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**ABSTRACT**

This is a pilot study utilizing a Firearm Training Simulator, FATS, as part of the rehabilitation of upper extremity traumatic injuries, including amputation, incurred by American soldiers, airmen, and marines while serving in Operation Iraqi Freedom or Operation Enduring Freedom who are undergoing rehabilitation at Walter Reed Army Medical Center. The objective is to assess the number of study participants that re-qualify with a Military service weapon following guided training on FATS. The advances in rehabilitation, medicine, and technologies afford combat-wounded soldiers the opportunity to remain vital assets to the American fighting force.

The FATS supports training for both individual marksmanship skills and squad level skills, to include tactical exercises with a variety of modified weapons. The scenario presentation technologies utilized consist of compressed MPEG2 digital video with marksmanship lanes using high-resolution 2D graphics and interactive targets. Three dimensional graphics delivered with computer generated imagery create virtual training scenarios.

Military service members who participate in this study will receive customized rehabilitation that incorporates FATS into their plan of care. The anticipated benefits of utilizing this technology are two-fold: first, it will allow the service member the opportunity to re-handle and re-qualify on service weapons; and secondly, it may contribute to a smoother, speedier, and safer reintegration of soldiers back into the Military environment.

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## **BODY**

### **Objective**

The objective is to assess the number of study participants that re-qualify with a Military service weapon following guided training on FATS.

### **Background Data**

The FATS being requested for this study is the CST300D. The CST300D meets the challenging demands of the military in support of marksmanship, and judgemental (shoot/no-shoot) scenarios use of force training. State of the art technologies are incorporated into the CST300D to produce an overall system accuracy of 0.1 – 0.3 milliradians, depending on the systems configuration. The Windows-based instructor interface and open architecture design allows for multiple language support as well as future upgrades. The CST300D supports training from individual marksmanship skills through team/squad level tactical exercises with a variety of modified weapons. The scenario presentation technologies utilized consist of compressed MPEG2 digital video with marksmanship lanes using high-resolution 2D graphics and interactive targets. Three dimensional graphics are available utilizing computer generated imagery. The weapons for this simulator are environmentally safe and do not require primers. The software provides support for up to four wireless weapons, Bluefire, or non-lethal force options. By utilizing the CST300D simulator, a rehabilitation program can be developed to simulate the many challenging demands of the soldier to include: support for marksmanship and judge-mental use of force, realistic targets selected as friendly or threat, realistic human entities and realistic time-of-day lighting and weather conditions.

### **Methods**

Patients being consulted to the Occupational Therapy Clinic, WRAMC, for rehabilitation of an upper extremity injury will be prospectively enrolled, once screened by a therapist for eligibility. By implementing the use of the FATS into the rehabilitation program of the upper extremity injured soldier, an operational environment will be simulated to facilitate the re-qualification with a Military Service weapon.

The project manager will gather information about each upper extremity injury as related to their military career, such as time in service, age, gender, rank, Military Occupational Specialty (MOS), diagnosis, and level of participation in the training will be tracked. Data will be coded in the way outlined below:

- A. Initial marksmanship score
- B. The training time on the FATS will be coded as one of the following:
  - 1. Less than one hour of training time
  - 2. Between 2-4 hours of training time
  - 3. Between 4-6 hours of training time
  - 4. Between 6-8 hours of training time
  - 5. Between 8-10 hours of training time
- C. Whether or not the subject is able to meet qualification standards on a Military Service weapon.

### **Conclusion**

The goal is to track the number of subjects who successfully re-qualify with a Military Service Weapon and monitor the number of hours spent training on FATS.

**Medical Application:**

By implementing the use of the FATS into the rehabilitation program of the active duty upper extremity injured soldier, an operational environment is simulated to facilitate the reintegration of that soldier back into the Military environment. The data gathered through quantitative research aids in developing a standardized training program specific to the needs of the upper extremity injured soldier allowing him/her to train in those common tasks necessary for operational requirements. Due to limited data on firearms training systems, and no other competing technologies, this proposal is a demonstration of the Military's efforts to remain the forerunner in setting the standard for program development. This research effort also maximizes data collection opportunities that could further benefit the active duty upper extremity injured soldier and their counterparts within the civilian sector.

**Continuation of Study**

Initial budget amount for project will expire on 23 November, 2005. A request for additional funding to continue and complete this study has been submitted to John DePasquale, TATRC. The time frame it took from the start of the FATS concept to deliverable is over 16 months. Work on the study began February, 2004, and the grand opening was held in June of 2005. The lengthy process of protocol concept, submitting for DCI approval, and construction delays has depleted most of the salary portion of the budget.

