

INTERIM STATUS REPORT

(Sans Financials)

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MedITAC



**Virginia Commonwealth University
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Executive Summary

This report serves as an interim report on the Medical Informatics and Technology Applications Consortium (MITAC) activities from November 1, 1999 – April 30, 2000. The first six months of the 4th year of the MITAC has been busy and productive period. During this period, the MITAC has been involved in a number of activities. This report will highlight many of these activities as well as discuss the development of commercial products and services from MITAC activities in the laboratory.

MITAC staff remains committed to accomplishing the task as they are assigned. The MITAC responds quickly to NASA requests. The MITAC staff has traveled to a number of unique locations throughout the world to further develop test beds for evaluation and validation of technologies. This is often in direct support of a NASA request or initiative. MITAC's efforts in education continue with enhanced learning tools.

As a Commercial Space Center, the MITAC is focused on business development. Efforts during these past 6 months have been focused on creating 5-6 discrete companies for spinning technology out of the laboratory into commercial products.

The coming 6 months will see continued efforts in these activities. In addition, the company formation and commercialization of MITAC-derived or MITAC-related technologies will be realized.

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INTERIM STATUS REPORT

INTRODUCTION

This report represents a status of the MITAC's activities from November 1, 1999 – April 30, 2000. It is considered an interim status report. A status is provided on administrative areas (management, interaction with NASA, financial, and organization); education; projects and testbeds; technology initiatives; business development; and future activities. Many of the MITAC activities can be viewed at the following web site www.meditac.com.

ADMINISTRATIVE

A number of administrative activities were conducted during the past six months. MITAC organized a medical informatics meeting, which was held, March 6-7, 2000 in Houston, TX. This one and half day meeting was one of four to be sponsored by the MITAC. It was attended by a select group of experts in the field of Medical Informatics. There was significant participation by NASA JSC personnel. The meeting summary is available at www.meditac.com/documents/.

The second meeting, focused on ultrasound, is being developed as of this reporting. It is tentatively scheduled for early summer in Houston. All of these meetings are being organized and sponsored in close coordination with NASA JSC. They are held in Houston to maximize interaction and participation of NASA JSC personnel.

MITAC has worked closely with the VCU telemedicine program led Ms. Carol Hampton, Associate Dean for Faculty and Instructional Development. MITAC technical staff provided assistance to the telemedicine programs with the Blackstone Family Practice Clinic and the Powhatan Correctional Facility.

MITAC submitted five proposals against the NASA Headquarters Human Exploration and Development of Space (HEDS) NASA Research Announcement (NRA). Each of these proposals received low scores in the review process and although some had merit none were approved for funding.

MITAC has also worked closely with the Department of Surgery in submitting proposals to a Department of Defense (DOD) Broad Agency Announcement (BAA) on Telemedicine and Rehabilitation of Landmine Victims. Additional proposals have been submitted to the Virginia Commonwealth Research Board. Award for the first proposal will occur in late summer. The second proposal, which was to evaluate the application of telemedicine in preoperative screening in a clinic in rural Virginia, was not approved.

VCU with Department of Surgery and MITAC support received approval in January 2000 for a Next Generation Internet (NGI) grant from the National Science Foundation. This grant, totaling \$350K has a component of telemedicine in it. This component involves Dr. Merrell, Mr. Doarn and the MITAC.

Management

MITAC's management team remains strong with a focus on providing high quality services, sound management principles, fiscal responsibility and business development. These attributes and the high standards instilled in the staff are vitally important to the success of MITAC.

The MITAC's Board of Directors met in January 2000 for the second time. The meeting was focused on MITAC's activities and business development. NASA Headquarters personnel from Code UM, including Mr. Mark Uhran, Ms. Candy Livingston, and Dr. Raymond Askew provided input into MITAC's business development. Mr. Uhran attendance at this meeting was in conjunction with a site visit that his office had coordinated with all the CSCs. Minutes from the meeting were produced and have been made available on the MITAC web site at www.meditac.com/documents/.

