

Satellite Interconnection of Military Hospitals of the SEDM Countries (SIMIHO): A Novel Technological Forum as Model for Military Medical Surveillance and Response in SE Europe

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SUMMARY

Introduction: Ministers of Defense (MOD) of AL, BU, CR, FY, GR, IT, RO, SL, TU, US under the auspices of the South East Europe Defense Ministerial Process (SEDM) have adopted on Oct 9th,2000, the Greek proposal for Satellite Interconnection of the Military Hospitals (SIMIHO) of their major Military Hospitals, and this initiative is evolving into a state-of-the-art medical surveillance system. Materials and Methods: The SIMIHO Working Group (SIMIHO WG) was formulated, tasked to provide feasibility recommendations for the next MOD meeting, constituted by senior military medical and technical experts of all SEDM countries and convened in Athens on three separate occasions,.as SIMIHO/Med WG, specifying the essential requirements for the network. The MOD in their Antalya meeting (Dec 2002) commanded that the SIMIHO WG will proceed into buying the essential material for the implementation of the project, and the work continues under the SIMIHO/Tech WG. Results: Within a time frame of 18 months, SIMIHO WG examined discussed and defined the following: (a) Compatibility issues of existing information infrastructure, including integration issues, (b) Telemedicine centers to be included in the project throughout SEDM countries. (c) Medical specifications

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for the SIMIHO Telemedicine integrated system, which may include telediagnosis, teleconsultation (videoconferencing) and medical teletraining. (d) Operational policy issues of the Telemedicine Network under construction. (e) Technical specifications, which among others include: utilization of a satellite network (avoidance of “single point failure”), a minimum of 2Mbps for interactive communication, and techniques for maximization of imaging performance with minimization of bandwidth utilization, and (f) Financial policy issues, such as possibility for “pay-per-use” bandwidth utilization. These proposal was adopted by the MOD Ministers and work is under way for the implementation of the Project, and possibly expanded into mobile rapid deployment force units, such as SEEBRIG in Sofia, BU. Conclusion: The above framework may serve as a model state-of-the art medical surveillance system, which owns the potential to be utilized in several ways (e.g. C3, medical planning, casualty management) both in mobile units, and in case of civilian events, such as a major catastrophe with mass destruction.

1.0 INTRODUCTION

1.1 South East Defence Ministerial (SEDM) Process

South East Defence Ministerial (SEDM) Process constitutes a diplomatic initiative of the Ministers of Defence of the Countries (both NATO and PfP) occupying the sensitive area of the South East European territory (mainly Balkans and surrounding territory – **Figure 1**), which aims to establish co-operation, understanding and communication among nations and countries, and therefore promote peace stability and better relationships through common projects, work and military action. The Countries participating in SEDM are (in alphabetical order): Albania (AL), Bulgaria (BU), Croatia (CR), the Former Yugoslavic



Republic of Macedonia (FY), Italy (IT), Germany (GE), Greece (GR), Romania (RO), Slovenia (SL), Turkey (TU), and the United States of America (USA).

The SEDM MOD meeting goals are facilitated by the SEDM Co-ordination Committee (SEDM-CC), whereas each if the SEDM Countries participates via a permanent delegation, and convenes at 3-monthly intervals.

1.2 The Satellite Interconnection of the Military Hospitals of the SEDM Countries (SIMIHO) Project and SIMIHO Medical Working Group (SIMIHO/Med WG)

During the first Ministers of Defence (MOD) Meeting held in Thessaloniki, GR, on Oct 9th, 2000, the Ministers adopted a proposal by the Greek MOD recorded in the Meeting minutes (Ref 1) as follows:

“The ministers also endorsed the Greek proposal for The ministers also endorsed the Greek proposal for satellite interconnection of military hospitals of the SEDM Countries in order to practice telemedicine and exchange medical information. For this purpose, they decided to establish an experts group to examine the matter and to prepare recommendations for review by the Ministers of Defense.”

Following the order above, the Satellite Interconnection of the Military Hospitals of the SEDM Countries (SIMIHO) Project was initiated, and the SIMIHO Medical Working Group (SIMIHO/Med WG) established, consisted of senior Medical Experts in Telemedicine as well as Computer and Telecommunications military experts and civilian counsellors, under a Greek Chairman.

