I am sorry to report, was taken ill and returned home.

My talk to you this evening consists of three parts, two historical and one reflective. The first part acquaints you with the founder, whom we recognize by this address, Prof Ronnie Shephard. Some of you more senior ISMORians knew Ronnie, but those are in the minority here tonight.

The second part of the address is the story of how operational research, invented here in the UK, crossed the pond and made its way into the US. The final part covers my thoughts, briefly, on the role of operational research today.

Introduction to Ronnie

I first met Ronnie in 1963. I, with four colleagues, was attached to a field office at Headquarters, US Seventh Army, in the then the Federal Republic of Germany. A few members of our team visited the UK Army Operational Research Establishment, as it was then known, at West Byfleet, to exchange views on analysis for the field forces, we for the

US Seventh Army, our British colleagues for the British Army of the Rhine, both committed to NATO. Ronnie was designing and applying war games for force structure and resource allocation analysis; he was a prime mover in the development of games for those purposes. He was an easy person to get to know and admire; he was also quick to make significant contributions, always in a quiet and pleasant way. I hold two papers of Ronnie's from that time. One is *War Gaming as a Technique in the Study of Operational Research Problems*, presented at the Operational Research Society Conference, 1962[1]. The other is *Rules of the AORE Tactical War Game*, subtitled *an exposition*, 1963; it is six pages of British government foolscap -- only six pages to explain the rules of a major war game, which were contained in a book of 106 foolscap pages!

Ronnie was educated at Queens' College, receiving a BA (Cantab) in 1943 and a MA (Cantab) in 1948; both degrees were in Physics. [For the benefit of non-UK folks present, the abbreviation *Cantab* refers to *Cantabrigian* which is defined as "A native of Cambridge; esp. a student or graduate of the University of Cambridge, England." Many years ago, I had the honor of introducing Professor Ronnie as the banquet speaker at a Washington, DC professional society meeting. In a clumsy attempt at humor, I stated that Cantabrigian should not be confused with Cantabrian, which my authority defined as "pertaining to or designating the Cantabri, an ancient warlike people of northern Spain ..." Ronnie took the remark with his usual grace and charm.]

Immediately upon graduation in 1943, as with most of the new graduates, he was drafted into government wartime service. Ronnie went to the Ministry of Supply to participate in research on tank armament. He regaled us with stories about his first days at tank armament testing sites and near catastrophes having to do with incorrect sightings and premature firings. Subsequent assignments included postings to the Armament Research Establishment, the Army Operational Research Group, and the Defence Operational Analysis Establishment (West Byfleet's name until it was absorbed into the large research and development organization now known as Dstl). Much of his research and analysis career was concerned with Army operations, organization and ground-to-ground weapons, with special interest in suppression and shock as significant factors in ground combat. He also had a strong, abiding interest in the application of historical (preferably wartime) data to analysis [I quote from his own *c.v.*: "The use of historical data for defence analysis is one of his main current interests."]. Over the years, his experience with real data, military operations, and operational gaming resulted in strong feelings about models and

[1] The paper was published the following year; the reference is *Operational Research Quarterly* (now *Journal of the Operational Research Society*) **14**, 119-130 (1963).

relationships that were not accompanied by reasonable cause and effect explanations. He was particularly sensitive to straight line graphs.

In 1968 he became Professor of Ballistics and Operational Research at the Royal Military College of Science, Shrivenham, Wiltshire. There, he introduced the teaching of operational research as part of the Army Staff Course. One of his valuable contributions to the literature of military operational analysis was his compilation and publication of *Readings on Early Military Operational Research (With Particular Reference to Army OR)*, The Royal Military College of Science, March 1984. Later, as the senior author in collaboration with colleagues at Royal Ordnance and RMCS, Professor Ronnie produced a book of military operational analysis cases.

Ronnie retained the title of Professor, of which he was quite proud, when he joined the staff of Royal Ordnance as a Military Operations Advisor, 1984. He also was a Senior Advisor to BDM International, McLean, Virginia, as well as a consultant to British Aerospace's Centre for Operational Research and Defence Analysis in London.