Interaction with NASA

MITAC continues to support requests from NASA Headquarters. In all cases these are coordinated closely with the contracting officers technical representative (COTR), Dr. Samuel Pool at JSC. Several key activities included a rewrite of the NASA Strategic Plan for Telemedicine and Telehealth. This version is a revision of the original strategic plan written by Mr. Charles Doarn in 1997. This request came to Dr. Merrell, Mr. Doarn and Dr. Sanders through the Life and Microgravity Sciences and Applications Advisory Committee.

MITAC is working closely with Headquarters Office of Life and Microgravity Sciences and Applications (OLMSA) to develop a telemedicine plan to support the Agency's initiatives in the Ukraine. During the past several months and on behalf of NASA Headquarters, MITAC has explored potential telemedicine activities in Alaska. On several occasions Mr. Doarn has provided input to NASA Headquarters to support both congressional testimony for Code U, OLMSA as well as provide material on telemedicine for the NASA Administrator's speeches.

MITAC was asked by NASA Headquarters to develop two white papers (concept papers). One was on telemedicine in disaster response and the second was telemedicine in home health care. Both of these papers were submitted to Code U. Mr. Doarn has been involved in a number of discussions with Dr. Saralyn Marks (NASA Headquarters and Department of Health and Human Services – Office of Woman's Health) to discuss potential collaborations with the American College of Radiology on breast cancer and telemedicine.

MITAC continues to develop and foster a strong relationship with NASA JSC. Mr. Doarn has worked closely with Dr. Pool in developing a 'Concept of Operations' for MITAC. This JSC-developed document was developed to support NASA's oversight of the MITAC. The MITAC management team participates with JSC, Marshall Space Flight Center (MSFC), and Headquarters personnel in regularly scheduled teleconferences that are focused on MITAC project status.

Mr. Doarn visits JSC on a regular basis either to meet with JSC Space Life Sciences Directorate (SA) personnel or to participate in telemedicine-oriented meetings. In November 1999, Dr. Merrell, Mr. Doarn, and Dr. Sanders participated in the JSC-lead "Strategic Planning Meeting for Telemedicine in Space Flight." Additionally, Mr. Doarn and Dr. Sanders participated in several JSC, MITAC, and U.S. Army Telemedicine Advanced Technology Research Center (TATRC) meetings on collaborative activities in telemedicine. Mr. Doarn also serves as a member of JSC Working Group on Telemedicine.

On a number of occasions, MITAC has responded to MSFC request for statistics required by the Space Product Development Office.

MITAC interacts with NASA Ames Research Center (ARC) with specific focus on information systems and biocomputation. Dr. Muriel Ross, formerly of NASA ARC now at the University of New Mexico (UNM), has been developing a relationship with MITAC. This cultivation will result in a subcontract for her services through UNM with a focus on the 'Virtual Collaborative Clinic.'

In March 2000, MITAC personnel visited with the Langley Research Center (LaRC) Director and the LaRC Office of Technology Transfer. Several potential technologies for telemedicine and health care technologies were presented.

MITAC is leading an effort to assemble an inventory of NASA telemedicine activities Agency-wide. Each NASA field center has identified a point of contact and a questionnaire has been developed for electronic data entry.

Organization

MITAC has assembled an excellent team of technical and medical professionals to meet its objectives. The staff is highly motivated and extremely talented. Each member significantly contributes to MITAC in unique ways. Several post-doctoral fellows have joined the staff. These individuals bring a unique perspective to the organization. In addition, a physician on staff within the Department of Surgery, Dr. Rifat Latifi has stepped into the role of Director of the MITAC Educational Program and has done very well in promulgating the MITAC educational initiatives.

Scientific Direction

Dr. Jay Sanders continues as the MITAC Scientific Director under a contract with VCU. He continues to work with MITAC to identify technology needs and search out prospective partners that share common interests in developing and validating technologies appropriate for both space applications as well as on the ground.

Dr. Sanders has been involved in the following activities in support of the MITAC and its mission:

- 1) Organize and conduct the Medical Informatics Conference at NASA JSC in March 2000.

