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Blurring of the Lines:

The Call for an Integral Surgical Capability in Canadian Field Ambulances

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ABSTRACT

The future battlespace will be characterized by a need for speed, ability, flexibility and dispersion. The casualties generated during military operations in such a battlespace will have to be rescued from their place of injury, quickly stabilized and rapidly evacuated to an appropriate level of care. This will demand lightweight, very mobile Health Service Support elements that can operate as close to the fighting as the tactical situation allows and provide resuscitative surgery to stabilize casualties for further evacuation. The efficacy of Far Forward Surgery as a lifesaver has been proven and it is recognized in international doctrine as a key component of operational Health Service Support. Current Canadian Forces Health Service Support doctrine and organizational structures in respect of Far Forward Surgery do not support our emerging picture of military operations in the future battlespace. To meet the challenges of the future battlespace the Canadian Forces must establish an integral Far Forward Surgery capability in its brigade group field ambulances.

INTRODUCTION

As visions of the future battlespace dance in the heads of academic and military thinkers alike, a clearer picture of what that battlespace will look like and of what our forces will have to look like to operate effectively in it is beginning to emerge. While the full picture remains murky, what we know for certain is that future military operations will continue to generate combat casualties who will have to be rescued from their place of injury, quickly stabilized and rapidly evacuated to an appropriate level of care. What will change, and indeed is already beginning to change, is our understanding of how quickly and aggressively we will have to deliver care in order to assure the survival of these casualties. This will demand lightweight, very mobile Health Service Support (HSS) elements that can operate as close to the fighting as the tactical situation allows and provide resuscitative surgery to stabilize casualties for further evacuation.

Canadian operational HSS doctrine in respect of Far Forward Surgery no longer supports our emerging picture of military operations in the future battlespace. This paper will argue that it is therefore time to redefine the way in which we have grouped operational care capabilities, to include initial resuscitative surgery as a Role 2 function. It will go on to support this redefinition with an argument in favour of establishing a Far Forward Surgery capability as an integral element of our existing brigade group field ambulances. The paper will first establish a general context for the discussion, present a view of HSS in tomorrow's battlespace, describe the structure of operational HSS and briefly discuss the physiologic nature of trauma as defined by the 'Golden Hour'. It will go on to analyze the evacuation of casualties from the battlefield, examine the historical employment of Far Forward Surgery, and assess the failings of our current doctrine and

organizational structures in respect of Far Forward Surgery. The paper will conclude by presenting a model for the way ahead in Far Forward Surgery, detailing the advantages inherent in the proposed model and identifying three supporting imperatives upon which the success of a true Far Forward Surgery capability is predicated.

CONTEXT AND DEFINITIONS

While this paper directly addresses one aspect of sustainment to tactical level land operations, the topic itself transcends merely tactical considerations. It does so in that a viable operational HSS capability provides our soldiers with the assurance that should they be injured in combat they will receive quick and appropriate medical attention. This assurance has a powerful effect on morale and as such contributes to the moral cohesion sought after by all operational commanders. Indeed, the link between viable HSS, morale and operational effectiveness was one upon which Field-Marshal Viscount Slim placed great emphasis during his command of the Allied forces in Burma during World War II.[1] The importance of this link is echoed today in current North Atlantic Treaty Organization (NATO) joint doctrine, which cites HSS as a major contributor to both morale and force protection.[2]

Although the subject of Far Forward Surgery enjoys a relatively comprehensive treatment within international professional and technical literature, Canadian perspectives on the issue are quite sparse. Indeed, Salisbury and English's *Prognosis 2020: A Military Medical Strategy for the Canadian Forces* and Taylor's *Whither the Field Ambulance?*

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[1] W.J. Slim, *Defeat Into Victory: Battling Japan in Burma and India, 1942-1945* (New York: Cooper Square Press, 2000), 18.

[2] North Atlantic Treaty Organization (NATO), AJP-4.10 *Allied Joint Medical Support Doctrine* (Casteau: NATO, 1999), 13.

Role 2 Land Health Service Support in the 21st Century Battlespace appear to be the only two recent examinations of the major issues facing HSS in the future battlespace. As the title of Salisbury and English's paper implies, their treatment of the subject focuses on those factors that need to be considered in developing a longer-term strategy for HSS. In doing so they highlight the importance of Far Forward Surgery, but envisage a future where near complete reliance on Forward Aeromedical Evacuation (defined in NATO doctrine as evacuation conducted by air between points within the combat zone[3]) renders today's field ambulances irrelevant.[4]

Taylor also stresses the importance of Far Forward Surgery, but contrary to Salisbury and English argues in favour of the continued relevance of the field ambulance as both an operating base for the attachment of Far Forward Surgery capabilities and for the provision of ground based casualty evacuation. Indeed, although Taylor recognizes that the establishment of a dedicated Canadian Forward Aeromedical Evacuation capability would be prudent, he contends that ground based evacuation will remain the primary means of moving most casualties for the foreseeable future.[5]

For the purposes of this paper the following definitions of Far Forward Surgery and resuscitative surgery will be applied:

> Far Forward Surgery – resuscitative surgery conducted at, or forward of, a Role 2 HSS facility or unit (i.e. field ambulance level or forward).

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[3] NATO, *Allied Joint Medical …*, 64.

[4] D. Salisbury and A. English, "Prognosis 2020: A Military Medical Strategy for the Canadian Forces", *Canadian Military Journal* 4, no.2 (Summer 2003): 53. Originally submitted as part of the academic requirement for the National Strategic Studies Course at the Canadian Forces College under the title "Prescription 2020: Considerations for A Military Medical Strategy for the Canadian Forces."