His connections with the international community of operational analysts were very broad indeed. He was involved in many NATO activities, particularly with the Advisory Panel on Operational Research; he helped organize conferences of the International Federation of Operations Research Societies; he represented the UK at technical tripartite and quadripartite meetings; and provided advice and guidance on operational research to the Hellenic Ministry of Defense, the Federal Republic of Germany, Egypt, Turkey, the Sudan, and Switzerland. A truly international fellow!

Professor Shephard was a major contributor to a number of (US) Army Operations Research Symposia. I am proud to recall that I co-authored a few papers with him. His work on the shock action of tanks is particularly well remembered. Ronnie participated in many MORS special meetings, most notably the work on operational realism in models of combat. He always regretted being denied the opportunity to attend the annual MORS Symposia because he retained his British citizenship. [I often urged him to take out US dual citizenship, while maintaining his connection with Britain, just so he could attend the MORSS.] He has been represented in the *Phalanx* pages as well; some years ago he paid tribute to Sir Solly Zuckerman on the occasion of Sir Solly's death.

He was the author of more than 70 reports and the senior author of the book *Applied Operations Research: Examples from Defense Assessment*, Plenum Press, 1988. Among his delightful array of writings are two papers I recommend to young analysts. The first benefited mainly from Ronnie's organization and editing skills. To commemorate the 50th

anniversary of operational research in the UK, he prepared and chaired a retrospective session at a meeting of the Operational Research Society; Ronnie was a Fellow of the Society. He then compiled and edited the talks of four World War II-vintage analysts from that session for publication in the *Journal of the Operational Research Society*, Vol. 40, No. 2 (1989). In the same volume of the *Journal* you will find the second recommended paper[2], a short note by Professor Ronnie on "Flying Bombs and the Poisson Distribution." I commend both papers to you.

In 1984, struck by the fact that the NATO Advisory Panel on Operational Research discontinued its series of symposia, pleading poverty, Professor Ronnie added to his solid international reputation by establishing and conducting, almost single-handedly, the series of International Symposia on Military Operational Research at the Royal Military College of Science. [I am told that Ronnie used the acronym NATO at the first Symposium, only to be chastised by NATO officials, who informed him that "only NATO can name things NATO!"] One of the high points of the ISMOR is the traditional banquet, which, in addition to the wonderful meal and wine of the Roberts Hall Mess, featured addresses by early practitioners of operational analysis (often a World War II-era analyst).

Recognizing his own vulnerability, in 1993 Ronnie arranged for the Ministry of Defence to establish the ISMOR as a supported activity of the Ministry. Thus, we are assured that the ISMOR will remain as one major monument to Professor Ronald W. Shephard's contributions to military operational analysis. The twelfth ISMOR, opened on 4 September 1995, as usual at the Royal Military College of Science, Shrivenham. The program included a commemorative ceremony to acknowledge the passing of Professor Ronnie and the loss of a great practitioner of the art of military operational research.

<u>OR Crosses the Pond</u>

Now to the story of how operational research crossed the Atlantic Ocean. Initially, it was only a name! Before speaking about how operational research crossed the pond to land in the New World, it is useful to identify how it arrived in the Old World first. Scientists and engineers have been providing advice, services and analyses to the military since the dawn of history. Alexander the Great had his engineers accompanying him on his conquests. Archimedes, after helping to defend Syracuse from the Romans with his special engines of warfare, paid for his ingenuity with his life, a fate that you modern practitioners on the losing

[2] *Journal of the Operational Research Society* **40,** 113–114 (1989)

side do not usually face. Until the early 20th century, the contributions of scientists have been to the machinery of war and logistics.

Particularly around the time of the Great War, known to you juniors as World War I, the war to end all wars, scientists began to get into doctrine and concepts of operation, as well as the design of the weapons of war. It is worthwhile recalling the work of Lord Tiverton in 1915 in studying strategic bombing, including target selection, navigation methods, weather and logistical matters. The experience of A. V. Hill as head of the experimental section of the Munitions Invention Department, British Army, respecting antiaircraft operations, played an important role in Hill's later contributions to operational research; his unit during the Great War was known a "Hill's Brigands."