- 2) Began the initial planning phase for a second MITAC conference with a focus on ultrasound.
- 3) Interact with the Department of Defense and the TATRC to determine unique needs and potential collaborations in adapting technologies to meet these needs.
- 4) Participation in all MITAC board meetings and interaction with MITAC management in planning activities and developing strategies for success.
- 5) Attended the World Congress on Telemedicine in Toulouse, France in March 2000.
- 6) Initiated and begun development of a relationship with Dr. Howard Champion to develop new tools for training and teaching in trauma surgery that have potential applications in astronaut training.
- 7) Exploring an opportunity to have Worldwide Healthcare Division of EDS collaborate as an affiliate with MITAC.
- 8) Establish with MITAC a company, imMEDiate Care that is focused on developing and distributing telemedicine or health care kiosks. This company is one of the initial five that will come out of MITAC.
- 9) Work closed with MITAC to further the commercial concepts of telemedicine and further promulgate the idea of a contract research organization with a specific focus on telemedicine technologies and tools.

EDUCATION

MITAC has developed a comprehensive educational plan that highlights goals and objectives of MITAC's initiatives in education.

The MITAC telemedicine course, which has been presented both at Yale University and here at VCU, has been updated and will be available on both CD-Rom and via the Web in May 2000 in a beta version. The CD-version has a hypertext interface that permits the student to link back to servers at MITAC for additional information and interaction. This multi-session instructional module trains the student on the clinical, administrative, and technical aspects of contemporary telemedicine collaboration.

A multilingual CD-Rom (English, Spanish, and Portuguese), developed under a contract with the Society of International Space Cooperation was completed and delivered to the MITAC.

The Department of Surgery's grand rounds, held weekly, have been archived on the MITAC web site www.meditac.com/education. The archiving of these lectures utilizes video streaming with Real Player. This permits the viewer to go online and see the lecture in its entirety including synchronized graphics, anytime, anywhere in the world.

This same technology has been incorporated into the MITAC lecture series conducted with various medical institutions in Russia, Ukraine, and Armenia. This series is located at www.meditac.com/education. These lectures cover a wide spectrum of medical topics delivered to students and medical professionals around the globe. Discussions and question and answer sessions are held weekly on the MITAC multi-point H.323 videoconference server.

The MITAC, Department of Surgery and the VCU Department of Engineering developed and conducted a seminar series entitled “Engineering The Future of Medicine”. The series included presentations on 1) Clinical Problems/Engineering Solutions I: ICU and Home Health Care; 2) Biosensors; 3) Tissue Engineering and Repair; 4) Medical Informatics as Context for Health Care; 5) Human/Machine Interface; and 6) Clinical Problems/Engineering Solutions II: Rehabilitation. This seminar series provided an excellent forum for the exchange of ideas and established a foundation for exploring collaborative activities.

PROJECTS AND TESTBEDS

During the past six months, MITAC has been involved in a number of activities. The following is a status of each of these.

Everest Extreme Expedition

At the conclusion of the Everest Extreme Expedition in May 1999, Dr. Merrell met with the team members who participated in the expedition and outlined a plan for preparing manuscripts that highlighted the many achievements of the E₃ activity. To date 5 manuscripts have been completed and submitted to peer reviewed journals. These manuscripts are listed in the Publications Section of this report.

Operation Rainforest - Ecuador

Deep inside the jungles of Ecuador, Dr. Ronald Merrell demonstrated laparoscopic techniques in gall bladder removal to surgeons at VCU via the Internet. Despite being a 10-hour drive from the nearest major city, a portable telemedicine system, existing phone lines and a local Internet connection provided access to physicians at Virginia Commonwealth University. In addition to the this connection, a system has been installed to permit local surgeons to collaborate from Cuenca to the outlying areas within Ecuador. Physicians are now able to view patient records and talk directly to the patients from an ordinary desktop computer and explain symptoms or complications they may be encountered days prior to an actual operating procedure. A custom database has been developed and is in place to collect validation data on these events. This work has been accomplished with a MITAC person on site in Ecuador. A manuscript is in preparation that reviews the cost effectiveness of telemedicine in an environment such as this.