[5] J.C. Taylor, "Whither the Field Ambulance? Role 2 Land Health Service Support in the 21st Century Battlespace" (Toronto: Canadian Forces Staff College Advanced Military Studies Course Paper, 2002), 19.

Resuscitative Surgery – emergency surgical interventions for exsanguinating hemorrhage, airway compromise, life threatening chest injuries, and some soft tissue and orthopedic injuries. It focuses on providing only those procedures necessary to preserve life and limb until more definitive surgical care can be delivered.[6]

HSS IN TOMORROW'S BATTLESPACE

Tomorrow's battlespace has been described as a place where technology offers increased lethality, which in turn will demand a high degree of mobility and great dispersion of increasingly decentralized operational elements.[7] Speed, agility and flexibility will be the keys to survival in an environment where smaller but more capable groups of soldiers come together to accomplish specific missions and then quickly disperse again for protection.[8] The distinction between front and rear, close and deep will blur, as the increased range and accuracy of long-range weapons forces large installations operating in divisional and corps rear areas to move further from the fight or risk annihilation.[9]

The battlespace envisioned above will have a significant impact on the delivery of operational HSS. As combat elements grow smaller and more dispersed the reduced population at risk will result in fewer casualties and decrease the overall requirement for in-theatre 'bed spaces'. This trend will be supported by the increased speed with which combat forces are deployed into and out of operational theatres, thereby reducing the

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[6] S.E. Henthorne, "Technical Developments in Far Forward Medical Support for the 21st Century Warfighter", *RUSI Journal* 143, no. 5 (October 1998): 41.

[7] L.W. Hoff, "The Medical Package for the Objective Force" (Fort Leavenworth: U.S. Army Command and General Staff College Paper, 2002), 6.

[8] S. Beaty, "The Revolution in Military Medical Affairs", *Parameters* 27, no. 4 (Winter 1997/1998): 66.

[9] S.F. Gouge, "Combat Health Support of the Transformation Force in 2015" (Carlisle: U.S. Army War College Paper, 2001), 21.

period of exposure to environmental and other factors that cause non-battle injuries. Concurrently however, dispersion will increase evacuation distances, a factor that will be further exaggerated as larger surgical facilities move rearward to assure their survival.[10] This in turn will demand that resuscitative surgery be provided far forward as a standing requirement in order to stabilize casualties prior to lengthy evacuation, a need reinforced by Grau and Gbur:

> If sophisticated care could be quickly delivered near the scene of the injury, the need for early evacuation and all of the accompanying problems may be significantly reduced.[11]

In the future, forward deployed HSS elements will have to be lighter and highly mobile in order to keep pace with combat forces as they move within the fluid battlespace.[12] Agility and flexibility will become particularly critical in asymmetric environments as HSS elements react to swiftly concentrate assets as casualty densities develop during battle.[13] Such flexibility and responsiveness will only be achievable through the decentralization of resources and enhancement of care capabilities at lower levels in the chain of casualty care. In tomorrow's dispersed operating environment we will not be able to afford the economies of scale traditionally achieved by larger medical units.[14]

Beaty believes that ultimately it will be technology that allows "brilliant medics" to deliver highly sophisticated care very near the point of injury, thereby reducing the

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[10] A.M. Smith, "Military Medicine: Not the Same as Practicing Medicine in the Military", *Armed Forces and Society* 18, no. 4 (Summer 1992): 579.

[11] L.W. Grau and C.J. Gbur, "Mars and Hippocrates in Megapolis: Urban Combat and Medical Support", *U.S. Army Medical Department Journal*, no. 8-03-1/2/3 (January/February/March 2003): 21.

[12] Gouge, "Combat Health Support …", 21.

[13] K. Al-Ali, "Combat Health Support", *Army Logistician* 33, no. 6 (November/December 2001): 40.

[14] P.W. Lund, "Medical Support for Future Combat: No More Vietnams", *Naval War College Review* 45, no. 2 (Spring 1992): 88.

complications that arise as a consequence of delayed evacuation. The technology and techniques available to these "brilliant medics" will allow them to provide lifesaving interventions that today can only be provided on the operating table. [15] That said, even the availability resuscitative surgery at the very point of injury will not get a casualty out of the battlespace without a robust and capable evacuation system to back it up. Further, while many of the technologies needed for the realization of Beaty's future are already in development, their availability for use in the battlespace remains distant.[16] In the interim we will continue to be reliant on systems that require significant support structures. Consequently, we must reconsider our operational HSS doctrine to rationalize the way in which we will deliver care for the near future.

THE STRUCTURE OF OPERATIONAL HSS

Continuity in the care and treatment of personnel injured in combat is optimally achieved through a progressive, phased HSS system. Within the Canadian Forces (CF) this system extends from the point of injury in the combat zone, through successively more clinically capable levels of care, to Canada. Each level of care provides not only an incremental increase in capabilities, but is also wholly inclusive of the capabilities of the level of care below it. Casualties move rearward through this system only so far as required to reach a level at which appropriate care can be provided to definitively deal with their medical condition. The capabilities resident at each level of the system are referred to as 'Roles' and are classified by minimum capability requirements as follows:

> **Role 1** – This level of capability involves locating casualties, providing them with first aid and emergency medical treatment, evacuating them from the site of

[15] Beaty, "The Revolution in …", 67.
[16] *Ibid.*, 70.

injury, and stabilizing and preparing them for evacuation to the next level of care as required. It is classified as Integral Support and typically includes self-aid, buddy aid and HSS provided by Health Service (HS) elements attached or organic to units (e.g. unit medical station, ship's sickbay or squadron medical element).

