

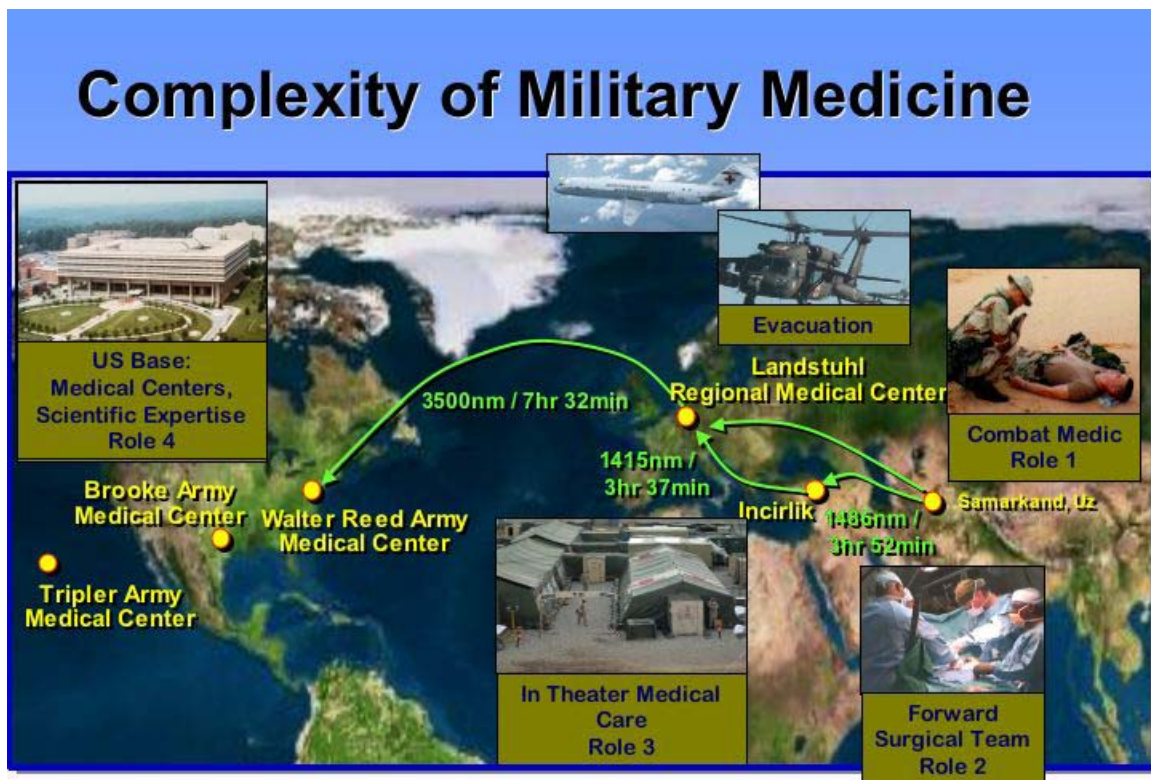
## Telemedicine in the Context of Force Protection

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The best form of force protection is to be able to offer your soldiers the highest level of medical care, both before and after they become ill or injured. This has been the goal of military medicine for centuries, and generally each war has seen advances over the past. However, the world of military medicine has changed dramatically in the past 20 years, and now we must develop new ways of accomplishing this mission. From the period of the first field hospitals centuries ago through the first Gulf war, the tendency of most western militaries was to deploy an entire complement of medical specialties to field settings. A fully-deployed military medical system in this setting encompassed all the NATO Roles of care, from Role 1 (forward medical aid, e.g. Medic and Battalion Aid Station) through Role 2 (Clearing Company Equivalent), to Field Hospitals with Surgical Capability (Role 3) and Hospitals with Specialty Surgical Capability (Role 4). Today, few nations other than the U.S. have the capability to field such an extensive field medical system, and even that of the U.S. is much diminished. Figure 1 provides an overview of such a complex and widespread system.



### Projecting **INTEGRATED** Healthcare Anyplace in the World

Figure 1: The extent and complexity of a full Role1-4 Medical Organisation

Historically, most NATO medical forces were organized to fight a large-scale Article 5 war. This organization included the requirement for large hospitals to be deployed, containing large numbers of specialists and all their specialized equipment. Thus, within a theatre of operations, most specialty consultations would have been able to be obtained within a national medical system in-theatre. At their height, these deployable military medical facilities rivaled and often surpassed in capabilities civilian hospitals of similar size. But, these large and capable hospitals are increasingly being phased out of military inventories for several reasons.