Dominican Republic

In March 2000, MITAC personnel worked closely with VCU physicians in supporting Operation Helping Hand. MITAC established video and data

communications between the U.S. and a clinical site in the Dominican Republic via the Internet using Plain Old Telephone System (POTS) and portable satellite connections. MITAC personnel transferred files and conducted videoconferences with personnel at VCU. During videoconferences, live images of surgical procedures such as a laparoscopic cholecystectomy were transmitted in real-time so that physicians at VCU were able to view and identify structures within the abdomen as well as make recommendations on “where to cut” using the whiteboard feature. Because of the integration of standards-based protocols, a physician from anywhere in the world would have been able to participate in this scenario with as little as a dialup connection to the Internet.

Jamaica

As a result of an opportunity, MITAC was provided with some donated computer equipment and asked to evaluate the potential of telemedicine and distance learning in Jamaica. These computers were outfitted with software and small cameras to support videoconferencing and installed in a hospital in Montego Bay, Jamaica. Although several tests have been conducted, the project has not moved forward. There is, however, tremendous interest in how telemedicine can be integrated into the health care system of Jamaica.

Kosovo

In January 2000, the Dean of the School of Medicine, University of Prishtina, Prishtina, Kosova visited VCU and signed a Memorandum of Understanding with MITAC to explore collaborative activities in telemedicine and distance learning. In follow-up, MITAC representatives visited the Surgical Hospital at the University of Prishtina in February 2000. There are numerous issues in the war-torn region including lack of specialty talent, equipment, supplies and communications. The 3-person team engaged in surgical procedures, education and technology assessment. Information gathering on the affects of landmine victims was also initiated.

Telecollaboration On Line Database

VCU’s Office of Intellectual Property Foundation has assisted the MITAC with obtaining a copyright for the Telecollaboration on Line Database (TOLD). This Web-based interactive tool is currently in the process of being licensed by Knowledge Systems International, Inc. In addition, MITAC personnel are developing a second series of changes.

G-8 Subproject 4

MITAC participated in international meetings of the G-8, Subproject (SP)-4 held in London, England and in Toulouse, France. The follow on project, International Multipoint Project of Advanced Communications in Telemedicine (IMPACT) continues between the U.S. (VCU) and sites in Montreal, Canada, Regensburg, Germany, and Oxford, England. Mr. Doarn participated as an author to facilitate the publication of the G-8 SP-4 final report. IMPACT lectures continue in Breast Cancer research and Trauma

MITAC is working closely with colleagues on the G-8 to develop telemedicine practice guidelines.

France

MITAC established a relationship with Institut de Médecine et de Physiologie Spatiales (MEDES) in the following areas:

- 1) Explore technologies that might be adapted and integrated into home health care. Candidate technologies include personal status monitoring for patients who have illness or injuries such as neurological disorders or cardiovascular disease. Global positioning system (GPS) also will be integrated into these candidate technologies. MITAC will develop a common protocol for gathering data. This standard protocol will be utilized to collect data from a variety of sources. Simple communication protocols will be the foundation of data exchange.
- 2) Foster an infrastructure for education exchange. Multimedia tools will be made available through the Web and as a stand-alone CD-Rom. Materials would be shared through licensing agreements and they will also MITAC and MEDES will market their educational material as a commercial product. .
- 3) Agree to explore the establishment of a Telemedicine Service Organization that would serve the medical needs of these travelers. This will be accomplished through a panel of consultants, located in each respective country, United States and France. A traveler would solicit guidance from a counselor in the country they are visiting. The counselor serves as a liaison who would connect the patient with their doctor in the their home country via some communications modality.
- 4) MEDES agreed to work with the MITAC in exploring collaborations with the organization, with Doctors Without Borders, to provide technical assistance in integration medical informatics capabilities into their efforts.

This MOU is aligned with one of NASA Headquarters OLMSA's performance goals for FY00.