THE GOLDEN HOUR

The term 'Golden Hour' is used within medical circles in reference to that period of time following injury within which a significant number of serious trauma casualties will die without surgical intervention. This model is based on civilian trauma data, which displays three peaks in a plot of deaths over time after injury: the first in the minutes immediately following injury, the second at one hour following injury and the third at six hours following injury. Although some debate on the subject continues,[19] the one-hour window has come to be recognized as the civilian standard within which surgical intervention must be initiated to ensure the highest possible survival rates. The 'Golden Hour' is also recognized as an appropriate benchmark within most military circles, including the CF, which states the following in its emerging joint HSS doctrine:

> Initial surgery, carried out as soon as possible after injury/onset of illness, ideally within the first hour, is the most important factor in reducing mortality rates and is the focal point of operational HSS.[20]

However, the doctrine manual goes on to note that it is unlikely that such a benchmark could be consistently achieved on operations,[21] a conclusion that is understandable given our current operational HSS structures.

The foregoing aside, there is also some debate as to the applicability of the 'Golden Hour' within the realm of combat trauma. Indeed, examination of combat casualty data seems to point to the occurrence of the first peak of deaths as being at the 30 minute point, rather than at the 1 hour point evident in the civilian trauma data.[22]

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[19] G. Cecchine, *et al*, *Army Medical Support to the Army After Next : Issues and Insights from the Medical Technology Workshop, 1999* (Santa Monica: RAND, 2000), 39.

[20] *HSS to CF Operations*, 1-5.

[21] *Ibid.*, 2-1.

[22] Gouge, "Combat Health Support …", 6.

Smith goes so far as to suggest that as many as 20% of past combat fatalities suffered from injuries that were surgically correctable and might have lived had surgery been initiated within 30 minutes of injury.[23] Whether 30 minutes or 1 hour, it is clear that combat casualties must be promptly secured from the battlefield and rapidly evacuated to surgical care.

EVACUATION OF CASUALTIES

It has been generally accepted since the Vietnam War that the use of aviation assets is the most effective means of evacuating casualties from the battlefield. Indeed, it was during the Vietnam War that the ready availability of helicopters allowed development of the hub-and-spoke concept of evacuation. This concept, depicted in Figure 1, is highly dependent upon aviation assets to move casualties from any point in the evacuation chain directly to a Role 3 surgical care facility in the rear. Taylor ably summarizes the potential perils of over reliance on such an aviation centric model:

> While this approach has enjoyed successes in certain conflicts including the Vietnam War, and many periods during the last decade of peace support operations, history and doctrine recognize that it requires a tactically permissive environment, and may not be sufficiently resilient.[24]

Taylor's point on the vulnerability of aviation assets is a key one and well supported by historical precedent. During the Falklands Campaign the loss of helicopters, including several that were on evacuation missions, was a significant factor

[23] A.M. Smith, "All Bleeding Stops Eventually", *U.S. Naval Institute Proceedings* 127, no. 11 (November 2001): 68.

[24] Taylor, "Whither the Field Ambulance? …, 18.

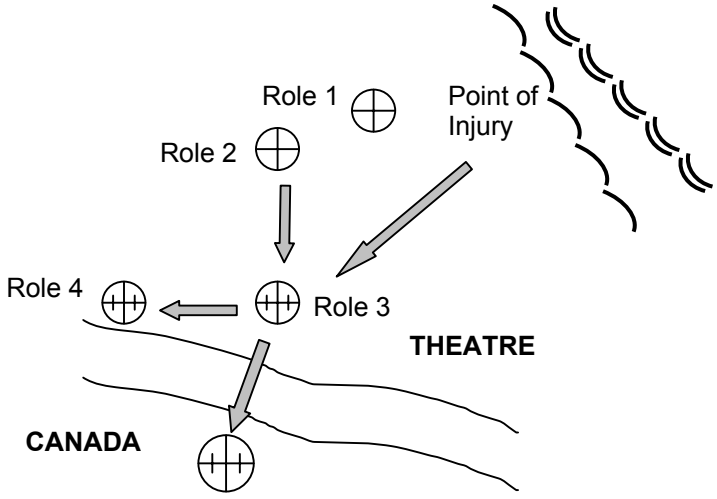

Figure 1. Hub-and-spoke casualty evacuation concept.[25]

in the decision to deploy surgical assets ashore.[26] In the 1991 Persian Gulf War, U.S. Marines found that heavy reliance on air evacuation was often hazardous[27] and during the Grenada Expedition the Americans lost in excess of 10% of their aviation assets.[28] Even in Vietnam, where the Americans enjoyed air superiority and Forward Aeromedical Evacuation was very successfully employed, U.S. forces lost a staggering 17,700 helicopters.[29] Lastly, the experiences of both the Russian forces in Grozny[30] and U.S.

[25] Adapted from Taylor, "Whither the Field Ambulance? …", 17.

[26] T.E. Broyles, "A Comparative Analysis of the Medical Support in the Combat Operations in the Falklands Campaign and the Grenada Expedition" (Fort Leavenworth: U.S. Army Command and General Staff College Paper, 1987), 63.

[27] R.D. Handy, "Health Service Support and the Marine Division: A Primer", *Marine Corps Gazette* 77, no. 8 (August 1993): 27.

[28] A.M. Smith, "Care Delayed is Care Denied", *Naval War College Review* 52, no. 4 (Autumn 1999): 112.

[29] *Ibid.*, 112.

[30] L.W. Grau and T.L. Thomas, "'Soft Log' and Concrete Canyons: Russian Urban Combat Logistics in Grozny", *Marine Corps Gazette* 83, no. 10 (October 1999): 71.

forces in Mogadishu[31] revealed the fatal vulnerability and tenuous nature of helicopter evacuation in urban environments.