Such capabilities are expensive, difficult to move, and “have a large footprint”. They require extensive site preparation and maintenance, burn up lots of fuel, and are excellent targets. Further, because of their size and relative immobility they are not normally capable of being placed close to the combat zone, but are held more to the rear.

Not directly relevant to this issue, but of concern to our military medical planners is that even without far-forward-deployed hospitals, Medical Personnel have historically been killed and injured at an extremely high rate during combat operations. The number of medical personnel killed or wounded while trying to rescue or treat casualties has historically been very high—as only one example, a recent review of medically-related Medal of Honor citations (the highest US decoration for valor) showed that nearly 50 % were posthumously given. It appears obvious that if we can reduce the deployment of high-value and scarce medical personnel, while maintaining the quality of care we provide, this will be of great benefit.

Thus, taking into account that most wars foreseen at the present time are “small wars”, there is an international tendency to decrease the number of specialized medical personnel in the forward areas of the battlefield, and to rely on smaller less capable facilities (the so-called Role 2+-- Role 2 plus a surgical capability, with early evacuation [and advanced care en-route] rather than the larger and more capable Role 3). This trend within NATO is so marked that the most recent edition of MC 326/2 eliminated the concept of Role 2+ in favor of requiring surgical capabilities at all Role 2 units, both Role 2 E and Role 2 LM.

However, during the same period, our military forces have become smaller and more technologically intense, and the types of deployments in which they are involved have greatly increased, to include not only war but peacekeeping, peacemaking, and humanitarian assistance, each of which has different medical requirements. Conscription has been done away with in most countries, leading to an increased reliance on professional and more highly skilled soldiers. It has been proven to be neither practical nor medically possible to provide the previous level of medical deployment to support ever-smaller troop levels, while maintaining the flexibility needed to respond to the varying medical needs of various missions. It has become evident that the specialty skills needed to provide care for combat casualties may be very different from the skill mix needed to provide humanitarian assistance, for example following a flood. The clinical needs of a young healthy soldier with an acute traumatic injury are very different than those of an elderly person with chronic disease who has no access to maintenance medicines following a natural disaster—thus, the specialty requirements vary from mission to mission. At the same time, there has been a demand from our politicians and our civil populace for maintaining a very high standard of medical care for our deployed personnel. This latter demand is exemplified by NATO document MC 326/2, which demands that every soldier will receive during deployment the same level and quality of care which he or she could receive in the home country.

These changes have produced within the NATO military forces a more streamlined organization, an increased role for multinational shared medical resources, and an increased effort to use new technologies to enhance military capabilities. We also see a growing expectation among our civil populations and politicians that our military operations should be casualty-free. In the period of the so-called “CNN effect”, instant transmission of images of combat casualties has significantly raised the expectation for sophisticated casualty care and medical services whenever and wherever casualties may occur.

On their face, these requirements would appear to be mutually contradictory. How can we provide home-country quality of care to our soldiers without deploying large hospitals and extensive teams of specialists to a far-off battle zone? Fortunately, many of our nations have begun development of a relatively new technology which has been proven to be able to satisfy these apparently disparate requirements--- Telemedicine.

With the ongoing NATO Transformation, the emphasis is on a reduced medical service footprint, and hospitalization assets may not deploy into the Area of Operations until the theater is mature, if at all. Many of the services previously provided by deployed medical specialists will not be physically available early in a deployment, if at all. In order to ensure that junior providers at Roles 1 and 2 have access to specialist advice, and to preclude unnecessary evacuation of soldiers for “routine” consultations, telecommunications technologies must allow for clinical consultations to occur in the physical absence of specialist providers from the forward areas. The delivery of specialist medical advice utilizing telecommunications and information technologies offers the prospect of this support in austere environments.

Thus, as the traditional mechanisms for obtaining specialty consultation in the field have been more and more disrupted, and will no longer be viable without frequent and often prolonged patient travel, with consequent adverse impacts on operational capabilities, there has been a great need for a new mechanism to ensure that only those patients actually requiring evacuation are sent away from their units for medical purposes.

## Telemedicine in the Context of Force Protection

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Multinational Telemedicine is one mechanism for obtaining specialty consultation while maintaining the desired smaller medical footprint in theatre. Additionally, it can provide increased access to clinical specialists who no longer need to be deployed to the conflict zone in order to allow application of their expertise, and who can thus provide their expertise in many locations simultaneously.

This concept of telemedicine serves as the basis for developing doctrine, training, leader development, organizations, and materiel changes focused on the requirements for Telemedicine support to deployed and garrison troops. It further can provide the framework to describe the capabilities required for Telemedicine support to the NATO Reaction Force and other NATO force deployments.