An additional 20 patients are needed to enroll in the study and qualify on a live-fire range. A focused effort in recruiting all upper extremity wounded patients is underway to achieve desired number of study subjects into the program.

The patients love the FATS training and find it very realistic to live-fire training. All suspect that the training will help them on the range. Proper prone position is being stressed as well as breathing, sight alignment, and trigger control.

Another factor that is emphasized during training is muzzle control. Changing the weapons magazines while keeping the muzzle pointed down range is a safety issue. Muzzle control has got to be maintained throughout the training if we expect to qualify on a live-fire range. What used to be second nature is now frustrating and muzzle flare is present. Changing weapon magazines with a one-handed technique is being developed. Some methods that have been taught to the patients at Basic Training; however, they appear to be more for a battle-wounded individual who has no choice in reloading during battle. These taught methods are likely unacceptable on ranges as they promote unsafe muzzle control (which would be a no-go on a live-fire weapons range).

This study could be expanded to include lower extremity amputees as well. It would be a good study to develop proper prone position firing, as well as balance while shooting the weapons. A future study may also include exposure therapy to PTSD patients under the strict guidance of psychiatry.

## **KEY RESEARCH ACCOMPLISHMENTS**

As of 4 September, 2005, 15 patients have enrolled in the study. Two patients have reached the 10 hour benchmark of training on the FATS, but no subject has gone to a live fire range to qualify with the M16, M4 or M9.

The study has encountered multiple issues. One issue is that most of the patients who've lost their arm above the elbow can't shoot unsupported prone. The prosthesis and harness are very limiting in movement. If they can't shoot unsupported prone, they can't re-qualify, according to FM 3-22. Another issue is that patients have a difficult time holding the weapons "off hand" as they become heavy and painful on their residual limb. This appears to affect those study subjects with shorter residual limbs.

Trans-radial amputees and wrist disarticulation amputees find it easier to shoot and qualify on the FATS system than trans-humeral or shorter trans-radial amputee patients. On shorter, trans-radial amputees, the ability to hold the weapon steady while firing is difficult. The prosthesis may only be resting on two inches of the residual limb making it unsteady while trying to visually maintain a sight picture. The longer, trans-radial amputees and the wrist disarticulation amputees find it relatively easy to hold a steady sight picture while firing.

It's also becoming apparent that current harness design for trans-humeral amputee patients needs examined and possibly re-designed or modified to accomplish an unsupported prone firing position.

Another hurdle is locating a funding source for the weapons, ammo, and a range to do the live fire qualifications. The closest range that offers pop-up targets is at Ft. AP Hill which is two hours South of WRAMC.

The question has surfaced about the various qualification standards between services, and whether or not there should be a tailored evaluation of each study subject's exact requirements based on his/her branch of service.

Some patients have begun FATS training but have not completed it due to a return home following a MEB out of the Service. Additional patients have signed up for the training, but have failed to make scheduled appointments.

An addendum to exclude patients with PTSD has been initiated. A consulting psychiatrist has evaluated the FATS training and has agreed with the recommendations put forth in the addendum. Patients currently enrolled will continue training, and new subjects will be enrolled once addendum is approved.

**REPORTABLE OUTCOMES**

The study is still on-going. No outcomes can be reported on at this time.

**CONCLUSIONS**

No conclusions can be made until the study is complete.

**APPENDIX A: TECHNICAL SUMMARY**

To date all current weapons have been returned for repair, and are back in use except for the M9. The M9 is still in the FATS Service Department being repaired, however they did send a "loaner" M9 to keep the program alive for those who want to shoot pistol.

The next generation of FATS firearms, Bluefire, is about to be deployed by FATS. Bluefire weapons are tether-less while still providing the realistic recoil by Nitrogen filled magazines instead of the CO2 filled trunk lines. Shot feed back is transmitted to the control station through Bluetooth technology. This new generation of weapons will allow the users more freedom while doing the live-video MOUT scenarios and also utilizing the CGI Authoring abilities. New TSP's are stating the development and training of quicker, reflexive close-quarters combat training, and the Bluefire weapons would be extremely realistic by providing the un-tethered technology for freedom of movement.

**APPENDIX B: FUNDED PERSONNEL AND PARTICIPANTS**

**Funded Personnel:**

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**APPENDIX C: SUPPORTING DOCUMENTATION**

N/A

**APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS**

No posters, presentations or publications have been presented as of 5 September, 2005.