Nor is vulnerability to enemy action the only factor working against assured evacuation by air. The employment of aviation assets for evacuation missions can also be limited by weather, terrain, distance, availability and the medical condition of the casualty.[32] Hoff notes that even when they are available it often takes more than 30 minutes to get air evacuation assets to a casualty's location, which means that half of the time available to get the casualty to surgical care has already been consumed.[33]

The foregoing should not be construed as a blanket condemnation of Forward Aeromedical Evacuation in favour of ground based alternatives. Indeed, ground evacuation is also fraught with limitations that impact its ability to move casualties rapidly. Ground ambulances are inherently slower, limited by terrain, and particularly vulnerable to enemy attack in asymmetric environments and non-linear battlespaces. In the final analysis, the availability of dedicated air and ground evacuation assets is critical to casualty care, but both are vulnerable to disruption in today's likely operational environments. Furthermore, this reality is recognized within the Canadian Army as one that must be addressed as we move towards the *Interim Army*.[34]

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[31] J.A. Laterza, "Medical Support of Military Operations on Urban Terrain (MOUT)" (Fort Leavenworth: U.S. Army Command and General Staff College Paper, 2002), 5.

[32] J.C. Taylor, "Whither the Field Ambulance?…", 11.

[33] L.W. Hoff, "The Medical Package …", 10.

[34] Department of National Defence, *The Interim Army: A Force Employment Discussion Paper* (Ottawa: DND Canada, 2003). B-8.

FAR FORWARD SURGERY

The nature of the modern battlespace is such that it might well preclude the rapid evacuation of casualties to surgical facilities in rear areas. Yet the failure to adequately support casualties with initial stabilizing surgery within short timeframes causes premature death and long-term complications among those who do survive.[35] This leads one inexorably to the same conclusion drawn by Handy, Hooton, Lund,[36] and others - that we need to place surgically capable elements closer to the fight. However, the ability of forward surgical elements to remain close to forward forces in a fluid battlespace demands that these elements be light, mobile and focused on providing only that minimal surgery required to ensure that the casualty makes it to the next destination in the chain of evacuation.[37]

The idea of pushing surgical assets forward to compensate for extended or delayed evacuation of casualties is not a new one. In both the Pacific and European Theatres during World War II, amphibious landing ships were converted for use as surgical suites and beached to provide forward stabilizing surgery before casualties were evacuated to care afloat.[38] Forward surgical teams were also widely employed in Burma to compensate for the prolonged evacuation times associated with jungle operations.[39] During the Falklands Campaign the vulnerability of afloat surgical assets and uncertainty of air evacuation prompted the British to deploy ad hoc surgical teams ashore. Indeed, as

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[35] A.M. Smith, "Care Delayed …", 109.

[36] R.D. Handy, "Health Service Support …", 25; C.J. Hooton, "Medical Support for the FMF: Far in the Rear, Too Much Gear", *Marine Corps Gazette* 74, no. 4 (April 1990): 52; P.W. Lund, "Medical Support for Future …", 88.

[37] M. Hewish and J.J. Lok, "Stemming the Flow: Reducing the Rate of Combat Casualties", *Jane's International Defense Review* 32 (December 1999): 9.

[38] A.M. Smith, "Adapting is Key for Casualty Care", *Proceedings of the U.S. Naval Institute* 129, no. 5 (May 2003): 72.

[39] Slim, *Defeat Into Victory*…, 179.

the campaign developed, surgical teams were extensively employed at the field ambulance level so as to more closely support combat operations.[40] Soviet forces in Afghanistan enjoyed a marked improvement in casualty survival rates once surgical capabilities were placed as far forward as possible, often down to the regimental level.[41]

Although the Persian Gulf War of 1991 revealed several major problem areas in U.S. HSS doctrine and equipment, it also proved the utility of Far Forward Surgery on the modern battlefield.[42] This was confirmed during U.S. military operations in Panama, for which the only in-theatre surgical capability was resident in the surgical elements attached to Echelon II units (the U.S. equivalent of Canadian Role 2). The Panama conflict is also noteworthy because of the rapid evacuation of post-surgical patients out of theatre, whereas the long held belief had been that such patients required a significant period of immobility prior to extended evacuation.[43] Most recently, U.S. forces deployed on both Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom employed Far Forward Surgery extensively, often down to battalion level. [44] In summary then, the requirement for and successful use of Far Forward Surgery enjoys substantial historical precedent.

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[40] Broyles, "A Comparative Analysis …", 57.

[41] L.W. Grau and M.A. Gress, eds. *The Soviet-Afghan war: How a Superpower Fought and Lost: The Russian General Staff* (Lawrence: University Press of Kansas, 2002), 303.

[42] Gouge, "Combat Health Support …", 14.

[43] *Ibid.*, q2.

[44] U.S. Army Medical Department, "After Action Reports – Operation Enduring Freedom" and "Initial Lessons Learned Reports – Operation Iraqi Freedom". Available from http://www.lessonslearned.amedd.army.mil/; internet; accessed 1 October 2003.

