SOLDIER C³

COMPUTER AUTOMATION FOR THE SOLDIER

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A. COMMAND ON THE MOVE

Operation Desert Storm demonstrated the value of advanced technology on the battlefield. It also surfaced the need for what the Army is now referring to as, "Command-on-the-Move". It showed that speed, flexibility, and the ability to react faster than the enemy, are all vitally important to a swift and decisive victory. It also showed that, given this superior ability to rapidly move its forces, a force must still maintain the ability to exercise Command and Control (C²) while on the move. Speed and flexibility are only of value if commanders, at all echelons, have the ability to direct their resources.

What part did the individual soldier play in the victory of Desert Storm? What part will he play in future battles? The answer is, "a vital role", and the Army must work to provide the future soldier with the same advanced technology that has made our aircraft and armored vehicles the best in the world. Speed, flexibility, and Command & Control (C²) are as important at the individual soldier level as they are to aircraft and vehicles and at higher echelons. Advanced technology has the

potential to increase the efficiency and effectiveness of individual soldiers, at all echelons. The Army does have a major initiative under way known as the "Soldier System", of which a major portion is known as Soldier Command, Control & Communications (C³). This paper will cover the basic concepts and objectives of the Soldier C³ Program.

B. SOLDIER SYSTEM

The Soldier System is a coordinated effort by many Army organizations to start treating and developing the Soldier as a major weapon "system" for the purpose of increasing the effectiveness and reducing the weight burden of the soldier. The Soldier System is defined as "... the individual soldier, and everything he wears, consumes, or carries for individual use in a tactical environment ...". The U.S. Army Communications & Electronics Command (CECOM) Soldier C³ Program will be an integral part of the Soldier Systems.

The first big demonstration of the Soldier System will be the SIPE demonstration, which stands for Soldier Integrated Protective Ensemble. This is an officially chartered demonstration

20.3.1

known as an Advanced Technology Transition Demonstration, or ATTD, and is scheduled to take place in September '92. CECOM is playing a major role in the demonstration by integrating into the system a computer, radio, and host of other electronic devices and capabilities.

The fieldable system is known as The Enhanced Integrated Soldier System (TEISS), and is scheduled to enter development in 1994, and production in 1999.

C. SOLDIER C3

Soldier C³ is an umbrella program at CECOM which includes various efforts relating to the electronics and Command, Control, and Communications (C³) capabilities of the individual soldier. It is comprised of the Soldier's Computer and Soldier's Radio Programs, as well as a host of related concepts still under development.

D. SOLDIER'S COMPUTER

The Soldier's Computer will consist of the following components:

1. Pocket Size Computer

The target weight of the basic processor, including battery and basic peripherals is 1 lb., for infantry soldiers. The processor has not been chosen yet, but some of the major trade-offs will include capability, weight, cost, and power consumption. Higher speed microprocessors can run better software and more peripherals, but also consume more power, which adds to weight and cost.

2. Display

The visual output device could be

mounted to the helmet or cap, to the wrist, or to the back of the pocket computer. There are two types of head-mounted displays:

a. A heads-up display reflects its image off goggles or a faceshield, which permits the soldier to look through the computer image and still see the real world. This has the advantage of not blocking any of the forward vision of the individual, but the disadvantages of being heavier, more expensive, and more confusing for the user.

b. An occluded display blocks a portion of the forward vision, but one could still drive a vehicle by positioning the device at a low angle, or work with his hands by positioning the display at a higher angle. Human factors tests need to be conducted to determine the user preferences of these two types of displays.

3. Computer Input Devices

a. This could be a joystick or trackball mounted to the belt, to the pocket computer, or hand-held.

b. Voice recognition is another prime candidate for an input device, because it would permit hands-free input. It is likely that voice recognition will always need a backup device.

c. An in-the-ear microphone is currently being evaluated by CECOM. This device is less obtrusive than a helmet-mounted boom microphone, and also cuts out virtually all ambient noise, since it picks up the vibrations of the users voice that travel through the bone structure of his head.

d. The future soldier will probably utilize a suite of input devices that he will choose based on his particular task

20.3.2

and situation. It is predicted that some truly unique devices will find great utility for military applications.

4. Position/Navigation (POS/NAV)

Global Positioning System (GPS) devices are downsizing very rapidly and could provide a partial POS/NAV solution for the soldier. Additional concepts are also being considered such as pedometers, miniature accelerometers, and triangulation based on directional antennas and distance between Soldier's Radios.

5. Beyond these basic components, there are numerous other peripheral devices that could be integrated into the Soldier's Computer including:

a. Medical sensors that could monitor a soldier's medical status in combat. The output could be fed back to the soldier so that he could pace himself, as well as reported up the chain of command so that each level of command could see a rolled-up summary of the medical status of subordinate units.

b. Audio sensors could provide the soldier with situation awareness beyond his own natural capabilities.

c. Video Imagery: The soldier could snap a digital image with a camera or night vision device and transmit it to his squad leader. This would give the squad leader the ability to see what his soldiers see.

