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A Preliminary MANPRINT Evaluation of the All Source Analysis (ASAS)

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The object of the limited evaluation described in this research note was to provide data useful to ASAS developers. To that end, the note presents the findings of a limited MANPRINT evaluation of the All Source Analysis System (ASAS) conducted during operational testing in November and December of 1986. Questionnaires addressing the six MANPRINT domains were administered to all operators and their immediate supervisors. Questionnaires on system functions were given to personnel supervisors and to observers. Operators were interviewed at the end of the trials. Workspace and physical measurements were obtained in the Forward Sensor Interface and Control work-shelter module to assess their compliance with appropriate human factor engineering standards. The collection of meaningful data was severely hampered by security, equipment, and organizational restrictions.

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A PRELIMINARY MANPRINT EVALUATION OF THE ALL SOURCE ANALYSIS SYSTEM (ASAS)

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A PRELIMINARY MANPRINT EVALUATION OF THE ALL SOURCE ANALYSIS SYSTEM (ASAS)

SYSTEM DESCRIPTION

The All Source Analysis System (ASAS) is being designed to provide commanders with a transportable, semiautomatic, tactical intelligence system capable of producing an integrated picture of the battlefield. In addition to system supervision, functions to be provided include intelligence development, situation development, target development, collection management, electronic warfare/electronic combat support, and operations security support. However, the system evaluated during the field trials at Fort Hood, TX, had a greatly reduced functional capability. In fact, only one of the modules, the Forward Sensor Interface and Control (FSIC), was configured as a part of the objective ASAS system. The items employed during the trials were operated as part of a Division communication net. The net included the forward sensor communicating to the Military Intelligence (MI) Battalion which communicated to the Division Tactical Operations Center (DTOC) Support Element. Under this net concept, intelligence information from the forward sensors and jammers is relayed to the MI Battalion and DTOC support elements, and requirements or tasking for additional information and data flows back through the system to the forward elements. Further description of the actual configuration employed during the field trials is given below.

Forward Sensors

Since the exercises controlled by the Operational Test and Evaluation Agency (OTEA) followed a given scenario, no actual Forward Sensors were employed. Messages representing several surrounding sensors were generated by the TACSIM computer, printed on input forms in the proper format and then taken to the Sensor Input Station. They were inserted into the system at the proper scenario time via the AN/PSC-2 digital communications terminal (DCT). Simulated TRAILBLAZER inputs were entered directly into the Forward FSIC.

Forward FSIC

The forward FSIC served as the collection point for all messages from the forward sensors and jammers. Most such messages were automatically relayed to the rear by means of secure radio communications. The forward FSIC also served as the relay point for tasking and other messages from the rear to the forward sensors. Employment of the Fully Automatic Routing of Messages (FARM) software permitted messages to be automatically routed to one or several addresses. Also, the software could be employed to identify messages that had combat information of immediate use to Brigade command staff. These messages were routed to the FSIC operator's queue, sanitized to an appropriate level, and then transmitted by voice radio to Brigade command staffs. Messages which were improperly formatted or improperly addressed were also automatically routed to an operator's queue for correction and retransmission. The FSIC is mounted in an S250 shelter transported on a Commercial Utility Cargo Vehicle (CUCV). A towed 12.5 kw generator provides power. The primary elements of the FSIC hardware include an RM 11/84 computer, a GRIDSE-T model 1179 operator terminal, a dual disk drive, a tape cartridge unit, two printers, five radios with

associated security devices, and a DCT. The DCT permits the FSIC operator to send or receive preformatted or free text messages to or from the frontline sensors.

Rear Combat Electronic Warfare and Intelligence (CEWI) FSIC

The rear FSIC is identical in construction to the forward FSIC and enables the same functions. But its operator typically performs many fewer functions than the operator in the forward FSIC. Most messages requiring operator intervention are handled in the forward FSIC. All messages from the forward FSIC (except those sent by voice directly to the Brigade liaison officer) are received by the rear FSIC and passed to the ASAS Interface Module (AIM). Similarly, all tasking and technical data messages from rear operators are passed through the rear FSIC to the forward FSIC for transmission to the sensors and jammers.

CEWI Tactical Control and Analysis Element (TCAE) AIM(6)

The AIM module consists of a VAX 750R computer and associated equipment which is mounted in an S250 shelter and transported by a CUCV. The computer collects and stores messages and data received from the forward sensors and jammers. This data can be accessed by the intelligence analysts. The (6) in the AIM(6) refers to the six operator stations which are housed in three Modularized Equipment Container Assemblies (MECAs). Five of the work stations contain MICROFIX terminals and the sixth, for the system supervisor, contains a TER-100 terminal. Two of the analyst work stations were for communications intelligence analysis, two for electronic intelligence analysis, and one for assets management. The stations were operated by members of the MI Battalion technical control and analysis element (TCAE). Although the MECAs were intended to be transported on a CUCV, during the trials they were mounted in a five-ton expandable van. A third CUCV was employed to haul ancillary equipment during movement, and two towed 12.5 kw generators were employed to provide power to the system.

DTOC AIM(6)

The hardware at the DTOC was identical to that operated by the TCAE. However, the functions performed by the operators were different. In addition to a system supervisor position, there were two positions for situation analysts, and one each for collection management, target assessment and All Source Analysis. The equipment at the DTOC was operated by personnel assigned to the Division G-2.

It should be noted that neither the work stations nor the AIM module itself are part of the objective (planned) ASAS hardware. Smaller, much lighter Portable Analyst Work Stations (PAWS) will replace the MICROFIX stations, and a new AIM module, designed to interface between the FSIC and the work stations, will replace the AIM employed during the field trials. Also, the software for the field trials was version RA which allowed only limited system functioning. The version of the RA release employed included changes to address tactical requirements of the 2nd Armored Division as identified during earlier testing. Software will be improved throughout the development of the system and will include multiple releases.