EXISTING DOCTRINE

Despite the proven efficacy of Far Forward Surgery and its routine employment at Role 2 equivalent levels and below, there is a perplexing institutional reluctance to ascribe an organic surgical capability so far down the HSS chain. Indeed, current Canadian Army doctrine acknowledges that initial surgery should be performed as far forward as possible, but specifically recognizes this care capability as being inherently a Role 3 function.[45] Although the doctrine does note in passing the possible attachment of Forward Surgical Teams to Role 2 elements for the provision of initial surgery, it appears to exclude such an option by describing initial surgery as:

> …that which must be performed urgently and as far forward as the tactical situation permits, with resuscitative and stabilizing surgical intervention in order to save life and limb, and to control hemorrhage and infection. It demands comprehensive pre-operative diagnostic procedures, intensive preparation for surgery, … properly equipped operating room, appropriate post-operative care, and is characteristic of Role 3 treatment facilities.[46]

Nor does the treatment of Far Forward Surgery fare much better in the emerging Canadian joint HSS doctrine, wherein the possible augmentations to Role 2 are significantly increased but remain additions rather than integral capabilities.[47] The logic of this approach would appear to draw from the Standing Committee on Operational Medicine Support, which recommended that operationally deployed CF Task Forces be supported by a combined Role 1 and 2 HSS unit augmented with a surgical capability.[48] Indeed, it is exactly this type of arrangement that has been applied on most of the riskier

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[45] Department of National Defence, B-GL-343-001/FP-000 *Health Service Support*. (Ottawa: DND Canada, 2001), 12. Hereafter referred to as *Health Svc Sp*.

[46] *Ibid.*, 12.

[47] *HSS to CF Operations*, 6-6.

[48] Department of National Defence, *Standing Committee on Operational Medicine Review: Phase One Final Report*. (Ottawa: DND Canada, 2001), para 258.

land operations in which Canada has participated over the past decade, including the early Bosnia missions, Somalia and now Afghanistan. In all three of these instances the surgical capability attached to the integral Role 1 and 2 HSS elements was based on a reduced Advance Surgical Centre from 1 Canadian Field Hospital – a Role 3 unit.

Despite the fact that the U.S. recognizes in doctrine and practice that initial resuscitative surgery is an Echelon II capability,[49] the U.S. Army has done only marginally better than the CF in establishing such a capability as an integral Echelon II component. Indeed, U.S. Army doctrine largely deals with the issue in much the same way as CF doctrine, with the attachment of Forward Surgical Teams from Echelon III to Echelon II units.[50] However, the U.S. Army has long recognized an integral Echelon II surgical capability for their Independent Brigade Combat Teams (IBCTs), the structure and operational capabilities of which resemble those resident in Canadian Mechanized Brigade Groups.[51] Furthermore, the surgical capabilities integral to the Brigade Support Medical Companies supporting U.S. IBCTs are significantly more robust than those in the Forward Surgical Teams, a factor that has led to some criticism of the latter.[52]

The U.S. Marine Corps has been much more progressive in its doctrinal dealings with Far Forward Surgery, in that it defines resuscitative surgery as an Echelon II capability and has established this capability as an integral component of all its medical battalions.[53] That said, as part of its doctrinal revisions in the mid-1990s under the

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[49] U.S. Joint Chiefs of Staff, Joint Publication 4-02 *Doctrine for Health Service Support in Joint Operations* (Washington: DoD United States, 2001). Hereafter JP 4-02 *Joint U.S. Doctrine*.

[50] Department of the Army, Field Manual 8-10-4 *Medical Platoon Leader's Handbook*. (Washington: DoD United States, 1990).

[51] Department of the Army, Field Manual 8-15 *Medical Support in Divisions, Separate Brigades, and the Armored Cavalry Regiment*. (Washington: DoD United States, 1972).

[52] Hoff, "The Medical Package …", 9.

[53] J.T. Need, "Operational Medicine from the Sea: A Revolution in Medical Affairs." (Newport: U.S. Naval War College Paper, 1997), 6.

"Operational Maneuver from the Sea" (OMFTS) strategy, the Marine Corps seriously considered eliminating its shore based surgical capabilities. This suggestion generated significant debate and strong cautions that doing so would likely make OMFTS unsupportable from an HSS perspective.[54] It is also worth considering that although integral Echelon II surgical capabilities survived OMFTS doctrinal revisions, they may not fare so well as the Marine Corps tackles how it will support its new 'Ship to Objective Maneuver' strategy.

NATO joint doctrine clearly recognizes the importance of timeliness in the provision of emergency care and notes that "[w]here emergency surgery can be provided forward the number of casualties saved can be increased, and the degree of disability can be minimized."[55] Despite this recognition the doctrine goes on to classify such emergency surgery as a Role 3 capability that can be pushed forward to augment Role 2 units as required.[56] Indeed, NATO doctrine on the matter is so similar to CF joint doctrine that it is clear the former has served as a major guide in the development of the latter.

ASSESSING THE STATUS QUO

Before delving into any discussion on the way ahead for the employment of Far Forward Surgery in the CF, it is prudent to examine in what ways our current doctrine and organization fail to meet the requirements of the emerging battlespace. Consistent with CF doctrine, Canada's field surgical assets are currently resident in 1 Canadian Field

[54] A.M. Smith, "Matching Fleet Medical Readiness to the New Naval Strategy", *U.S. Naval War College Review* 50, no. 1 (Winter 1997): 25-26.
[55] NATO, *Allied Joint Medical …*, 14.
[56] *Ibid.*, 17.

Hospital, a 116-bed 'cadre' unit based in Petawawa. This unit is composed of an 86-bed main facility, two 15-bed Advance Surgical Centres (ASCs), an Evacuation Company of two Ambulance Platoons and an Air Staging Facility, and a Forward Medical Equipment Depot. 1 Canadian Field Hospital is in the final years of a multi-year project to create a credible CF Role 3 operational HSS capability and as such is well equipped with modern technologies. However, the complexity of these technologies demands a high price in supporting personnel, equipment and supplies, which in turn significantly reduce the unit's agility. 1 Canadian Field Hospital is also a particularly heavy field unit and, although moveable, is not mobile given that it does not possess sufficient integral transport to move all of its assets in a single lift. From the surgical perspective the purpose of the unit is to prepare patients for evacuation out of theatre by stabilizing them sufficiently to survive the rigors of extended flight. The level of surgical care and associated support systems required to do so are therefore more advanced than those required to provide forward resuscitative surgery.[57]

From the above description of 1 Canadian Field Hospital, it can be readily discerned that the unit's main facility is not capable of the mobility required to remain in contact with supported troops in a fluid environment. Indeed, such a conclusion is supported by an examination of the performance of U.S. Army Combat Surgical Hospitals, which closely approximate the structure and capabilities of 1 Canadian Field Hospital on a larger scale, during the 1991 Persian Gulf War.[58] Furthermore, given its size and lack of mobility, it can also be concluded that 1 Canadian Field Hospital is not

[57] Lieutenant-Colonel C.L. Mitchell, Commanding Officer 1 Canadian Field Hospital, e-mail with author, 1 October 2003.