1.3 NATO is nowadays involved into a operational continuum which spans from garrison operations to peace keeping and enforcing, up to war itself. Such a state-of-the-art network may well serve as a technological model for such a flexible medical surveillance system, which combines *per se* independency of terrestrial network, therefore deployability, cost effectiveness, simplicity and flexibility according its agreed operational policy.

This paper **aims** to present and discuss the experience of the SIMIHO Med WG in its efforts to set up principles, policy of a satellite facilitated network and address diversity among the ten (10) SEDM countries.

2.0 MATERIALS AND METHODS

2.1 SIMIHO Med WG Program of Work

This WG convened on three separate occasions within a 18-month period (2000 -2001): Dec 13th, 2000 – Mar 26th, 2001 – Sept 4th, 2001, resulting in outlining the appropriate technical and operational specifications of a satellite facilitated medical network, and a final recommendation report was promulgated to the 2nd SEDM MOD Meeting held in Antalya, TU, on Dec 20th, 2001.

The SEDM MOD Meeting adopted the recommendation as follows: *“The Ministers noted receipt o fthe progress report on Satellite Interconnection among Military Hospitals (SIMIHO) Working Group and supported continuation of the project”* (Ref 2).

2.2 SIMIHO/Tech WG Program of Work

Having defined the technical and operational specification of the medical network, the necessity arose for a new WG, tasked to acquire, install, and maintain the system defined: Therefore, SIMIHO Med WG evolved into SIMIHO Tech WG, whose Terms of Reference were approved by SEDM-CC on October 28th 2002, under silence procedure. This WG met in Rome, IT on November 27th 2002, in Athens, GR, March 20th 2003, in Rome, IT on June 27th 2003, and Sofia, BU on Sep 30th to Oct 1st, 03. The outcome of this WG is the preparation of an MOU to define operational policy and possible hardware/software alternatives.

3.0 RESULTS

As results of the SIMIHO Tech WG area still under negotiation, this paper will report on the results obtained by SIMIHO Med WG, in order to clarify specifications of the network system model.

Table 3: Technical Specification for Communication Infrastructure

1. One (1) Satellite terminal
2. Special modems for interconnection to computer infrastructure

3.1 SEDM Parties were able to designate a suitable military hospital for the SIMIHO project purposes, as shown in Table 1.

3.2. In all hospitals designated for the SIMIHO project, there was complete software compatibility among apparatuses possible to utilize in the project.

3.3.

	COUNTRY	ESTABLISHMENT	LOCATION	REMARKS
1	Albania	Central Military Hospital	Laprake, Tirana, AL	
2	Bulgaria	Military Medical Academy	Sofia, BU	
3	Croatia			No military Hospital
4	FYROM	Military Hospital	Ilidenska b.b. 1000, Skopje, FYROM	
5	Greece	251 Hellenic Air Force General Hospital.	Athens, 115 25 GR.	
6	Italy	Policlinico Militare Di Roma.	Rome, IT.	
7	Romania	Clinical Emergency Military Hospital	Bucharesti, RO.	
8	Slovenia			No designation
9	Turkey	General Staff Health Department	Ankara, TU.	
10	USA	National Naval Medical Centre	Bethesda, Maryland, USA	

Table 1: Military Hospital designated in SEDM Countries for the SIMIHO Project

Table 2: Technical Specification for the Telemedicine Unit Equipment

1. One (1) Workstation with telemedicine software

1.1. Minimum Hardware Requirements

- 1.1.1. Processor Pentium III 1 GHz or Double processor Pentium III 700 MHz
- 1.1.2. Motherboard (supporting the selected processor)
- 1.1.3. Network board 10/100 Mb
- 1.1.4. SVGA card 64MB
- 1.1.5. Video capture card (recommended Osprey 100)
- 1.1.6. Sound Card
- 1.1.7. 128 MB RAM
- 1.1.8. 18 GB Hard Disk
- 1.1.9. CD/DVD-Rom
- 1.1.10. Headset – Microphone & Loudspeakers
- 1.1.11. Live Camera(-s) equipped with remote control (e.g. Canon CV-3)
- 1.1.12. Document camera(-s) (e.g. Canon CV-3)
- 1.1.13. Windows NT Workstation Software

1.2 Functional Characteristics of telemedicine software

1.2.1 Customised advanced telemedicine software: Medical applications (e.g. teleconsultation) require a high-end, interactive video conference system providing high quality real-time video, still-images and audio transmission.