CONDUCT OF THE TRIALS

The initial operator training was conducted at the contractor's facility during August and September 1986. Two groups of personnel were trained in separate two-week training sessions. Training was followed by a system readiness verification test (SRVT), also conducted at the contractor's facility. Following the SRVT, the system hardware was transported to Fort Hood, Texas, and reassembled in a garrison environment. Data collector training was conducted in early November with practice in mid-November during a 2d Armored Division exercise. Second Armored Division personnel, who rotated as players and data collectors later during the field trials, received training on data collection prior to assignment as data collectors. A pilot test was conducted shortly after the middle of November to determine whether operator training, data collection procedures, data management procedures, and system availability were adequate to meet the objectives of the later phases.

The second phase of the trials consisted of two command post exercises (CPX) conducted during December 1986. The CPXs consisted of approximately 90 hours of system operation with the system being driven by TACSIM-derived outputs. The test directorate controlled the trials during both of the CPXs. A third phase, a field training exercise (FTX), was controlled by III Corps/2d Armored Division, and consisted of approximately 77 hours of system deployment and operation in maneuver areas on Fort Hood. The FTX was also conducted in December 1986.

TEST ISSUE

The test issue addressed in this report was issue six, MANPRINT: what are the MANPRINT implications of the AIM(6)/FSIC? The test director was aware that the domains of manpower, personnel and training would be addressed only superficially in the data. There were several reasons for this. First, most of the hardware system components involved were substitutes. Second, the software available was a very preliminary version. Third, the overall system configuration was very limited. Under these circumstances, it was felt that neither the operator personnel, their immediate supervisors, nor the test directorate personnel could realistically evaluate manpower requirements, essential personnel characteristics, nor the exact nature and extent of training required. On the other hand, it was felt that the domains of human factors engineering, health hazards assessment and system safety assessment should be covered to the extent possible in order to provide data for consideration in hardware/software design of the eventual system components.

It was further understood that priority should be given to the evaluation of the FSIC component of the ASAS. Any major deficiencies found in the FSIC would have to be considered for modification. Data on deficiencies and strengths of the stand-in modules would be provided to the designers of the future versions of those modules.

DETAILS OF THE TEST

Data Collection and Analysis Plan.

Early plans called for data pertinent to the MANPRINT domains to be obtained from questionnaires, interviews, rating scales, test personnel and data collector comments, relevant performance data from the OTEA database, physical measurements of selected human engineering characteristics and direct observations by the staff member. Copies of all data collection forms and requirements are shown in Appendixes A through J. All data collection forms were submitted to the test directorate for review and comment, and revised as requested. Items selected for the end-of-test structured interviews were those thought to be difficult to cover with a group-administered questionnaire. However, it was anticipated that the structured interviews would be revised based on both the direct observations during the trials and the operators' responses to the questionnaires. Although a general methodology and data collection plan had been coordinated with the test directorate, the actual data collection forms were not devised until the staff member had observed operator training and had the opportunity to review both the task analyses and the written training materials provided by the contractor. In addition, several items for inclusion in the questionnaires were submitted by test directorate personnel.

It was assumed from the beginning that descriptive rather than inferential statistics would be the primary mode of analysis. There were two primary reasons for this. First, there was no real predecessor system with which to compare the system under trial. Both the Battlefield Exploitation and Target Acquisition (BETA) system and the Technical Control and Analysis Center-Division (TCAC-D) provided limited support to signals intelligence functions. However, neither of these systems provides the full array of capabilities identified as ASAS requirements in the Required Operational Capability (ROC) document. Second, the number of individuals who performed any one of the specific operator or analyst jobs during the trials was very small. For example, while there were 20 MICROFIX station operators (two shifts of five operators each at both the TCAE and the DTOC), they performed seven different jobs. Four FSIC operators performed jobs in the forward FSIC, and another four worked in the rear FSIC. The workload of the forward FSIC operator was acknowledged to be both heavier and to include additional tasks not performed by operators in the rear FSIC. Therefore, considering the small number of individuals who performed any one job, statistical comparisons of the effectiveness of the system among the job positions or even between the TCAE and DTOC would have been of low value.

While these more typical comparisons were ruled out, some specific plans for the treatment of the data were made. These were:

One, an examination of the relationships among self-reported demographic data, responses to specific questionnaire items, and ratings by supervisors. It was assumed, for example, that any training or experience with computer systems (including either BETA or TCAC-D) should be related in some manner to supervisors' judgments of job performance variables, relevant knowledge, and

job/system attitudes. Similarly, it was assumed that experience as measured by time in MOS should show some relationship to the supervisors' ratings. However, no direction for any of the relationships was assumed. It was thought possible, for example, that the operators with more computer experience, while performing more adequately, might see more shortcomings in the system and give it lower ratings. Similarly, speculative reasons why job knowledge and experience could affect job performance and attitudes either positively or negatively could readily be postulated.

Two, tabulation of all responses to the multiple-choice items of each of the questionnaires was planned. Separate tabulations of responses for personnel in the DTOC and TCAE were planned, as were separate tabulations for operators in the forward and rear FSICs. However, it was felt that responses for all eight FSIC operators could be combined for most items as could the responses for all of the AIM(6) analysts. This is because it seemed reasonable that personnel operating identical equipments would have similar man/machine interface, safety and health hazard problems. Also, it was known from observations during training and discussions with operators, that they frequently consulted each other concerning problems with particular functions, and worked together to solve problems. By combining the responses the sample sizes could be increased, and presumably, make the data more meaningful.

Three, an analysis of both the written comments from the questionnaires and those obtained during the interviews was made. It was expected that written comments on the questionnaires would clarify the meanings of the responses made by the individual respondents to the multiple-choice items. It was also expected that the comments might reveal potential or existing strengths or weaknesses either not covered at all or not covered adequately by the written items. The same was anticipated for much of the commentary obtained during the interviews. In other words, the comments were to be used to "fill in the blanks" and help ensure that all data pertinent to the system that could be obtained from the trials was obtained. It was also assumed that most of the data relevant to the MANPRINT domains of manpower, personnel and training would come from the commentaries.

Limitations

Significant Factors. Several factors had a significant influence on the conduct of the MANPRINT evaluation. These were beyond the control of either the MANPRINT evaluator or the test directorate, and except for the ever present possibility of losing important data, were not anticipated. Some constraints on the planned treatment of the data did not become evident until the trials were nearly over. Nevertheless, they had a negative impact on the evaluation. The exact extent of the impact cannot be accurately determined, but there is little doubt that it was serious.