[58] Gouge, "Combat Health Support …", 23.

capable of operating far enough forward to provide a timely resuscitative surgery capability without compromising its survival. This is recognized in our current Army doctrine which notes the requirement for field hospitals to be far enough to the rear so as to be out of enemy artillery range,[59] while our emerging joint doctrine identifies its placement on the battlefield as being between 30 and 100 kilometers from the Forward Edge of the Battle Area.[60]

If 1 Canadian Field Hospital's main facility is incapable of providing the Far Forward Surgery capabilities required in the emerging battlespace, what of its ASCs? These sub-units are comprised of 109 personnel, 29 vehicles, take approximately six hours to set up or tear down and are described in the doctrine as compact versions of the main facility. ASCs are fully mobile with integral lift and are capable of operating independently for periods of up to 72-hours, in either a step-up capacity for the main facility or to provide a surgical capability further forward than would otherwise be prudent with the main facility. In this latter capacity they are intended to provide Close Support to tactical formations.[61]

Although the above description of the CF's ASCs would appear to better incorporate the characteristics necessary of a viable Far Forward Surgery element, these sub-units would fare only marginally better in meeting our needs than does 1 Canadian Field Hospital's main facility. The ASC's size and mobility make it more suited to operating in forward areas, but the six-hour set up time would inhibit its ability to maintain proximity with supported forces in a fluid environment. Even at its existing

[59] *Health Svc Sp*, 93.
[60] *HSS to CF Operations*, 6-27.
[61] *Ibid.*, 6-27.

size, the ASC is still too heavy to either assure its survival as far forward as it would have to operate to provide viable Far Forward Surgery or to remain flexible enough to react quickly to changing operational situations. Indeed, the capabilities resident in the ASC are available in much smaller configurations, including the Royal Netherlands Army MOGOS (a Dutch acronym for mobile medical operating theatre system) - a field surgical unit that is fully mobile on 13 vehicles and capable of being operational within two hours at a distance of 10-15 kilometers from the front line.[62] Even more impressive, and particularly well suited as a potential integral Role 2 surgical capability, is the Advanced Surgical Suite for Trauma Casualties (ASSTC) fielded by the U.S. Army and Marine Corps. This 'hospital-in-a-box' with tent expansion offers triage, resuscitative surgery, post-operative care and temporary holding capabilities in a highly mobile package that can be operational within 15-30 minutes.[63]

THE WAY AHEAD FOR FAR FORWARD SURGERY

Overcoming our current shortfall in providing credible HSS on tomorrow's battlefield lies in part in improving the skill sets available to our first responders – the soldiers at section and platoon level. We need to place advanced lifesaving skills into the hands of those soldiers that will be first on the scene of combat injuries, because they are directly involved in the activities that generate them. Already well established within the U.S. Army as the Combat Lifesaver program, this concept has proven its efficacy in operations[64] and been identified as a significant component in the provision of combat

[62] Hewish and Lok, "Stemming the Flow …", 47.
[63] Henthorne, "Technical Developments …", 41-42.
[64] Laterza, "Medical Support of …", 3.

health support to the U.S. *Army After Next*.[65] While such Tactical Combat Casualty Care (TCCC) trained soldiers remain first and foremost combat soldiers, they also provide a critical link between self/buddy aid and the Medical Technicians at company level. The need for such an enhancement to CF operational HSS capabilities has been recognized, endorsed by the Surgeon General and validated through a trial TCCC course conducted by 1 Canadian Mechanized Brigade Group during the spring of 2003.

Another key part of the overall solution lies in the development of our evacuation capabilities. A significant step in this direction is already well underway in the form of an ongoing project to reconfigure 77 Bison Wheeled Light Armored Vehicles as ambulances.[66] The attendant protection and mobility that this project brings to ground evacuation will significantly improve our ability to move casualties within tactical areas and maintain proximity to supported forces. Equally significant steps now need to be taken to secure dedicated Forward Aeromedical Evacuation assets, the lack of which limit our current and potential operational HSS capabilities.[67] Indeed, recent U.S. operations in Iraq clearly link the success of Far Forward Surgery concepts to a robust and dedicated intra-theatre air evacuation capability.[68]

While implementing the foregoing requirements will further our ability to provide efficacious HSS in tomorrow's battlespace, the most critical task lies in creating a viable Far Forward Surgery concept. Such a concept must balance emerging demands for mobility, flexibility, capability and readiness. It must also be consistent with the

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[65] Cecchine, et al, *Army Medical Support* …, 44.

[66] Lieutenant-Colonel K. Moore, DAPVB 3 NDHQ Ottawa, e-mail with Colonel A.C. Patch, 21 October 2003.

[67] Salisbury and English, "Prognosis 2020 …", 49.