But, our story really had its beginnings in the 1930s. Stanley Baldwin, out of office as Prime Minister temporarily in 1932, stated "The bombers will always get through." Others, such as Winston Churchill, speaking from knowledge gained from his friendship with Frederick Lindemann, wanted more action in support of increased scientific efforts before giving in to the bombers. A. P. Rowe, assistant to H. E. Wimperis, Air Ministry Director of Scientific Research, went through all 53 files on activities within the Air Ministry relating to air defense and found little of value. He wrote a memorandum to Wimperis making the point that unless something was done to stop the bombers, Britain would lose any war that would start in the next 10 years. That period of time was the standard assumption in British strategic planning; it was regularly assumed that there would be no war for 10 years. The year was 1934.

In November of that year, Wimperis recommended that a Committee for the Scientific Study of Air Defence be established to "consider how far advances in technical knowledge can be used to strengthen the present methods of defence against hostile aircraft." The Air Ministry approved. The committee was formed under the chairmanship of Henry Tizard, with members A. V. Hill and P. M. S. Blackett, and Wimperis representing the Ministry with Rowe as secretary. It is important to note that Tizard was a World War I pilot, Hill had the anti-aircraft research experience from that war, and Blackett served in the Royal Navy during that war. The experiences of those committee members were to serve them well in the future relations with the officers of the military services – credibility was important.

As a Side Bar: Among the presentations made at the meeting of the Operational Research Society celebrating the 50th anniversary of OR, one of the World War II analysts said that, in his opinion, an important trait of a good military operational analyst was the ability to drink beer in the Mess with serving officers. That is a trait I have embraced with vigor!

Before the first meeting of the Tizard committee, Wimperis asked Robert Watson-Watt, superintendent of the Radio Department of the National Physical Laboratory about the possibility of a "death ray." After some calculations, the conclusion was that, at that time, it was not possible to injure a crew or to disable an aircraft by radiation. Watson-Watt did say that reflected radio waves might be able to locate aircraft.

That observation triggered a response from the committee. Quickly, a rough experiment was carried out successfully and a program of activity was initiated on radio direction-finding (RDF), later to take the US name of radar. Jumping to the end of the story, the happy joining of Watson-Watt's genius with the ability of the Tizard committee to get things done around and outside the normal bureaucracy must be acknowledged as deserving of an major share of the credit for the Allied victory in World War II.

A complicated program was undertaken, consisting of "bench" research and engineering, field trials, experiments, and demonstrations, to apply the phenomenon of radar to help manage the air defense of the British Isles. The program started in 1936. No radar station was yet in operation, so contrived data were provided to a control station (at Biggin Hill) to develop methods of interception by fighter aircraft of incoming bomber aircraft. The integration of radar into the early warning system was the objective. During this period of activity, Rowe, seeking to identify the collection of actions and efforts undertaken to integrate radar into the air defense system, coined the phrase *operational research* to differentiate the activity from traditional *laboratory* research. Thus, in the beginning, it was only a name!

When the war began, in 1939, application of the notion of bringing to bear a variety of the methods of myriad professions to military operational problems (such as anti-aircraft artillery, anti-submarine warfare, strategic bombing, and the defense of convoys, to name a few) while working within the operational forces and reporting to senior levels of command, all under the title of operational research, was undertaken with vigor. Blackett led the way, establishing and directing a number of "circuses" for Bomber Command, Fighter Command, Anti-Aircraft Command, and Coastal Command.

The Atlantic Ocean has never been a barrier to communications between British and American scientists and military officers. Word of *operational research* began to reach the New World via visiting British scientists, British scientific missions, US military attachés and observers, and direct contact between British and American military staffs. Initial awareness of the new approach was long before 7 December 1941, the event that brought the US into the war. Even the work on radar and air defense was known in the US before 1939. The first official knowledge came with a Tizard scientific mission to the US in September 1940. Among other important scientific exchanges of that mission was what has been called "the

most valuable cargo ever brought to our shores." The item was the cavity magnetron, a critical component that allowed for the building of small radar sets suitable for mounting in aircraft. That gift led to the establishment of the MIT Radiation Laboratory and a major redirection of US radar efforts. Elements within the US Army Air Forces and the Navy began thinking of the adoption of operational research within those services.

In the fall of 1941, Blackett penned a short paper, *Scientists at the Operational Level*, which he later suggested was written somewhat "tongue in cheek", that is, not to be taken too seriously. However, the paper was received seriously by the Naval Attaché at the US Embassy in London and forwarded to the Chief of Naval Operations, Admiral Harold Stark. That action was the beginning of serious efforts to take up the operational research concepts and move forward.