1.2.2. *Multiple Video input :*

- 1.2.2.1. Live-cameras for true live video conferencing. These are cameras connected to different, medical equipment: room camera for open surgery (integrated into the operating light), surgical microscope camera, laparoscope and endoscope camera, camera of the pathological microscope etc.
- 1.2.2.2. Document-cameras: Scanned images from a live camera that are sent separately, e.g. CT, MRT, US images.
- 1.2.2.3. Virtual-camera: Sending of image-files (stored in TIFF, BMP, JPEG, GIF, etc format) previously saved to the computer or a network file server.
- 1.2.2.4. Adjustable video-window size: The user can alter the size of the Self-View window sent to the video-conference-partner, e.g. 128x96 pixels, 176x144 pixels etc.
- 1.2.2.5. Adjustable bit rate & frame rate - Use of scalable bandwidth transmission channels (starting from 128 kbps at least)
- 1.2.2.6. Remote pointers.
- 1.2.2.7. Optimized video compression codecs based on the concepts of Partition, Aggregation and Conditional Coding or future developments.

2. Off-the-shelf videoconferencing applications

Use of H323 (or future developing standards ensuring compatibility and interoperability to the existing standards), standards-compliant commercial videoconferencing applications for less demanding tele-collaboration sessions, that allow for live videoconferencing, file transfer, program sharing etc.

- 2.1 One (1) Scanner One high quality film-scanner suitable for medical applications is required per site, in order to facilitate the digitalization of medical images, x-rays etc.
- 2.2 One (1) Remote control camera & one (1) Document camera
- 2.3 One (1) Video projector
- 2.4 One (1) screen
- 2.5 One (1) Audio system

With respect to the diversity of the Telemedicine apparatuses and infrastructure available to each SIMIHO the final recommendation consisted of the following:

3.1.1 Each Party is to built / assemble / create a computer infrastructure capable of video-conferencing and complying with the technical specifications described in Table 2, as well as communication infrastructure, shown in Table 3.

3.1.2. Each party is to utilize a single, common to all Parties, provider of satellite interconnection among the hospital computer infrastructures mentioned above, with the characteristics included in Table 4.

3.1.3. In case of a SEDM Country already maintaining a fully operational Telemedicine system, this Country is responsible for establishing an interactive linking facility to the telemedicine network under construction by the other SEDM Countries, providing complete compatibility, interoperability and performance equivalent to the rest of the above telemedicine network.

3.1.4. Each party is to utilize the satellite interconnection facility according to the principles laid down in Table 4;

3.1.5. The cost of creating, modifying, assembling and maintaining the parts of the telemedicine network under construction for each Party is the sole responsibility of the SEDM Country.

Table 4: Description of the characteristics of the satellite interconnection provider for the SEDM telemedicine network.

1. Fully integrated system, capable of providing the following applications:

- 1.1 Tele-diagnosis
- 1.2 Tele-consultation (videoconferencing)
- 1.3 Medical tele-training.

2. Satellite facility operating on multi-satellite (satellite network) support (avoiding of “single point failure”) and providing a full coverage of all Parties and Europe.

3. Maximization of image performance with minimization of bandwidth utilization (2Mbps recommended for interactive communication).

4. Effective and efficient utilization of IP protocol over satellite.

5. Possibility for exclusive (“pay-per-use”) utilization of the bandwidth.

6. Billing system.

7. Network management utility.

8. Option for integration with terrestrial networks or other networks.

3.1.6. Additionally, the cost of utilization of the satellite facility will be shared equally among the interconnecting Parties, according to the billing system of the facility, as appears in Table 4.