[68] U.S. Army Medical Department, " Initial Lessons Learned Reports – Operation Iraqi Freedom". Available from http://www.lessonslearned.amedd.army.mil/; internet; accessed 1 October 2003.

direction in which the CF is moving at the operational and strategic levels. One solution that meets all of these requirements is the establishment of an integral resuscitative surgical capability within our existing field ambulances. The field element created to provide such a capability will by necessity have to be smaller than our current ASCs, but can inherently be smaller by virtue of being able to draw much of its first line support from existing field ambulance resources rather than having its own integral support assets. It will also have to be focused on providing only the resuscitative surgery necessary to ensure that casualties survive to the next destination in the chain of evacuation.

ADVANTAGES OF THE PROPOSED MODEL

The establishment of a surgical capability within Canadian field ambulances has a number of inherent advantages over current CF doctrinal and organizational practice. Foremost among these is that it will best meet the demands of tomorrow's battlefield by melding Far Forward Surgery capabilities into the existing framework of an operational element specifically tailored for the forward tactical environment. Ancillary advantages to be gained by implementation of the proposed model include improved cohesion, morale, training and readiness. As will be seen, a number of these advantages accrue as a result of having a formed, standing operational entity rather than generating deployable surgical capabilities on a case-by-case basis as currently done in the CF.

Improved Mobility and Capability

Given its nature as a tactical field force unit, the field ambulance possesses an inherent mobility, which coupled with the depth resident in its multiple platoons provides a flexibility to react quickly to changing operational conditions. The establishment of a surgical capability within such a unit provides an opportunity to capitalize upon these characteristics. That said, there is an inherent dichotomy between capability and mobility, and the very assets needed to sustain a Far Forward Surgery capability can significantly limit a unit's ability to keep pace with the very forces it is supporting. As such, we cannot simply transplant our existing ASCs from 1 Canadian Field Hospital to the field ambulances and must instead develop a lighter less logistically dependent Far Forward Surgery element. Thus while the marriage of a surgical capability to the field ambulance presents a key opportunity, we must remain cognizant of Porr's caution that the highest priority remains mobility.[69]

Improved Command and Control

After Action Reports for U.S. units in Afghanistan note the inherent difficulties that arise when external surgical elements are attached in support for the provision of Far Forward Surgery, particularly in respect of their unfamiliarity with the operating procedures of the units they are supporting.[70] Such familiarity can only be achieved if supporting elements train with supported ones on an ongoing basis. The creation of an

[69] D.R. Porr, "To Be There, To Be Ready and To Save Lives" (Carlisle: U.S. Army War College Paper, 1993), 11.

[70] U.S. Army Medical Department, "82nd Forward Support Battalion After Action Report – Operation Enduring Freedom", para 3.i. Available from http://www.lessonslearned.amedd.army.mil/; internet; accessed 1 October 2003.

integral Far Forward Surgery capability in field ambulances would not only facilitate this, but would also ensure that the entire brigade level HSS team remains focused on the needs of their affiliated brigade. It would also provide a capability to mount the full tactical level HSS requirement for most contingency operations from a single unit, thereby streamlining the coordination of pre-and post-deployment activities. Furthermore, the integration of HSS assets is a significant factor in ensuring accomplishment of the HSS mission[71] and although formalized Command and Control relationships facilitate such integration, it is best achieved when all HSS elements operating at the same level are unified under a single commander.

Improved Cohesion and Morale

Although a complete ASC has yet to be deployed operationally, Canada has deployed a surgical capability based on an ASC in support of several different operations over the past decade. Given the cadre structure of 1 Canadian Field Hospital, this has meant bringing together the constituent members of the 'unit' at some point in advance of embarkation. However, the development of a team identity and the definition of individual roles within the team take time. This is well recognized within military circles, wherein we invest a great deal of energy developing teamwork and group identity at all levels of our organization. The return on this investment is a highly cohesive team with strong morale, which is an important precursor to operational effectiveness. These outcomes are not achieved to the same degree when individuals are brought together on

[71] JP 4-02 *Joint U.S. Doctrine*, II-1.

short notice prior to deployment and invariably their collective performance will be sub-optimal.[72] Further, cohesion is one of the main factors that have a consistent impact on reducing operational stress,[73] a critical concern that must be duly considered by any organization with limited numbers of operational personnel.

Improved Training

Under the current cadre structure of 1 Canadian Field Hospital the HSS personnel that will staff surgical capabilities upon deployment do not have an opportunity to regularly work with the equipment they will use in the field. The lack of familiarity with equipment that results from this type of approach is regularly cited as a major operational issue, and has been specifically noted in U.S. Army After Action Reports for the 1991 Persian Gulf War,[74] Kosovo [75] and most recently Afghanistan.[76] Collocating surgical personnel and equipment at the field ambulance level, thereby providing these personnel with the opportunity to work with field equipment on a regular basis, would largely overcome this issue. Nor would such an arrangement compromise wider specialist skill maintenance, as current CF practice in this area provides for time outside of purely clinical settings for the development of general military and operational skills.

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[72] A.L. Moloff and S. Denny, "The Contingency Medical Force: Chronic Challenge, New Solutions", U.S. Army Report 212th MASH, 1999. Available from http://secure-ll.amedd.army.mil/Reports/CMFartide.htm; internet; accessed 1 October 2003.

[73] A.D. English, "Leadership and Operational Stress in the Canadian Forces", *Canadian Military Journal* 1, no. 2 (Autumn, 2000), 36.

[74] A.M Smith, "Joint Medical Support: Are We Asleep at the Switch?", *Joint Force Quarterly*, no. 8 (Summer 1995): 104.

[75] Moloff and Denny, "The Contingency Medical …", 2.

[76] U.S. Army Medical Department, " 102nd Forward Surgical Team After Action Report – Operation Enduring Freedom", section I, para 1. Available from http://www.lessonslearned.amedd.army.mil/; internet; accessed 1 October 2003.