Lack of observation of in-FSIC training. Only two FSIC modules, one AIM module and two sets of analysts' stations were available for training. Because priority was given to the FSIC, the MANPRINT evaluator attended FSIC operator training classes as an observer. Although allowed to participate fully in the classroom, only the military personnel who were to serve as operators received hands-on training inside the FSIC shelter. In fact, it was virtually impossible

even to observe the hands-on training. Since four operators were to be trained, two operators and an instructor were inside the FSIC shelter at all times when the equipment was functioning. These three crowded the very limited space available in the FSIC shelter, making it impossible to observe the actual operation. Furthermore, the high noise level (measured later at 76 dBA) made it nearly impossible to hear the verbal exchanges while standing outside at the entry. As a result, the MANPRINT evaluator was only able to obtain information on operator problems via discussions with the operators during breaks, lunch periods, and during periods of system malfunction. This lack of first-hand experience, even direct observational experience, made it difficult to ferret out existing or potential man/machine interface problems or system design deficiencies.

Lack of observation during the field trials. After assignment to the ASAS evaluation, there was insufficient time for the MANPRINT evaluator to obtain a clearance for access to Sensitive Compartmented Information (SCI). Some messages passing through the system during the field trials were at the SCI level. For this reason, it was determined by security personnel that the MANPRINT evaluator could not observe operations while the system was energized. The result was that the only functions the evaluator was able to observe directly were displacement and emplacement. The lack of the special intelligence clearance also had a detrimental effect on the interviews. There were some aspects of the system which the operators were hesitant to discuss with the interviewer for fear of divulging information the interviewer was not authorized to obtain.

Unavailability of requested system/operator performance data. The data requested from the OTEA database covered several areas, but a major purpose for the specific data requests was to evaluate the effects of various factors on operator workload. Unfortunately, very little of the data could be made available. Part of the problem was due to the late date at which the MANPRINT evaluator joined the test team. The level of effort programmed for the database contractor had already been determined before the MANPRINT requirements could be formulated, and the resources to meet the requirements were simply not available. Most of the data requested would have required the correlation of data from multiple sources. For example, several items (items C, D, E, and F in Appendix J) were designed to assess backlog in message transmissions as indicators of operator workload in the FSIC. For these data to be meaningful, it would have been necessary to relate these data to message input rate at the times in question. It would also have been necessary to determine whether the backlogs developed were due to failure of transmission lines or software failures which prevented the messages from moving through the system. Providing these data would have required the development of additional software programs. The database contractor determined that time and resource constraints precluded the development of the necessary software to provide the data in the form needed. The time required for the MANPRINT evaluator to manually extract the data was also beyond that available. It was felt that without being able to take into account those factors which influenced the basic data requested, that these data could easily be misinterpreted. Therefore, the decision was made to present no data from the system performance database.

Data voids or near voids. Supervisors were asked to rate their personnel on a number of performance, attitude, and knowledge items. The intent was to examine the relationships between these ratings and selected demographic variables and questionnaire responses. However, many of the supervisors did not complete the rating forms, saying that they were unable to realistically rate the characteristics described. Where ratings were received, the raters tended to use only the top two categories, providing very little discrimination between incumbents. Also, in one instance where two sets of ratings were received for the same personnel, the supervisors showed low agreement. The combination of lack of discrimination, low agreement, and missing data rendered the ratings of insufficient value for presentation.

Demographic Relationships. The brief biographical form included in the questionnaires requested the operators to provide information on experience and training on automated systems. It had been thought that differences in this area might influence questionnaire responses and also be related to supervisors' opinions. However, none of the operators reported any special training on computer systems; none had any experience with TCAC-D, and only three (two AIM and one FSIC) operators owned personal computers. These numbers were considered to be too small to warrant any comparisons based on differences in experience or training with automated systems. Time in MOS as a measure of experience was also included. However, during the interviews, the operators indicated that neither their MOS training nor their MOS experience was very relevant to their jobs on the ASAS system. This point was especially emphasized by FSIC operators who stated that a communications specialist rather than an intelligence analyst would be a more appropriate choice for the FSIC operator. Based on these findings, any plans to look for relationships of the demographic data to other data were abandoned.

Data Collection Procedures

The handout describing the MANPRINT domains (Appendix H) was given to the data collectors, test directorate personnel, and personnel supervisors during the first week of the trials. Operator questionnaires (Appendixes A and B) were administered in groups near the completion of the second CPX. Operators not available at scheduled times completed the questionnaires during time available the following week.

Supervisor rating forms (Appendixes F and G) for operators were given to the supervisors at the beginning of the last week of the trials and collected by the test directorate at the end of the week. The same was true of the Personnel Supervisor/Observer questionnaires. "Personnel supervisors" were those in the command structure who did not directly supervise the operators during job performance. "Observers" receiving the questionnaire were selected by the test directorate. They were not directly involved in the system operations but were frequently observing on site and were highly familiar with the system. Personnel not returning the forms were contacted the following week in an attempt to collect as much of the data as possible.

Operator interviews (Appendixes C and D) were conducted with groups of two to four personnel during the last week of the trials with the exception of one AIM and two FSIC operators who were interviewed individually after the trials were completed. Due to reasons beyond the control of the test directorate, two of the AIM operators were not available for the final interviews. All eight of the FSIC operators were interviewed.

The physical measurements (Appendix I) obtained for the FSIC were completed with the aid of an operator in the CEWI FSIC the week following the completion of the trials.

The MANPRINT evaluator attended meetings of the Data Analysis Group (DAG) which were held almost daily during the first few days of the trials and weekly thereafter. The purpose of the meetings was to verify and validate the data management procedures, to review and verify data base entries, and to investigate any problems that surfaced during the conduct of the test.