4. DISCUSSION

With ongoing work, SIMIHO Med WG was delighted to realize that very few compatibility issues existed among hardware and software utilized in the military hospitals located mainly in capital cities of the SEDM Countries. Having given the fact that the concept accepted by the SEDM MODs concerning a satellite facilitated network (Figure 2), is a simple, cost effective and readily deployable in principle network, this WG had to address several issues arising in three separate and distinguishable steps:

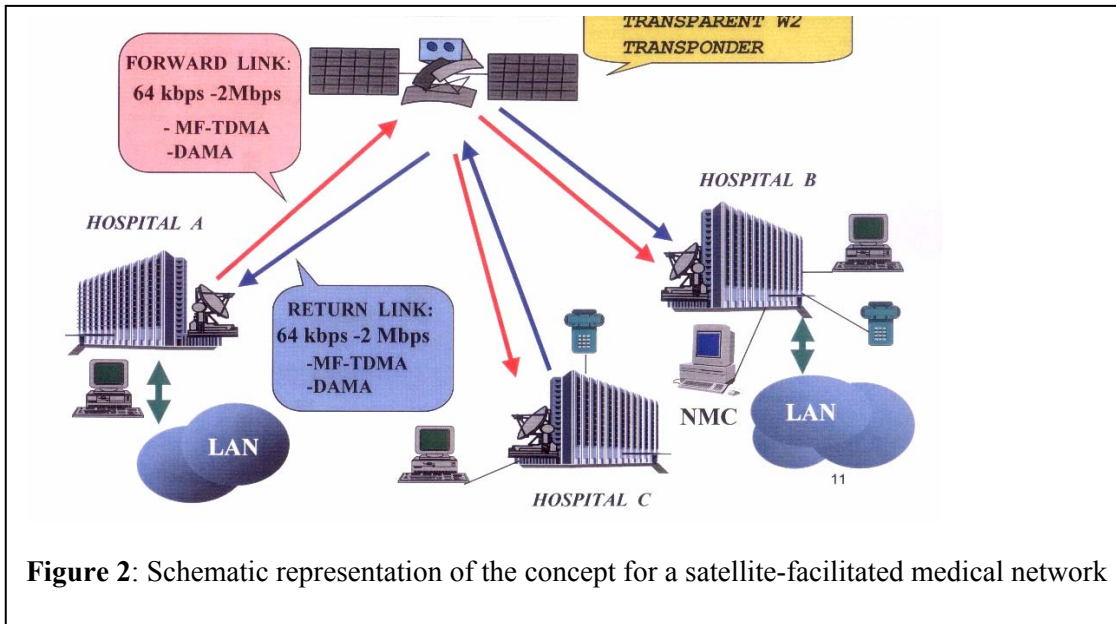


Figure 2: Schematic representation of the concept for a satellite-facilitated medical network

4.1 Address diversity among SEDM Countries

The technological status level of medical surveillance for each SEDM country was different, but

Table 5: Diversity among SEDM Countries regarding network and ratification / implementation of SIMIHO project.

SEDM Countries	Ratifying and implementing	Ratifying but not implementing
With existing operational satellite network	US	IT
Without an existing operational satellite network	BU, FY, GR, RO, TU	AL, CR

may be summarised as shown in Table 5. Of all SEDM Parties, only US and IT operate a similar network; the US system is operationally centered in Landstuhl, GE, while the Italian one in Rome. AL experienced funding problems and CR does not maintain a central military hospital, however, they are in support of implementation of the project. The remaining Partners (BU, FY, GR, RO, TU) will implement SIMIHO.

For the Ratifying but not implementing partners, the WG proposed issuing of explicit instructions, guidelines and technical manuals to enable active participation when their infrastructure becomes available (AL, CR), or become ready to meet the cost of adapting their system to the SIMIHO one (IT).

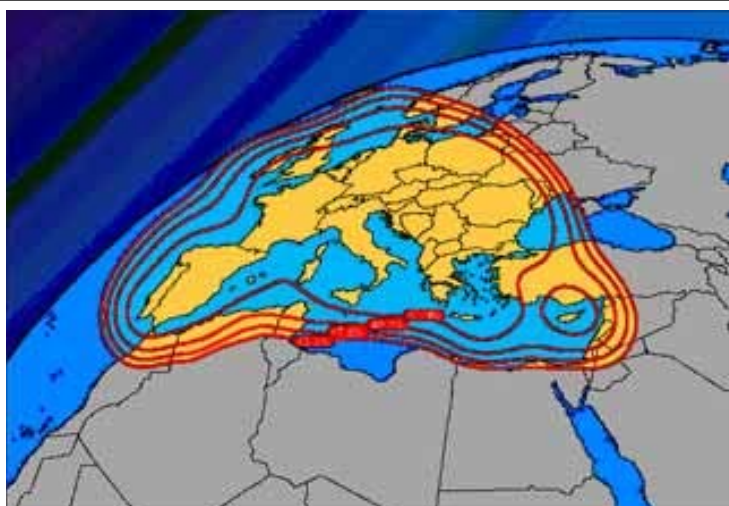


Figure 3: Beam area of Hellas Sat (2003)