Improved Readiness

Although the CF theoretically maintains an Immediate Reaction Force ASC, this facility is twice the size of a regular ASC and hence would be even less well suited than the latter for the provision of Far Forward Surgery support. Furthermore, the requirement to pull together the personnel to staff such a facility on short notice presents tremendous challenges and invariably results in the late identification of personnel deficiencies. Consequently the lack of a true standing Far Forward Surgery element limits our ability to react quickly to crises as they arise. The establishment of an integral Far Forward Surgical element at the field ambulance level would largely resolve this issue and allow for the rotation of some Immediate Reaction Force responsibilities among 3 units instead of one. It should also be noted that the advantages detailed above in respect of improved command and control, cohesion, morale and training, contribute directly to enhanced operational readiness.

Consistent with Future CF and Army Direction

Not surprisingly, a review of *Shaping the Future of the Canadian Forces: A Strategy for 2020* [77] and *Advancing With Purpose: The Army Strategy* [78], reveals some interesting themes relevant to this discussion. Replete with words like agile, capable, deployable and sustainable, these documents paint a future wherein the CF stands ready to deploy a relevant medium-weight force, in or out of a coalition, wherever deemed appropriate by the national authority. It is not too difficult to conclude from the

[77] Department of National Defence, *Shaping the Future of the Canadian Forces: A Strategy for 2020* (Ottawa: DND Canada, 1999).

[78] Department of National Defence, *Advancing With Purpose: The Army Strategy* (Ottawa: DND Canada, 2002).

foregoing that what is envisaged are globally deployable, early entry, self-sufficient brigade size packages that must be ready to fight on arrival in-theatre. We have long realized that such brigade groups must be organically sustainable to be relevant and the time has come to reappraise how self-sufficiency will be achieved on tomorrow's battlefield. As we have seen elsewhere in this paper, self-sufficiency from the HSS perspective includes the ability to deploy a true Far Forward Surgery capability. This is best achieved, and our forces would be best supported, by establishing such a capability as an integral element of our brigade group field ambulances.

SUPPORTING IMPERATIVES

For an integral Role 2 Far Forward Surgery capability as proposed in this paper to be successful, there are three major barriers that must be recognized and overcome. Doing so will not be easy, as all three of the associated supporting imperatives speak to issues that can be more widely classified as cultural and cultural barriers are notoriously difficult overcome. First, although Canadian doctrine recognizes the requirement for hard choices to be made in treatment decisions within an operational environment,[79] our military physicians are products of a civilian medical system which teaches them that compromise in patient care is never acceptable. Regrettably such compromises are an inherent reality in the provision of HSS during military operations and are critical to ensuring that the surgical assets we place far forward remain available to support those who can most benefit from them. In short, as noted by Smith:

[79] *HSS to CF Operations*, 2-8.

> Surgeons in an echeloned system must accept the reality that they can render only the amount of care necessary for the moment, in stages, without attempting to carry out definitive care.[80]

Second, there is an existing paradigm within the Canadian military HS community that field hospitals must be state of the art and as comparable as possible to the capabilities of home-based fixed facilities. Such a belief inherently detracts from the imperative of providing appropriate HSS as early as possible (i.e. far forward) and focuses instead on building field-based medical centres.[81] Indeed, Porr stresses that combat surgery need not be as aseptic or technologically advanced as its civilian trauma equivalent, given the availability of definitive care further along in the medical chain.[82] In other words, we must restrict our forward operational HSS capabilities solely to those required to preserve life and limb.

Third, we cannot afford to hold stabilized post-surgical patients forward, as doing so will tie the field ambulance down and prevent it frBDC BT/TT0 112 .752tw 12 0 0 159830 0t22u Tw 12 0

effect early movement of post-surgical patients is critically dependent on a robust air and ground intra-theatre evacuation system.

CONCLUSION

> Overall, the trend during the last 60 years has been for medical organizations to become more deployable, mobile and smaller while retaining significant capabilities with an increased emphasis on forward surgical care and rapid evacuation to an "appropriate" medical care facility.[86]

Although quite correct in their assessment, Moloff and Denny understate the import of this continuing undercurrent in military medicine. We are now able to bring lifesaving resuscitative surgery far closer to the casualty than ever before. This saves soldier's lives and will save even more in the future, as we become increasingly capable of reaching those that would otherwise have died on the battlefield or before reaching appropriate forward care.

Our understanding of the physiologic nature of trauma as defined by the 'Golden Hour' has never been clearer and the proven efficacy of far forward resuscitative surgical care continues to be proven in every new major military operation. Given the foregoing, it is not at all surprising to find the increasingly routine employment of Far Forward Surgery at Role 2 units and even below. Despite all this, there remains a perplexing institutional reluctance to assign an organic surgical capability so far down in the HSS chain. This reluctance is all the more puzzling when we consider the future battlespace wherein we will have to provide operational HSS; a battlespace characterized by requirements for mobility, agility, flexibility and responsiveness - the very attributes that define lower level tactical units.

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[86] Moloff and Denny, "The Contingency Medical …", 2.

Although the CF has made great strides in developing a credible Role 3 operational HSS capability in the form of 1 Canadian Field Hospital, the existing doctrine and organizational structures that surround this capability will not meet our future battlespace requirements. Indeed, these can only be met when we stop fighting the undercurrent that is pulling casualty care ever forward towards the very battle lines. The time has come to redefine Role 2 operational HSS to include initial resuscitative surgery and to support this redefinition with the establishment of a Far Forward Surgical capability integral to Canadian field ambulances. Doing so will not be without its challenges and will demand certain supporting imperatives, but the advantages to be gained are significant and are critical to positioning operational HSS to support the Army of Tomorrow.

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