RESULTS

The primary purpose of any evaluation of a system under development is to provide decision makers with objective data on which to which to base decisions concerning the system's future. Assuming that the development is continued, the data are of primary use to the system's developers. To be most useful to developers, the data should not only point out actual or potential deficiencies that suggest a need for system modifications, but should also indicate strengths where modifications should not be made. With this in mind, the data were examined to learn what aspects of the system the users considered positive and which they considered negative.

The remainder of this results section is divided into four subsections. The first deals with the results derived from the operator questionnaires, the second with findings based on the interviews, the third with the responses to the supervisor/observer questionnaire, and the fourth reports findings from the measurements taken in the FSIC shelter.

The first part of each subsection consists of an explanation of how the data were handled. The second part presents results in a bulleted format. The third part is a discussion which attempts to synthesize the results reported into a meaningful whole.

Operator Questionnaire Findings

Data Handling. Tabulations of the responses to the questionnaires are provided in the appendixes. Responses to the FSIC operator questionnaire are shown separately for the forward and rear FSIC operators. Response tabulations to the AIM operator questionnaire are shown separately for DTOC and TCAE analysts, with a total which includes the system supervisors. Although there were items that were not applicable to AIM supervisors, in some cases the

supervisors did respond to these items. Their responses are included in the totals.

Positive and Negative Responses. It was assumed that unanimity of response would be rare. Therefore, an arbitrary decision had to be made on what constituted positive and negative responses. For purposes of summarizing the major findings, responses were considered to be positive if 75 percent or more of the potential respondents reported that a function, purpose, task or hardware item was at least "good," "easy," or "adequate." Responses were considered to be negative if 25 percent or more gave ratings of "poor," "inadequate," "difficult," or worse. The rationale for these numbers is based on the notion that any aspect or characteristic of the system which is rated acceptably by at least 75 percent of the users is probably one which the developer would want to maintain, and therefore, should be alerted to ensure that no degradation occurs in subsequent development. On the other hand, if some aspect or characteristic is seen as being essentially unacceptable by 25 percent or more of the users, a further look at the problem seems warranted. It should be noted that by these criteria, responses to an item could fall into both the positive and negative categories. However, it was assumed that this would be most unlikely because of the available "marginal" and "in between" response alternatives.

Yes and No Items. Not all of the items in the questionnaires required responses like those described in the preceding paragraph. In some cases, simple "yes" or "no" answers were required. Some of these items were included mainly to clarify reasons for choices to previous items. Responses to these will be included in the discussion of the primary finding when appropriate. However, in some cases the yes/no items were intended to "stand alone" because only dichotomous responses seemed reasonable. These items will be included in the summary if, in the judgment of the MANPRINT evaluator, they could have a significant impact on system design, personnel selection or training. Still other items required the respondents to estimate frequencies of occurrence. Responses to these items will be included in the summary if it is judged that they might impact in the MANPRINT domains.

FSIC operator findings. These are shown below in bullet format.

- Over half of the FSIC operators indicated that they should have been given instruction on the operation of the KG84A (digital encryptor), the TD1289 (digital multiplexer), and the C6533 (radio amplifier and switcher) instrument components of their work stations. More of the forward FSIC operators indicated this need for instruction than did the CEWI FSIC operators. The operators were not asked about previous experience with these elements, so any effects from experience or lack thereof cannot be ascertained.

- Six of the eight FSIC operators indicated that they lost "sync" three or more times on the average during a 12-hour shift. Three of the operators indicated that sync was lost on the average of five to six times. All eight operators indicated that it was easy to reestablish sync, although three indicated that it was time consuming. Written comments suggested that it was typically reestablished quickly, but could run into hours.

- Seven of the eight operators indicated that two different voice messages incoming at the same time on the H-161 headset interfered with reception. Estimated percentages of the time this occurred varied from 0 to 25-30 percent. However, only two operators rated understanding voice communications as being less than "easy."

- Six of the eight operators reported they could not read the output of the audit printer without moving or lifting the paper. Four of the operators indicated they had to stand up to read the printed pages.

- Five of the six operators responding reported that they either "seldom" or "practically never" heard the alarm on the DCT when critical or flash messages were received. (Data obtained from the post-trial interviews indicated that the alarm was not loud enough to be heard when wearing the H-161 headset.)

- Five of the eight operators reporting indicated that lighting for making the red patch panel connections was less than adequate. Lighting for other purposes was judged to be either "adequate" or "very adequate."

- Storage space for personal papers and items was rated as "very inadequate" by five of the eight operators. Only one of the operators rated the space as being "adequate" or better. Four of the operators rated legroom as being less than adequate, and five of the eight rated elbow room as being less than adequate.

- No significant injuries to personnel were reported. However, five of the operators indicated they had experienced pinched or mashed fingers or hands during the trials. No more than three of the operators reported any physical symptoms of consequence on a list of 10 symptoms provided.

- Six of the eight operators reported that it was less than easy to load/key the crypto devices.

- FSIC operators were asked to rate the adequacy of system prompts for performing each of 11 listed operations. Prompts for nine of the 11 were rated as being adequate by a minimum of five of the operators. Three operators did not respond to "Entering office and operator names" and two did not respond to "Entering password".

- Seven of the eight operators indicated they had no problems in shutting down the system and preparing for system movement. Selecting a site and leveling the vehicle were also reported to be "easy" or "very easy."

- All eight operators indicated that the Altroute function worked "well" or "very well" and that Altrouting was either "easy" or "very easy."

- FSIC operators were asked to rate the ease of performing each of 13 tasks. Four or more operators reported that message dissemination, transcribing messages from voice to text, and correcting message error formats was less than easy.

- Seven of 20 listed commands were not used by any of the eight operators. Only one of the commands, line message logging (LML), was used by all eight operators.

- Of eight listed recall modes, only one was used by more than two operators, three were not used at all, and three were used by only one operator each.

- Three of the six operators reporting indicated that it was "difficult" or "very difficult" to understand the rules for determining addresses for ACTION and INFO messages. The other three operators rated it as "in-between."