4.2 Cost Effectiveness

The requirement for Possibility for a billing system, as laid down in Table 4 together with an exclusive (“pay-per-use”) utilization of the bandwidth, provides a minimum service cost, which may be tailored to individual needs. Depending on the satellite service provider, the hourly cost of a 2Mbps bandwidth may well be under 75 Euro, and availability of services covering the Balkan area is not rare (Figure 3).

4.3 Operational Impact

The operational potential of a satellite interconnection network is significant: except for the capacity to promulgate international co-operation and build trust among the SEDM Patrnrs, a political target, it may well serve in other national and international occasions:

4.3.1 Operational medical surveillance during multi national deployments, such as in SEEBRIG located in Plodviv (Filippoupolis) in BU, and in other theatres woldwide (e.g. The telemedicine system employed by US Regional Medical Command Europe to monitor troops deployed in Balkan theatres (Hill 722 & Camp Corner, Eagle Hospital in Bosnia, Bondsteel Hospital in Kossovo - ERM/LRMC USAEUR).

4.3.2. Although the network official interconnection point will be the designated military hospital (NATO Role 4), there is no restriction to further develop the network within country limits: each Partner may further expand the network via optical fibres or wireless coupling to include further hospitals or mobile units (ships, isolated units surrounded by desert areas). This may facilitate public and military health systems, either by providing essential medical information pre-, post- or during deployment, or provide a forum for international co-operation in cases of mass casualty/destruction (e.g. earthquakes, forest fires, etc). The latest development in medical surveillance presents remote surveillance



Figure 4: Medical surveillance of vital signs in a space mission

of vital signs of VIP personnel, such as the ones in orbit (Figure 4).

4.4. Relationship to other NATO telemedicine activities.

Possible overlap with other Telemedicine initiatives within NATO was also considered, such as the NATO Telemedicine WG (TMED WG). The aim of SIMIHO WG is to provide a satellite interconnection mainly, but not exclusively among military hospitals (operational NATO role 4), presents a high-end specifications application (minimum speed: 2Mbps), with immediate applicability based on an accepted common hardware and software standard. The NATO Telemedicine WG is orientated towards operational roles 1-4, presents a low-end specifications

application (Maximum speed: 0.18 Mbps, the current NATO standard) and is responsible for producing a STANAG, which is subjected to time-consuming national ratification and implementation procedures, also dependent on existing national reservations. The relationship between SIMIHO and TMED remains close, with the SIMIHO/Tech Secretary updating TMED in their Oslo, NO Sept 2003 meeting, and SIMIHO member commenting on the newly developed TMED STANAG.

5.0 CONCLUSION

The SIMIHO Med WG proposal for a Satellite facilitated Interconnection of the Military Hospitals of the SEDM countries presents a valid, cost-effective, independent of ground texture or environmental associated issues, realistic and cost effective means of serving the SIMIHO purpose.

6.0 References: ..

- [1] Joint Statement SEDM Ministers Of Defence/09-10-2000, Thessaloniki, GR
- [2] Joint Statement SEDM Ministers Of Defence/21-12-2001, Antalya, TU.

SYMPOSIA DISCUSSION - PAPER 17

Authors Name: Dr Diamantopoloulos (GR)

Discussor's Name: Dr Clere (FR)

Question:

What is the robustness of the network in the case of many thousands of simultaneous users accessing the network in case of crisis, war?

Author's Reply:

A cell phone network is rapidly saturated if a lot of users have to use their cell phones.

For a satellite network, it is not the case because there is a constellation of satellites and, if one satellite is saturated the network transfers the work to the other satellites of the network. Thus, the network provides insurance against saturation which is not present in land-based cell technologies.

Authors Name: Dr Diamantopoloulos (GR)

Discussor's Name: Capt (RNL)Hovens (NL)

Question:

Did the committee think of connecting the military hospital "by wire" and hook up the remote installation by satellite?

Author's Reply:

It is politically given circumstance to use satellite communications in both locations.