E. SOLDIER'S RADIO

The Soldier's Radio will be a personal communications device which will transmit both voice and data. While its primary purpose will be for communications within small units, it will also have the capability to

interconnect with the other data networks planned for the future battlefield. This internetworking will extend the range of the radio and increase its utilization. CECOM is currently performing a study on the Soldier's Radio to identify all of the technical approaches which have potential for meeting this requirement. As part of this study, we will be working very closely with the user community to start trading off the advantages and disadvantages of each technical approach.

While the aforementioned study is far from complete, certain conclusions are beginning to crystallize. The network architecture within squads will likely be a Net Topology, where each radio attempts to connect directly to each other radio in the unit. This will provide the greatest chance of maintaining squad-wide connectivity in varying terrain. Connectivity outside the squad will probably be through a central node, and may be limited to data only. The Soldier's Radio will probably end up being a card embedded in the Soldier's Computer and not a stand alone system. Both the radio and computer will certainly be acquired as a Non-Developmental Item (NDI), though certain peripherals such as antennas may need to be developed by the Army.

The choice of a frequency band has not been made, but will require the consideration of many factors including propagation, radio density, separation and replication of frequencies and nets, connectivity requirements, throughput, voice/data requirements, compatibility, range, cost, and NDI availability.

Also under study and not yet determined are the appropriate levels of Information Security (INFOSEC), Communications Security (COMSEC), Transmission Security (TRANSEC), and Computer Security (COMPUSEC).

A host of additional considerations are under study including voice/data contention, full duplex operation, internetworking, new protocols, power conservation techniques, unmanned retransmission units, Electronic Counter-Countermeasures (ECCM), antenna design and location on the soldier, and the problem of high densities of Soldier's Radios on the future battlefield.

F. APPLICATIONS OF SOLDIER C³

The number of applications that can be derived from Soldier C³ are limited only by one's imagination. This section will cover some of these applications, with an emphasis on those users that relate to Command-on-the-Move.

1. Battlefield Status

"Seeing" the battlefield has always been vitally important to all echelons of battlefield command. Soldier C³ will permit even the individual soldier to view a map depicting information such as friendly and enemy positions or contaminated areas. A team of soldiers could view the same map while receiving commands or discussing strategy, and could do so while marching or riding in an armored vehicle.

The soldier could also become a source of battlefield information. He could report enemy movements, terrain

information, or other forms of data. He could be a passive platform for various sensors that would collect and forward data without his knowledge. For example, his audio sensor might sense an enemy helicopter that the soldier himself need not be concerned with.

This same information would both increase lethality and decrease fratricide. It would also increase the speed at which infantry squads could safely take new ground.

2. Multi-Media Communications

The current mode of communications within the squad consists of voice and hand signals. The Soldier's Computer and Radio will provide various other means of communications which will have advantages in many situations.

Voice radio will permit soldiers to spread further apart, while still retaining the ability to communicate and function as a team. Text messages could be input into the computer and then delivered by the network for later review. Voice mail will permit a verbal message to be recorded and delivered by the network. For preformatted messages, such as a call-for-fire report, the computer could fill in many of the blanks. Digital photographs will permit a soldier to show his commander what he sees.

Each of these means of communication has certain advantages based on factors such as the available bandwidth, or the types of information that need to be transmitted. Multimedia communications, at the soldier level, will bring us closer to the ultimate goal

20.3.4

of a real-time battlefield information system.

3. Vehicular Display

Many military systems such as tanks either have, or will have, computerized battle stations, which should work fine when the operator is sitting right at them. A pocket computer will permit the soldier to move away from his primary station and still maintain some level of interaction with the on-board computer. If for some reason the soldier is cut off completely from the system, he could still retain some degree of functionality.

4. Electronic Notebooks

Many soldiers enter into battle carrying large amounts of information in the form of paper-filled notebooks and small manuals. This trend can only increase as military warfare and equipment become more complex, and as soldiers need to be prepared to deploy anywhere in the world. Electronic notebooks, similar to the palmtop computers coming on the market, could be fielded in the next few years and could pave the way for the more complex Soldier C³ applications as discussed in this paper.

5. Additional Applications

a. Electronic Technical Manuals: U.S. Army policy already requires that technical manuals be developed in electronic format for new weapon systems. This maintenance software could be run on a belt-mounted computer with a head-mounted display and voice-recognition input system, which would provide the maintenance soldier with a fully portable hands-free

reference tool. This is an application that could be fielded within 3-5 years.

b. Embedded Training: As the battlefield and its equipment become increasingly complex, a new mode of training soldiers will be needed. One solution would be to equip the soldier with the ability to take training when and where it is needed. This embedded training has the potential to substantially increase a soldier's "virtual" knowledge.

c. Fire Control/Lethality: The Soldier's Computer, in conjunction with a thermal weapon sight, could aid the soldier in detection, acquisition, recognition, and engagement of enemy targets. Future improvements in lethality may have less to do with the weapon and more to do with the computer software.

G. CONCLUSION

U.S. aircraft, ships, and armored vehicles are the best in the world, and are so to a large part because of their advanced electronics and C³ capabilities. Advances in technology will now let us extend these capabilities to the individual soldier. Let it be hoped that the Soldier System can command the attention and the resources that will be needed to make this potential a reality.