- Operators were asked to estimate what percentage of their operating time they spent seeking help from sources such as contractor personnel, the HLP menu, manuals, class notes and other operators. Three operators indicated they spent 30-40 percent of their time, two indicated 20-30 percent, two indicated 10-20 percent, and one indicated 10 percent or less. Five operators indicated they never used the HLP command with one operator indicating the help provided was adequate, while two of those who used it rated it as "in between." (During the interviews it was discovered that two of the operators did not know that the HLP command existed.)

- All eight operators indicated that they used checklists at some time while performing their jobs, with seven of the eight indicating they used them for initializing the equipment.

- Seven of the eight operators reported that they received at least one error message, fatal message, informational message, or unusual occurrence message that they did not understand. Five of these reported that the average time required to understand these messages was more than five minutes.

- Of the seven status displays or statistical reports, only the queue statistics report and CSP dynamic status display was rated as being of at least moderate use by more than half of the operators.

- All eight of the operators rated the readability of the GRIDSE-T displays as being either "easy" or "very easy." However, three of the operators rated the readability of numerals, letters, and/or commands on the GRIDSE-T keyboard as being either "difficult" or "very difficult." (It was discovered that one of the FSIC keyboards had paste-on key designators which had become worn and

were difficult to read.) All seven of the operators reporting indicated that it would be either "difficult" or "very difficult" to use the GRIDSE-T keyboard while wearing MOPP IV gear.

- Seven of the eight operators did not feel that operating the FSIC placed too large a memory burden on the operator.

- Five of the eight operators reported that their performance of some tasks became less effective during peak workload times and also became unsatisfactory.

- Operators were asked to rate the FSIC's performance in five functions in providing an interface between the sensors and the MI Battalion TCAE. The results are presented in Table 1.

- The communications capability and the ability to deal with large volumes of data were seen by all of the operators as the best points about the system. Six of the operators reported that complexity was the major problem area. Two operators provided written comments indicating that operator workload was too great.

- Emplacing and leveling the FSIC vehicle was seen as being "easy" or "very easy" by all seven operators who responded.

- Two of the CEWI FSIC operators rated their pretrial understanding of the tasks required of them as being either "good" or "very good," while all four rated their posttrial understanding as either "good" or "very good." A tendency in the opposite direction was found among the forward FSIC operators. One of the two operators who rated his pretrial understanding as being "in-between" rated his posttrial understanding as "very poor."

Table 1

Ratings of FSIC Performance in Providing an Interface Between the Sensors and the MI Battalion TCAE

	Adequate or better	Inadequate or worse	No response
Providing data communications between sensors and the TCAE, and converting messages into common formats.	6	2	-
Providing a capability for transcribing voice messages into automated message formats.	5	2	1
Providing data communications between the MI Battalion TCAE and the sensors.	4	4	-
Assisting in the identification sanitization and routing of combat information to the Brigade.	3	4	1
Providing automated interface with the AIM.	5	1	2

Note. Each topic was rated by all 8 FSIC operators.

Discussion of FSIC operator findings. Based on operator reports, the FSIC did not present any apparent real health or safety hazards to personnel. Displacement and emplacement of the system were also seen as being free of significant problems. The ability of the system to handle large volumes of data was seen as a major plus for the system. Only two of the more frequently performed tasks were rated as being "difficult" or "very difficult" by two or more of the operators responding.

There are several indications that the system was not fully exercised during the trials. While this may have been due in part to the scenarios selected, it is more likely indicative of a lack of familiarity with the system on the part of the operators. For example, the operators felt that they should have had some training on the cryptographic devices employed in the FSIC. They also spent considerable time seeking help in one form or another. Five of the eight reported that they spent 20 percent or more of their time in seeking help, and all indicated they used checklists at some time or another. A lack of familiarity with some of system outputs further suggests that the operators were not fully trained or practiced. Seven of the eight reported that they received at least one system message that they did not understand, and five of these reported that the average time required to understand one of these messages was more than five minutes. Since the

operators did not feel that operating the FSIC placed too large a memory burden on the operator, the seemingly excessive time spent seeking help and failure to understand messages reflect a need for further training and experience. A final bit of evidence comes from the lack of utilization of the system's capabilities. Seven of 20 presumably common commands were not used by any of the operators, with only one command used by all eight. Similarly, only one of eight recall modes was used by more than two operators while three were not used at all. The extent to which the utilization, or lack thereof, was driven by the scenarios, and which was driven by operator familiarity and comfort in using only a few commands, was not determined.

There were a few problems which surfaced which are seen as deficiencies that should be corrected. One of these concerns the DCT. Five of the six operators responding reported that they either "seldom" or "practically never" heard the alarm when critical or flash messages were received. Posttrial interviews indicated that the audible alarm was too weak to be heard while the operators were wearing their headsets. A flashing light placed between the keyboard and the screen on the GRIDSE-T or an audible alarm wired directly into the headset should alleviate this problem without any major modifications to the equipment.

As the system is now designed, two unrelated voice messages can be received simultaneously, with each message going to a different ear. Some operators indicated that this interference occurred from as much as 25 to 30 percent of the time. This arrangement is not satisfactory as neither of the simultaneous messages is likely to be understood. The operator will have to call back to each party, and precious time will be lost. During the later interviews, the operators indicated that they prevented the interference to the extent possible by removing the opposite earphone whenever a message was being received. This could, of course, cause the second message to be completely lost. It is recommended that the system be redesigned so that a second and any subsequent messages be held until the first message is completed. This could be done either by having a "busy signal" at the sender's end, a "message waiting" light at the receiver's end, or, having all subsequent messages recorded for review in sequence by the operator.

The operators reported that they had extreme difficulty in using the GRIDSE-T keyboard while wearing MOPP IV gloves. If it is anticipated that this circumstance would ever occur, a tool approximately the size of a pencil, but one which could be used for virtually no other purpose so as to prevent loss, should be placed in a rack or some conspicuous place where it can be readily retrieved by the operator if needed. It has been suggested that consideration be given to redesigning the keyboard layouts to better support their use when wearing MOPP gloves.