The following spring saw the establishment of two US Navy OR groups, the Mine Warfare OR Group and the Anti-Submarine Warfare OR Group, to which the US Center for Naval Analyses declares its heritage. By the fall of 1942, the first team of "Ops Annies" arrived at the London headquarters of the US AAF VIII Bomber Command, later to become the Eighth Army Air Force. By war's end, there were 25 OA sections with the numbered air forces around the world with more than 400 staffers. The now named operations research found a home in the New World.

Side Bar: The story may be apocryphal. When Blackett was asked about what professions he looked for in establishing his circuses, he mulled a bit and finally said that he believed he had hired from just about all professions, except perhaps lawyers. He was speaking to US Army Air Forces' officers planning on staffing OA sections. Apparently, the only word they heard was "lawyers." About 15 percent of the analysts deployed in the AAF OA sections were lawyers. A prime example is the first OA section sent to the Eighth Bomber Command. Among the six analysts were two lawyers. The section chief was John Harlan, a Boston lawyer. After the war, Harlan became an Associate Justice of the US Supreme Court – the only operations analyst to ever sit on the Court!

<u>Personal Reflections on OR Today</u>

I have often remarked that what we do today is not what the founders did in their day. I have the wonderful opportunity to have viewed operations research from my first awareness of the concept in 1954 to the present day. I have backed off from that earlier view. Much of what we do today is akin to what they did in the beginning. I am particularly proud of what the many deployed analysts have accomplished during the recent wars: UK, US and analysts from other nations. Much very good work.

I see two differences between the beginnings and today. They are the professional education system and the status of OR groups in the defense organizations, as well as in non-defense and private sector institutions. I believe the formal, particularly graduate level, education programs are the wrong way to go. The present form of the education of analysts is only rarely relevant to the many-faceted practice of OR. I still hold to the ancient notion of apprenticeship. You will recall that a definition of apprentice is one who is learning by practical experience under skilled workers.

The second difference refers to the level of leadership to which OR groups report. Blackett was very strong on the point of having the OR group report to the highest possible level of authority in the military unit to which the OR group was attached. He advocated that the chief of staff was appropriate, recognizing that there is concern with the span of control that belabors the unit's commander. Throughout World War II and for a few decades more, that principle was maintained. Alas, today it has almost disappeared. Our groups are seen as ordinary staff support groups, with our contributions filtered through multiple levels of management, most of the time.

And I still deplore the often unthinking dependence on digital computer representations of combat and related military operations. The war cry that I still shout out is "It is Analysis!" I do not add "stupid" anymore, as that is insulting and I am an aging curmudgeon who is losing steam.

Final Words

In closing, I have a story from an earlier ISMOR, which will lead to revising an innovation that may become a tradition. A motto I support is "We do it once, it is innovation; we do it twice, it is tradition!"

Prof. Ronnie had a chronic illness, requiring medication. On his return to the UK to prepare for 11 ISMOR in August of 1994, he took very ill (complications of some over-the-counter medication to relieve a cold). He was able to open the symposium but had to take to his bed later. He sent word to me, via Trish Follows, his primary support person for all those years, to take over the meeting. I had no difficulty with the symposium sessions, as we had the multiplicity of sessions chairs that is still a hallmark of ISMOR. It was the banquet process that I was concerned with. I was advised to seek the guidance of the Roberts Hall Mess Manager, Ms Goodfellow. I met with her and she walked me through the various steps of the banquet process. She then said, with her face lifted to mine (she was a bit shorter): "You are going to toast the Queen, aren't you!" I responded with: "Prof. Ronnie never toasts the Queen." She shuffled a bit closer to my face and said: "I know. YOU are GOING to toast the

Queen, aren't you!" I asked: "If I do that, what about all the other nations at the symposium? If we toast them all, as protocol might suggest, we would be terribly tipsy by the end." The Mess Manager gave me the toast that would take care of that aspect: "To the Heads of State here present."

11 ISMOR was innovative in that it is the only ISMOR to close the banquet with toasts. Tonight, I am breaking with the past. I propose a toast that may become a tradition.

Please join me in a toast to the Founder. To Prof. Ronnie Shephard, the Founder, who is looking down on us with a sense of satisfaction about the institution he created and filing away data for future reference. To Ronnie!

Thank you for listening and not snoring too loudly.