Like any other new concept, telemedicine means different things to different people. For that reason, I want to share my definition with you at the outset. The official NATO definition, found in STANAG 2517, is “The use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers.” What this means is that Telemedicine can allow us to move expertise forward on the battlefield, rather than moving experts to the battlefield. No longer does the expert clinician have to be physically located next to the patient to give advice and comfort.

For the purposes of this paper, I use the term “Telemedicine” in a restricted sense. I am not using it in the broadest sense of “e-Health”, with the implications of patient education, scheduling, telesurgery, telementoring, etc. I use the term strictly to mean “Teleconsultation”, “The provision of specialty services (e.g. dental, mental health, cardiology, dermatology, radiology, pathology) by health care specialists to other physicians”. Teleconsultation may employ a wide range of technologies (Figure 2) from simple voice communication through to real-time video tele-conferencing along with the ability to handle medical specialty-specific data streams (e.g. heart and lung sounds, electrocardiograms, video and still images) captured with the use of specialized equipment”, as defined within STANAG 2517, but the basic concept is simple— we are increasingly looking to export expertise, not experts. Two examples of this are currently deployed Telecardiology and Tele-Echography capabilities.

The broader sense of the term includes many aspects of healthcare which will remain the responsibility of the individual nations, and which will probably not come under the authority of a NATO Force Commander. Since it is Teleconsultation which can potentially provide the primary benefit within a NATO multinational medical support operation, this is the Telemedicine modality to which I have restricted my comments.

Although Teleconsultation has been practiced for many years, its use as a tool to enhance healthcare resulted from the wide availability of personal computers, the Internet and satellite communications. Military use of teleconsultation to support operations, so-called deployable teleconsultation, began in the Gulf War and has continued to be developed and refined to the present day. Many of the concepts and practices developed to meet military operational imperatives have now been adopted and refined to meet the needs of peacetime healthcare around the world.

Technically, Teleconsultation may be enabled as shown in figure 2.



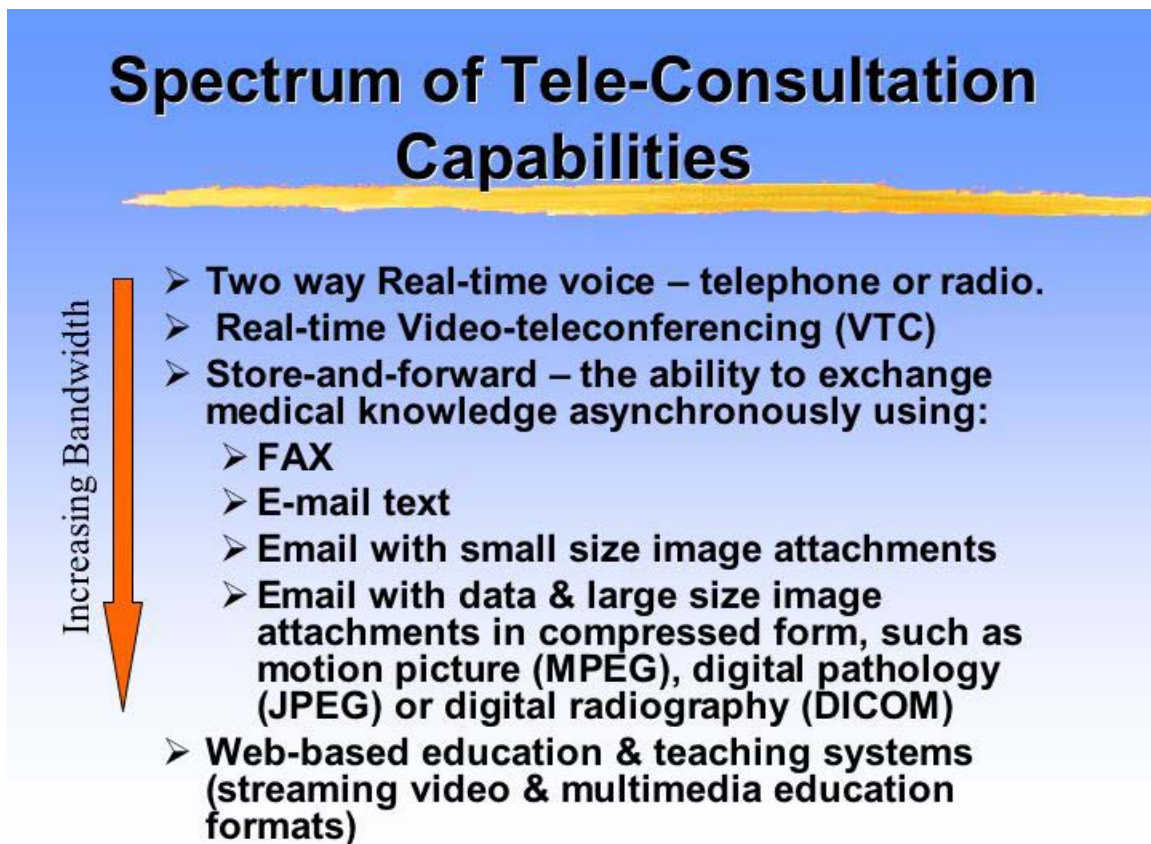


Figure 2: The Various Telecommunications means which can be used in Telemedicine

These modalities include the transfer of data in several ways:

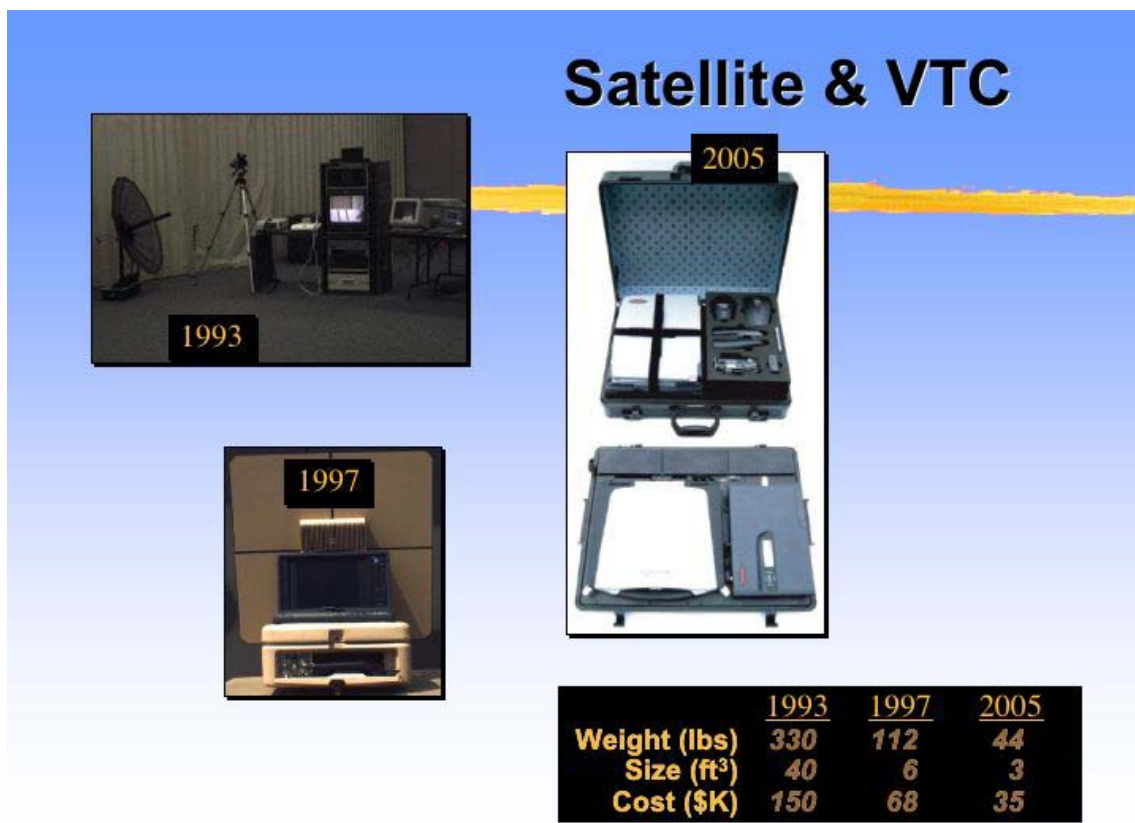
- (1) Real-time—through using dedicated two-way voice ( telephones or radio), or by use of Real-time Video teleconferencing (VTC).
- (2) Store-and-forward data – the ability to exchange medical knowledge asynchronously using:
  - (a) Facsimile.
  - (b) E-mail text only.
  - (c) Email with small size still image attachments.
  - (d) Email with data and with large size image attachments in compressed form, such as motion picture (MPEG), digital pathology (JPEG) or digital radiography (DICOM).
  - (e) Dedicated Internet connectivity, such as with dedicated servers
- (3) Other advanced technologies (e.g. streaming video, multimedia).

While real-time interactions imply that all parties participate simultaneously in a teleconsultation session, store-and-forward interactions involve sending, reviewing, and returning an opinion over a period of time.

## Telemedicine in the Context of Force Protection

Streaming is a method of delivery of real-time or stored data such as audio, video, documents, still images, or other data type across networks. With streaming, a receiving system can start displaying data before the entire content arrives.