Storage space for personal papers and personal items was rated as "very inadequate" by five of the eight operators. The lack of space for storage is obvious even to the most casual observer. Much of the electronic gear in the shelter is off-the-shelf equipment and is far from being state of the art. If newer equipment is obtained as replacements, this smaller equipment might alleviate the storage space problem. If such is not anticipated, some additional storage space should be considered. For example, storage boxes on

the side of the air conditioner over the cab might go a long way to alleviating the problem. Replacement of the bulky equipment with state-of-the-art equipment should also reduce the reported legroom problem.

Six of the eight operators reported that they could not read the output of the audit printer without moving or lifting the paper. Four of these indicated that they had to stand to read the output. At first glance this might seem like a major problem. However, during the interviews after the trials, none of the operators felt that these facts had a significant impact on their performance.

AIM operator questionnaire findings. Responses to some items which met the criteria (i.e., 75 percent positive or 25 percent negative) are not included in the summary because of the large numbers of nonrespondents to the items. It was felt that this might bias the sample in some way. Also, responses to some items are included that did not meet the criteria because of the importance of the function or task in question. There were a total of 28 AIM operators, not all of whom answered every questionnaire item. The findings are shown in bullet format below.

- Both operator and system supervisors were asked to recall how well they felt they understood the tasks required of them when they completed training. They were also asked to rate how well they felt they understood them at the time the questionnaires were administered (item 1). There was a tendency for the personnel to rate their understanding lower at the time the questionnaires were administered, although the difference did not reach statistical significance. Table 2 shows the responses to these two items.

Table 2

Ratings of Understanding of Tasks Required at the Completion of Training and at the Time the Questionnaires were Completed

Understanding of tasks required	At time of Completion of training	At time of Completion of questionnaire
Good or very good	22	16
In-between poor or very poor	6	12

Note. The above ratings are from all 28 AIM operators.

- Over two-thirds of the AIM personnel responding felt that onloading, offloading, and moving the MECAs was "easy" or "very easy." However, there was concern over safety for some of the operations. Of those personnel responding, 29 percent reported they felt "unsafe" or "very unsafe" while unloading the MECAs from the vehicle, 28 percent reported they felt "unsafe" or "very unsafe" while attaching wheels and handles to the MECAs, and 30 percent reported they felt "unsafe" or very unsafe" while loading the MECAs on the transport vehicle. The reports on safety were made based on experiences during training at the contractor facility.

- Twenty-three of the 27 AIM personnel responding indicated that they used checklists when powering up the AIM shelter components at some time during the trials.

- All 28 of the AIM personnel indicated that lighting was adequate in the shelter for powering up and powering down the AIM system.

- Twenty-two of the 28 AIM personnel reported that all cables and connectors were adequately labeled or coded to ensure proper connection to the MECAs without damage to the equipment or injury to the personnel. All 27 respondents indicated adequate labeling for netting shelter cables and connectors.

- Twenty of the 27 operators responding indicated that they did not use the map displays on their consoles. Those who responded that they did use the maps were requested to answer several questions concerning the overall adequacy of the maps. However, a number of the personnel who indicated they did not use the maps also responded to the items. The responses of 14 operator personnel who provided answers to these questions are shown in Table 3.

Table 3

Responses to Items Concerning Map Displays at AIM Workstations

Rating Level	Reading Letters	Area Coverage	Placing Symbols	Deleting Symbols	Distinguishing Symbols
5 & 4	7	5	6	6	3
3	5	2	2	2	6
2 & 1	2	7	6	6	5

Note 1. Rating level 5 means "Very easy" or "Very adequate." Rating level 4 means "Easy" or "Adequate." Rating level 3 means "Marginal" or "In between."

Rating level 2 means "Difficult" or "Inadequate." Rating level 1 means "Very difficult" or "Very inadequate."

Note 2. 14 AIM operators rated each of the five items.

- DTOC AIM operators and supervisors were provided a list of 36 GESCAN operations and asked to rate the ease with which they could be performed. Fourteen of these functions were performed by less than half of the DTOC personnel. Based on a rating scale of very easy = 1 to very difficult = 5, the easiest to perform functions were obtaining Hit Files for browsing (1.91), deleting Hit Files (1.92), aborting queries (1.92), copying queries (2.00), deleting queries (2.00), printing queries (2.00), and running queries (2.00). The most difficult functions to perform were editing queries (3.40), deciding where additional terms should be added to queries (3.14), determining fields for query terms (3.06), and choosing terms for queries (3.03).

- MICROFIX workstation operators rated the ease or difficulty of performing each of 10 terminal control processor operations. More than half of those responding rated all as being "easy," with 75 percent or more rating five of the operations as being "easy." Only three operations received any "difficult" ratings.

- AIM personnel were asked to report if they noticed any differences in system response time under four different conditions. Table 4 presents the responses of those completing the item.

Table 4

Ratings of Differences in System Response Times

	Yes	No
Time of day	0	24
Number of stations operating	15	10
Intensity of the situation	13	11
Type of Requirement	15	9

Note. 24, 25, 24, and 24 of the 28 AIM operators and supervisors responded to the above four items.

- Eleven of the 19 MICROFIX operators responding reported that response time to commands at their stations was "slow" or "very slow," six rated response times as "in-between," and two rated it as "fast" or "very fast."

- Seven of 19 MICROFIX operators reported that response time to tasking messages was "unsatisfactory" or "very unsatisfactory" during normal periods of operation, 11 gave these same response when queried about response time during peak periods of operation.

- Twelve of 22 AIM operators responding stated that the organization of information displayed was not helpful for doing their jobs.

- Sixteen of the 26 AIM personnel responding reported that generating MISMART messages was either "easy" or "very easy." Three reported it as being "difficult" or "very difficult."

- AIM personnel were asked to report on any symptoms they developed while operating at their stations. They were asked to indicate how long they had been on their shifts when each of the symptoms checked occurred. The times reported were highly variable, with some respondents indicating a symptom occurred in less than an hour after being on the shift, while others indicated the same symptom did not occur until several hours into the shift. The responses to the symptoms developed are shown in Table 6.