MITAC personnel participated in the World Congress on Telemedicine in Toulouse in March 2000. Mr. Doarn delivered two presentations. One on telemedicine in disaster response and the second on telemedicine in Russia. Dr. Rifat Latifi and Mr. Doarn also met with G-8 representatives to discuss a presentation on the G-8's response to the situation in Kosovo.

Republic of Georgia

MITAC's relationship with the National Information Learning Center (NILC) in Tblisi, Georgia continues. Regular scheduled videoconferences are held between MITAC and NILC to discuss collaborations in telemedicine and distance learning.

Greece

Staff at MITAC member, Yale University, is collaborating with several medical organizations in Greece, including Red Cross Hospital, University of Thrace, Hatjikosta Hospital, and Macedonia University. Interactions have included clinical consultations with TOLD, multimedia short courses for supporting distance learning and a telemedicine conference. The relationship between the MITAC, Yale University, and Greece has provided a foundation for developing telemedicine as an effective tool for health care delivery in Greece. In fact the government of Greece has allocated millions of dollars to this endeavor.

Tyco U.S. Surgical

Two key activities continue. VCU's Minimally Invasive Surgery Center and the Yale University Endo-Laparoscopic Surgery both continue to strive for excellence in surgical science, adaptive training techniques, and enhance educational tools, procedures and methods.

Russia

MITAC has a rich and productive relationship with several entities in Russia. These include TANA, Ltd; Zil Hospital; Moscow Medical Stomatological Institute (MMSI); and the Space Biomedical Center (SBC) for Research and Training. Efforts with these organizations continue. MITAC has developed in collaboration with the sites listed above a series of activities. These include teleconsultation services, regular interactive videoconferences, and distance learning.

The SBC is working closely with Dr. Merrell and Mr. Doarn to facilitate the preparation and publication of the following manuscripts:

1. Orlov, OI, Drozdov, DV, Doarn, CR and Merrell, RC. Wireless ECG Monitoring by Telephone Leads.
2. Orlov, OI, Doarn, CR, and Merrell RC. Business Development of Telemedicine in Russia.
3. Fedyukin IV, Reviakin, YG, Orlov, OI, Doarn, CR, and Merrell, RC. Experience in Applications of Java Technologies in Telemedicine.

Ukraine

MITAC received a task order from NASA JSC COTR to develop a plan, which outlines how MITAC will work with NASA in developing a telemedicine capability within the Ukraine. This is in response to interaction between the U.S. Department of State, NASA, NSAU and the Science and Technology Council of Ukraine.

MITAC provided input into several documents 1) letter agreement between NASA and NSAU and 2) a complete rewrite of NSAU's proposal to NASA, and a preliminary review of Ukrainian Telemedicine Proposals.

Romania

MITAC provided input into NASA Headquarters response to a request from the Ambassador of Romania regarding an interest in developing and integrating telemedicine into health care in Romania. The principle interest was to assist in the providing a basis for a mobile breast-imaging vehicle linked to a hub in Bucharest via the Internet.

Conference Participation

MITAC has participated and supported various conferences and online events including the Distributed Medical Intelligence Conference (Crested Butte, CO); Telecon West (Anahiem, CA); Telehealth and Multimedia Congress (Alberta, Canada); the Arctic Council on Telemedicine (State Department); the G-8 Conferences (London, England and Toulouse, France), World Congress on Telemedicine (Toulouse, France); NASA Headquarters-sponsored videoconferences on Public Health; Internet2 Megaconference; and the American Society for Information Scientist (Washington, DC). MITAC also arranged the first Internet Protocol, H.323 surgical mentoring over the existing university Ethernet in December 1999.

TECHNOLOGY INITIATIVES

MITAC has partnered with a number of organizations to explore new technologies or adaptations of existing technology in telemedicine. These included wireless monitoring.

The following technologies are leading to new products and services for telemedicine applications.