The technological limitations of smaller systems and the lack of availability of adequate bandwidth have until recently limited the majority of deployable teleconsultation systems to providing real-time voice and store-and-forward capability. The use of real-time consultation by VTC is currently supported at Role 3 of the medical care system and above for some countries. However, the rapid development of robust high performance and miniaturized equipment such as handheld computers, small inexpensive high-resolution cameras, miniature satellite telephones and image compression techniques may enable real-time video conferencing to forward Roles of care in the future, if it proves useful (Figure 3).



**Figure 3: Advances in Telemedicine Technology, 1993-2005**

Teleconsultation, both peacetime and operationally deployable, is being used to enable an ever-increasing range of clinical practices. The most common are:

- (1) Tele-radiology - Primarily using store and forward techniques.
- (2) Tele-dermatology - Primarily using store and forward techniques.
- (3) Tele-pathology - Primarily using store and forward techniques.

- (4) Tele-psychiatry - Primarily using VTC techniques.
- (5) Tele-dentistry - Primarily using store and forward techniques.
- (6) Tele-ophthalmology - Using a combination of VTC and store-and-forward techniques.
- (7) Tele-ultrasonography - Using a combination of VTC and store-and-forward techniques.

Health Service Support Mission. The overall mission of military health service support has remained unchanged for centuries. It comprises four key operational tasks and a supporting logistic function. These are:

- (1) The promotion of health;
- (2) The prevention of disease and injury – now described as Force Protection;
- (3) The evacuation of the sick and wounded;
- (4) The diagnosis and treatment of the sick and wounded; and
- (5) The provision of medical materiel and other logistic support to enable these tasks.

Teleconsultation may be employed to support each of the above missions. Properly developed as a medical support tool, a national or NATO teleconsultation concept can enable a “collective” health service support environment which will augment and enhance current individual nation support. This will be particularly vital in coalition warfare and operational environments involving limited health care resources and/or short warning and duration operations in which limits on logistic support would severely constrain the medical “footprint”. It is also essential in situations where different nations will provide Role 2 and 3 support to each other, or in which various national Role 3 facilities have different levels of specialist staffing, and could therefore benefit from the exchange of expert patient-related clinical information.

Through effective TMED utilization, various nations have been able to develop systems for the following medical functions:

- (1) Initial urgent evaluation of patients, triage decisions, and transfer arrangements;
- (2) Medical/surgical follow-up;
- (3) Supervision and consultation for primary care encounters where a physician is not available;
- (4) Routine consultations;
- (5) Transmission of diagnostic images;
- (6) Extended diagnostic workup or short term management of self-limited conditions;
- (7) Management of chronic diseases requiring a specialist not available locally;
- (8) Transmission of medical data; and
- (9) Public health, preventive medicine, and patient education.

To assist nations in identifying and implementing Teleconsultation systems for use in either a national or a NATO multinational setting, NATO has established a Telemedicine Expert Team (TMED ET), which is open to membership from all Allied and Partner countries. Its mission is to facilitate national development of Teleconsultation systems, and to assist in development of interoperability programs which will enable these national systems to interoperate with those systems provided by other nations. Ideally, these will not be stand-alone Telemedicine or Teleconsultation systems, but will be integrated into a NATO-wide Medical



## Telemedicine in the Context of Force Protection

Communications and Information System (MedCIS), such as the MEDICS program currently being developed by Allied Command Transformation (ACT), or its successors. The TMED ET is a subordinate body to the NATO/COMEDS Medical Communications and Information Systems (MedCIS) Panel, and if you are working in the Telemedicine arena, I strongly would recommend that you begin to become involved in the work of this group, which provides access in one place to the primary TMED expertise of the Alliance.

A detailed study of NATO air, land, and maritime organizations and formations has been undertaken by the TMED ET to identify the minimum desirable capabilities for teleconsultation systems and technology at each Role of care (Figure 4), and each nation should analyze these requirements as a guide to developing its own desired deployable Teleconsultation capabilities. It must be noted that these are minimum recommendations; if a nation wishes to provide greater Teleconsultation capabilities at a given Role of care, they are certainly encouraged to do so. In accordance with the underpinning NATO principal of developing capability-based organizations, the aim has been to identify and recommend a capability, not a specific system or equipment. Individual nations should attempt to meet a specific capability requirement (for example, the capability to communicate between medical support organizations using standard internationally accepted Information Technology (IT) protocols) with the specific caveat that individual systems must meet NATO interoperability standards, once those are developed.