Table 5

Reported Physical Symptoms Developed During AIM(6) Operations

	DTOC Personnel		TCAE Personnel	
	Yes	No	Yes	No
Eyestrain	9	5	8	3
Blurred vision	3	12	3	8
Headaches	5	9	5	6
Dizziness	1	14	1	10
Fatigue	9	6	7	4
Neck & shoulder stiffness	13	2	5	6
General muscle stiffness	9	6	5	6
Finger fatigue	2	13	1	10
Backache	10	5	5	6
Hearing difficulties	0	15	0	9

Note. Two TCAE supervisors did not respond. One DTOC operator did not respond to the "eyestrain" symptom, and one did not respond to "headaches."

- Twenty-four of 27 AIM personnel responding reported that it would be either "difficult" or "very difficult" to prepare the AIM stations while wearing MOPP IV gear, and 21 of the 27 respondents indicated that it would be either "difficult" or "very difficult" to use the keyboard while wearing MOPP IV gear.

- Tables 6 and 7 show the responses of the 28 AIM(6) personnel to questions concerning the strengths and weaknesses of the system. Respondents were encouraged to check as many of the alternatives as they felt applicable. They were also encouraged to provide written comments to specify other strengths and weaknesses. The written comments concerning problems (Table 6) typically indicated that the system did not do what they needed it to do. Written comments concerning the best points typically indicated that the concept behind the system was good.

Table 6

Responses to the Question "What are the Major Problem Areas of the System?"

Problem Area	Number of Responses
Complexity	10
Lack of software to support functions	14
Poor hardware design	11
Poor software design	15

Note. 28 AIM operators had the opportunity to answer the four items.

Table 7

Responses to the Question "What are the Best Points About the System?"

Best Points	Number of Responses
Communications capability	9
Ability to deal with large volumes of data	13
Speed of response	2
Ease of operator interface	5

Note. 28 AIM operators had the opportunity to answer the above items.

- Twenty-five of 27 respondents did not know when they should "bump start" the ECU in the AIM shelter.

- Eleven of 26 respondents felt that the system placed too large a memory burden on the operator.

Discussion of AIM operator responses. As was the case with the FSIC operators, there are indications that the training and practice received prior to the trials were somewhat lacking. There was a tendency for AIM operators to rate their understanding of the tasks required of them somewhat lower during the trials than at the completion of their training period. Some operators indicated they continued to use checklists throughout the trials, although approximately half reported they used them only until they became familiar with the procedures. Either because the scenarios did not fully exercise the system, or the operators were not familiar with all the functions, 14 of 36 GESCAN functions were performed by less than half of the personnel. Development of queries, in particular, seemed to present problems.

It must be remembered that the operator stations involved in the trials were substitutes for the PAWS which is intended to be part of the objective ASAS system. Also, only a very preliminary version of the software which will become available was available during the trials. Therefore, the pattern and extent of weaknesses or deficiencies reported by the operators may be quite different when the next generation of equipment is received, tested, and reported upon. Nevertheless, note should be taken of deficiencies reported to ensure that they are removed from the eventual system.

The major pluses reported by the operators were the communications capability and the ability for the system to handle large volumes of data. Terminal control processor functions were considered generally to be easy to perform. The AIM shelter, which is undoubtedly similar to the eventual system shelter and components, did not seem to create any problems for the operators. Lighting and labeling were adequate, and no problems in energizing or shutting down the system were reported.

Ratings of speed of response for the system were generally very poor. One of the contractor personnel stated that this was due in large part to a small and relatively slow computer in the MICROFIX stations. It is expected that speed of response will be improved with the new equipment. Support of both DTOC and TCAE functions received generally poor ratings. It is anticipated that software development will greatly improve the system's capability in these areas.

During the trials, the MECAs were kept on an expandable five-ton van rather than being carried on a CUCV during displacement/emplacement as they were during training. The operators had concern about safety during emplacement/displacement practice while training at the contractor's facility. However, the PAWS is expected to weigh several hundred pounds less than the current MECAs, so future concern for safety while handling the lighter equipment is likely to be considerably reduced.

AIM personnel reported many more physical symptoms than did the FSIC personnel. Eyestrain, fatigue, neck and shoulder stiffness, and backache were reported by more than half of the AIM personnel. In contrast, none of the FSIC personnel reported eyestrain, although three of the eight FSIC operators did report general fatigue and backache. The fatigue and backache undoubtedly stem from long hours sitting in front of a computer terminal. The difference in reported eyestrain is difficult to understand as is the generally higher level of symptoms reported by the AIM personnel. No apparent reason for this could be discerned, nor did the later interviews add any understanding of this subject.

There were two concerns reported by AIM operators which should be considered in developing the PAWS. One of these should create no real problem. AIM operators reported that they would have difficulties in using the terminal keyboard while wearing MOPP IV gear. Again, a pencil sized tool, that would have no other purpose, should be added to a built-in bracket on the PAWS. This would permit the operator to use the keyboard, albeit more slowly. It has been suggested that consideration could be given to redesigning the keyboards to facilitate their use by MOPP-glove-wearing personnel.

The second concern expressed relates to map area sufficiency. Twelve of the 18 MICROFIX station operators responding reported they did not use the maps available on their displays. In all, 20 of the AIM personnel reported maps were not used. Since the TCAE personnel do not do order of battle, the results from the DTOC are more pertinent. Half of the DTOC MICROFIX operators reported they did not use the maps, and one who did reported that it was only for a quick familiarization. Based on the comments received, the problem was that the territory covered at any one time was too small. The operators had the capability of scanning the map area, but the total area that was available on the CRT at any one time was too small to give them the "big picture."

Operator Interview Findings

Administration conditions. With the exception of two FSIC operators and one AIM operator who were interviewed individually, all other personnel were interviewed in groups of two to five. This was done for two reasons. First, other personnel in a group could serve as a check on the accuracy of statements made by one individual, provided they too performed the functions or tasks in question. Second, the limited amount of time available during breaks in operations due to system malfunctions and other reasons was not adequate to permit lengthy individual interviews during the trials. Interview times ranged between one and two hours for the groups, and somewhat less than an hour for the individuals. A set of prepared questions was employed to guide the interviews (see Appendixes C and D), but interviewees were encouraged to provide any additional information they felt to be relevant.