- 1) Rapidly Deployable Telemedicine Unit (RDTU)
- 2) Mobile Surgical Facility
- 3) Web-based interactive medical record – TOLD
- 4) Web-based teaching tools
- 5) Vital signs monitoring devices and wireless technologies
- 6) Hand held ultrasound device – in partnership with FAU CSC
- 7) Home health care concepts

BUSINESS DEVELOPMENT

The Department of Surgery, with MITAC support has developed a commercial relationship with QualKids, Inc. through an MOU. QualKids has developed a medical content Web site that requires information on pediatric surgery and other medical issues germane to parents, day care workers, and health care providers. QualKids has provided cash to the Department of Surgery for this content. The MITAC plays a significant role

in working closely with QualKids and the Department of Surgery in providing this information.

MITAC has developed an MOU with Knowledge Systems International (KSI), Inc. KSI is in the process of developing a licensing agreement with VCU to license the TOLD for applications in a multicasting activity with AT&T and CISCO. It is envisioned that KSI will provide VCU and the MITAC with a number of services such as upgraded routers and multicasting capabilities for no cost. In addition, MITAC and VCU will receive a revenue stream from licensing fees and royalties once this agreement is in place.

MITAC is working closely with both the VCU Intellectual Property Foundation (IPF) and the Virginia Biotechnology Research Park to establish several spin-off companies in the VBRP. These include the following concepts:

- ✓ Mobile Medical Solutions, Inc. The focus is on the MITAC-developed Rapidly Deployable Telemedicine Unit (RDTU) and mobile surgical facilities.
- ✓ DiaSon, Inc. The focus is on a portable diagnostic ultrasound device that has been jointly developed by the CSC for Space Communications Technology Center at Florida Atlantic University.
- ✓ imMEDiate Care, LLC. Established outside of MITAC and VCU, this company will work closely with MITAC in the VBRP. The focus is on a telemedicine portal or kiosk.
- ✓ Adaptive Telemedicine and Telehealth Services. This company is envisioned as service-oriented, providing basic legal, accounting, marketing, etc to the five start up companies from MITAC.
- ✓ e-EdMed. This company is focused on educational content in interactive multimedia, web-based distance learning in medicine – surgery
- ✓ Contract Research Organization. This company (not yet named) would serve the telemedicine community at large as a CRO, focusing on validating and certifying telemedicine tools and technologies.

These company names, concepts and technology focus are subject to change, especially as development continues in both the products and the company structure. MITAC has also focused on recruiting an individual to serve as the Chief Operating Officer (COO) of these entities.

PUBLICATIONS

1. Angood PB, Satava R, Doarn CR, Merrell RC, and E³ Group. *Integrated Telemedicine in a Remote Hostile Environment - Review of the Yale/NASA Everest Extreme Expeditions 1998 & 1999. (Manuscript submitted to Telemed J)*

2. Satava R, Angood PB, Harnett B, Merriam N, and Merrell RC. Ambulant Physiological Cipher: Real-time Monitoring of Status and Position on Everest. (*Manuscript submitted to Telemed J*)
3. Harnett B, Angood PB, Merriam N, Satava R, Doarn CR, and Merrell RC. Internet Integration of Medical Devices and Telecommunications for Remote Telemedicine: The Everest Experience. (*Manuscript submitted to Telemed J*)
4. Grin, J. Visual Function and Ophthalmologic Evaluations in Response to Hypoxia. (*Manuscript submitted to Amer J of Ophthalmology*)
5. Macedonia, C. Can Normal and Abnormal Adaptations to Hypobaric Hypoxia be Quantified via Remote Consultation Using a Portable Medical Imaging and Laboratory System. (*to be submitted to Aviation, Space and Environmental Medicine*)

FUTURE PLANS

The focus of the next six months for the MITAC is to continue with its test beds and support NASA's needs as required. A major focus will be to continue to develop and solidify the development of the initial spin off companies from MITAC activities. The commercialization activity will continue in a robust manner such that the companies outlined above will be in place by early fall.

The development and establishment of new partnerships will continue with organizations and academics institutions within the US and abroad. The future looks bright and MITAC is excited about its upcoming opportunities.