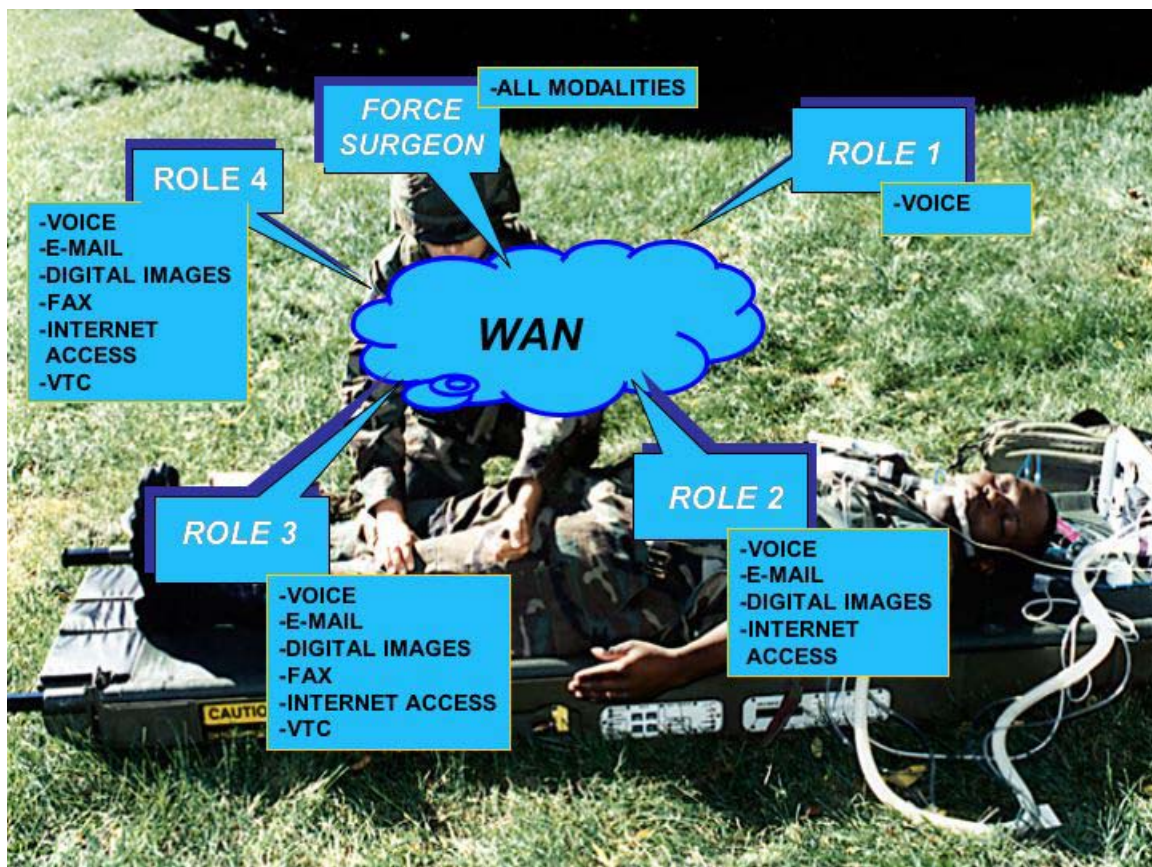


Figure 4 - A schematic view of the telecommunications modalities required at a given Role of Care and visibility of the situation by the Force Surgeon



Within the various national military health services systems, many telemedicine initiatives have moved from the conceptual stage to operational prototypes. These initiatives are under way at all organizational levels within military medicine and across the continuum of our responsibilities. I would like to share with you a few other examples of our experience with telemedicine—the fact that I am speaking primarily of US capabilities does not mean that the US is the only nation with such capabilities—in fact I know that is not the case, as several nations have very extensive TMED capabilities to support their field forces. I am just discussing those systems which I know the best.

The US currently has connectivity from our medical facilities in Iraq, Kuwait, and Afghanistan to our medical facilities in Germany and also with several of our medical centers here in the U.S. The capabilities in use include teleconsultation (using an Army-wide Internet-based consultation system), digital X-rays, computer tomography and ultrasound transmissions, clinical e-mail, high-resolution still imagery, teledentistry and medical and patient information systems. In fact, all X-Rays taken in a deployed setting are currently being transmitted electronically and read at our Medical Center in Germany—we no longer need to deploy diagnostic radiologists to the front lines (and as a side benefit, we have eliminated the use of “wet film processing”, with all its logistic requirements and environmental hazards, from the deployed setting). We are routinely making use of teledermatology consultations, and infectious disease/internal medicine consultations played a significant role during a recent deployment to provide humanitarian aid in the Pakistan earthquake zone. In the future, all of these systems will have the capability feed data into our enterprise Electronic Health Record, called the Armed Forces Health Longitudinal Technology Application, or AHLTA.

In the military arena, another very important component of this telemedicine capability is medical situational awareness and command and control. This is the age of information, and information superiority will be absolutely essential to the military in future engagements. I predict that appropriate use of Telemedicine and other IT technologies will be of great benefit in ensuring that our medical and line commanders have a vastly improved level of medical situational awareness compared to that they have had in the past.

Other nations have their own areas of expertise in TMED, such as the German Telemicrobiology System, and various Teleparasitology and Telepathology programs currently in the field, not to mention both field and shipborne teleconsultation and teleradiology systems. Of note is that all nations having deployed TMED systems have found similar benefits—what I have been discussing is not simply a United States-centric opinion.

A major goal of most NATO nations has been the replacement of the old paper medical records, and field medical cards, with an electronic system which would allow more accurate, complete, and readily transmittable medical records. One solution, being investigated by several nations for both civil and military use, is the Battlefield Medical Information System- Tactical, or BMIST (Figure 5). This system allows the first responder to enter immediate treatment data at the site of treatment, and to transmit it appropriately through several means, either by means of a transferable electronic medium such as the EIC or wirelessly to supporting medical organizations.

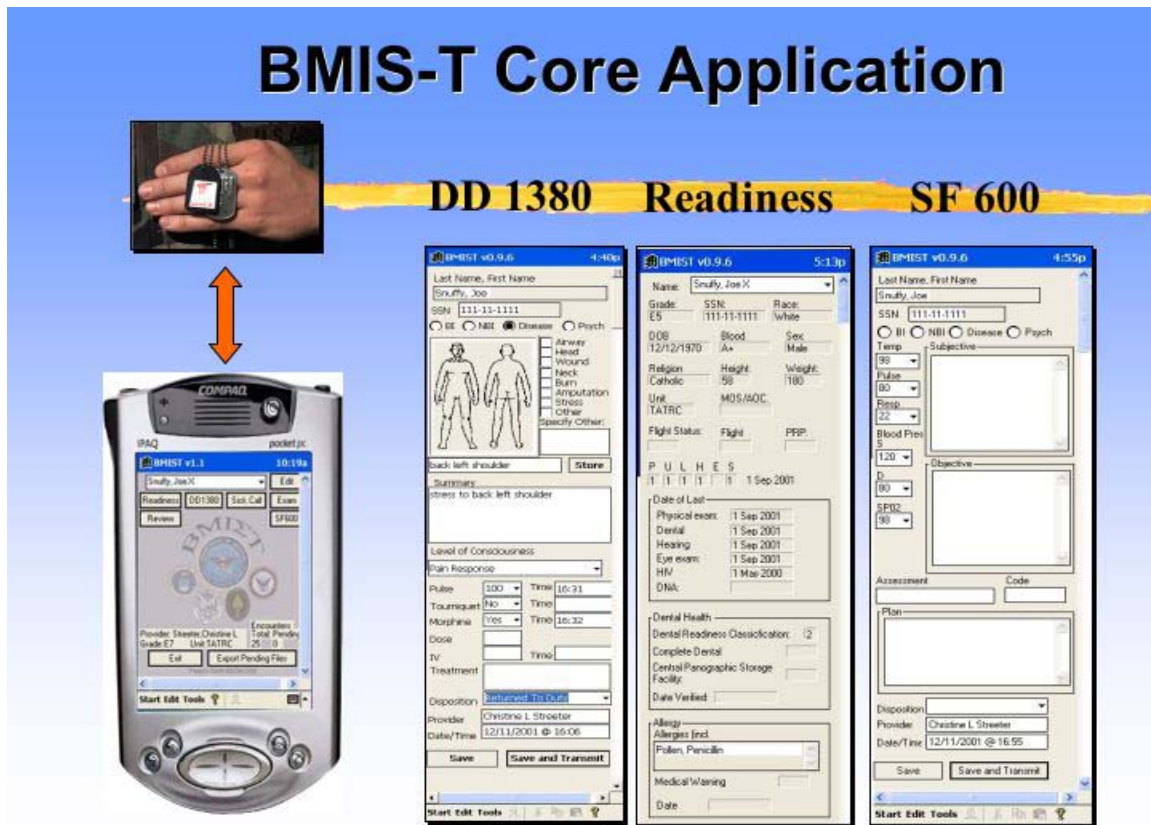


Figure 5: The BMIST, with its core capabilities and the “electronic dogtag”

One item of critical importance which cannot be overlooked is that of disease surveillance, and outbreak early warning systems. As we develop an increased level of multinational operations, an integrated database on infectious disease outbreaks will be critical to force protection. No longer can national outbreak data, often analysed months later, be considered acceptable. As we develop more integrated NATO-wide systems, disease surveillance reporting must be one of the earliest concepts to be integrated.

It is amazing to think that we have today the capability to instantly inform the world of what the weather is like anywhere on the globe; we can transmit stock values instantly across the world; and we share transportation schedules which allow worldwide travel, but that we do not have any type of international system which can provide rapid accurate notification of disease outbreaks, validation of a working diagnosis, and direction of a multinational focused response to contain an outbreak or epidemic. The tools for this already exist, yet much more must be accomplished, and telemedicine's capabilities will play the key role.

The introduction of new methods, new systems and new ideas always gives rise to apprehension, which in turn leads to resistance to change. We talk about “disruptive technologies” because they disrupt the way in which we have traditionally done our business. As telemedicine and other similar innovations within the military health services system become firmly established, we recognize this adverse response as one of our major obstacles. We simply cannot continue to do business as we have in the past—the days of the old paper-based field medical card and the associated medical records are numbered, and future field medical records

will accompany the soldier on some version of “electronic dogtags”. The new ways of doing business must be proven to be clinically acceptable, as well as providing improvements in the care we can offer. We must approach new conditions with new ways of doing business, and I would point out to you that one of the only non-science fiction ways of accomplishing this in the NATO medical environment today is by the effective use of multinational, cross-border, Telemedicine systems. Continuing to do business the same way we always have is simply not an option. For operational military medicine to change the way it functions will take investment of resources and efforts that our people must be ready to make.

A second problem area that we have within the NATO military health services system is the eagerness of some nations to fashion an information or telemedicine system which will satisfy their particular location or their particular special interest, without taking into account Alliance needs. We must all work to ensure that the systems we create will operate across the NATO Medical Information networks once they are fielded, that all systems can interact and that what is developed for use in one possible scenario can be transported to any other mission.

To assist the nations in developing this kind of system, the TMED ET has published STANAG 2517 on Teleconsultation. It contains basic guidelines for development and use of teleconsultation systems, and contains standardization tools which will ensure that nationally-developed systems can interoperate. I strongly commend it to you. It is very simplistic, and very useful. As this is written, Edition 2 is current, but Edition 3 has recently been submitted for national ratification and processing.

As a change agent for the NATO multinational military health system, telemedicine will change the way we conduct operations, regardless of where we happen to be, and regardless of which other nation, partner or ally, is on our flanks. The twin keys to improved combat casualty care are these forward battle area efforts and more medically intensive evacuation capabilities. Telemedicine is critical to them both.

Our national deployed clinics and hospitals, using telemedicine, will no longer be remote from one another. Our physicians and other health care providers will work more closely together because distance and time will not be factors. The primary care physicians will still be involved with their patients while specialty care is provided via telemedicine, which will greatly improve the continuity of care for the patient as well as the understanding of the problem for both primary and specialty physicians. Evacuation back to the home country simply for routine consultations will no longer remove soldiers from the theatre for days or weeks, thus allowing more comprehensive use to be made of our deployed personnel as well as more rapid attention to their medical needs. The future of military medical care, and I would submit to you as well that it is the future of civil medical care at least in emergencies and disasters, is that of an integrated system, in which data acquired by one nation can be rapidly and accurately passed to another nation to whom the patient is being transferred. Although we may have a full panoply of capabilities, from Role 1 to Role 4, including the evacuation chain, this whole system is highly unlikely to be provided by a single nation—thus the requirement for standardized data collection and transfer.

The phenomenal capabilities made possible because of these new tools can easily grab one's imagination and attention. We must remember that these advances are tools which enable us to accomplish things that previously were not possible. They are tools that expand our own personal abilities, which allow us to provide greater assistance to those who need health care. They cannot replace clinical expertise and capability, but they can help us make the best use of it, wherever located.

These technologies, like telemedicine, are agents of change. They carry significant implications for how medicine will be practiced, yet medicine remains a curative art firmly based in science. As an agent of change,

## **Telemedicine in the Context of Force Protection**

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telemedicine carries significant implications for how military medicine will operate, yet the mission responsibilities of military medicine to provide care wherever and when ever needed remain the same. The important point here is that telemedicine is a tool to be used to improve the delivery of health care. It is here, and it works—I strongly recommend your consideration of it as an enhancement to your national military healthcare system, and as a viable aspect of your force protection program.

### **REFERENCES:**

AJP-4.10 Allied Joint Medical Support Doctrine

MC 326/2 NATO Principles And Policies Of Operational Medical Support

STANAG 2517 Development And Implementation Of Teleconsultation Systems