It was assumed that statements made during the interviews represented the opinions/attitudes of all members of a group unless there was disagreement. Disagreements were rare, but other individuals in a group frequently clarified or added to statements made by another individual. Therefore, any statement, as amended or expanded during the interview, was considered to represent a consensus for reporting purposes.

FSIC operator interview findings. These are presented below in bullet format.

- All FSIC operators agreed that the workload of the forward FSIC operators was higher than that of the CEWI FSIC operators. Reasons cited were the requirement to send messages to Brigade and to send and receive messages on the AN/PVS-2. No mention was made of the requirement for forward FSIC operators to correct format errors in messages.

- None of the operators felt that they had problems of any consequence with the generators.

- All of the operators felt that the training they received on the FSIC was inadequate. Estimates of training time required to produce effective operators varied from four weeks to one year. The need for basic computer training was expressed by all. Training in typing skills, for those who had not already acquired them, was also felt to be necessary.

- The operators felt that they were not using their MOS skills, especially in the CEWI FSIC. Several respondents stated that the FSIC operator should have a communications MOS. Two groups mentioned that an analyst equipped with a DCT and a radio should be put in another forward location, thus allowing the FSIC to function only as a communications device.

- Forward FSIC operators had great difficulty in hearing the alarm on the DCT.

- The first echelon operator maintenance manuals did not serve their intended purpose. The index was judged to be poor and the information needed when a problem occurred was either not in the manuals or could not be found.

- The procedural checklists provided by the contractor were rated very highly.

- Operators had difficulty in judging whether or not the work they were doing required more, the same, or fewer personnel than required when using manual methods. This was because the tasks they were performing were not the same as those they performed previously.

- None of the operators felt that the job created any unusual stresses, but two mentioned that persons with claustrophobic tendencies should not be placed in the FSIC.

- The FSIC operating system was not considered to be user friendly. Initializing was stated to be too time consuming, requiring too many commands, and requiring the same information to be entered

more than once. Also, the system provided little help in correcting errors or in helping the operator in case of a software malfunction. Error messages were considered to be insufficiently explanatory, and most operators simply called the contractor personnel any time a problem occurred.

- Operators mentioned that attaching the UHF antenna could be hazardous in icy conditions as it would typically require the operator to climb to the top of the shelter. The operators felt that there were no other health or safety hazards inherent in the system.

Discussion of FSIC operator interviews. The interviews corroborated and clarified some of the responses obtained to the questionnaires. Of particular note is the finding that the operators unanimously felt that basic training in computer systems and computer operations were necessities. They claimed that they did not understand what they were doing on occasion. That is, they did not know why certain inputs were required, and generally operated by strictly rote procedures. This may be part of the reason they felt that the FSIC was not user friendly and why they had to seek help so often. The implications for training are fairly clear. Some computer basics need to be included in training, as well as more specifics on the purpose and function of various inputs on the FSIC system.

None of the operators had any praise for the operator maintenance manuals. This may have resulted in part from the operators' lack of knowledge concerning computers. Nevertheless, there appears to be a need for revision, with an improved and more comprehensive index. Also, training in the use of the manuals should be a part of the program. Manuals were not available to the operators during the original training at the contractor's facility.

The need for a more suitable alarm for the DCT was corroborated during the interviews. Since the alarm is there to alert the operator of the arrival of extremely important messages, it is imperative that some other alerting system, such as the audible beeps suggested earlier, be designed into the system.

The FSIC operators felt that their MOS skills as analysts were only very minimally utilized. They suggested that a separate MOS, with less analytical and more communications training, be initiated for the FSIC. Also, the merit of separating the analytical and communications functions completely, as suggested by forward FSIC operators, should be examined.

Although no injuries of consequence were reported during the trials, operators felt that climbing on top of the shelter to emplace the UHF antenna in icy conditions could be extremely hazardous. Emplacement of the antenna without mounting the shelter was viewed as being extremely difficult for average sized soldiers. Also, one group expressed fear of turning the vehicle over when traversing rough terrain due to the top heavy load in the shelter.

Other comments of interest which are worthy of consideration in design, personnel selection and training were:

- o Indicators on much of the equipment are difficult to see from the operator's position.
- o More room for writing is needed.
- o Controls on the multicoupler, one radio and the CPP are hard to reach.
- o The equipment must be shut down to switch generators. It takes at least 20 minutes to get back on the air.
- o The message edit menu is not tailored to the operator's needs.
- o Operators must either have or be taught typing skills in training.
- o The battle override switch can be kicked by accident.
- o A speaker should be provided in the cab to give relief from the headset during movement.
- o Personnel with claustrophobic tendencies should be screened out.

AIM operator interviews. These findings are presented below in bullet format.

- o The operators as a group felt that the system functioned too slowly. Specific examples given were the time to download a data base to the MICROFIX (as much as 20 minutes), having to send several messages to transmit a single message because the formats were too short, the ability to run only one query at a time, and the inability to skip steps in a procedure.

- o Cabling the system in the field was seen as a problem by the TCAE personnel. Labels were reported to get dirty or lost, and that the number was excessive (10 cables on the generator). Cabling while wearing MOPP IV gear was considered to be nearly impossible.

- o The operator maintenance manuals were considered to be of little value and were little used. The materials provided by the contractor were considered to be excellent.

- o The training received at the contractor facility was considered to be inadequate. Estimates of training time required ranged from four to eight weeks which should include basic computer science.

- o Typing skills, if not already acquired, should also be trained.

- o The operators felt that more people were required to do the job with the AIM(6) than were required when using manual methods as a manual backup was needed in case of a complete system malfunction.

- o Several operators mentioned that a separate numeric keyboard would improve their work efficiency.

- o The video maps provided were considered to be of virtually no use. The primary reason cited was that the geographic area coverage was too small, and therefore, a hard copy map covering a greater area had to be maintained.

- The tasks considered to be the most difficult to perform while wearing MOPP IV gear were cabling, using the keyboard, and camouflaging the vehicles.

- The operators felt that the system did not permit use of their MOS skills to the fullest advantage. The primary reason cited was that the functions available on the system were lacking in many respects and different from many they normally performed.

- No major health or safety hazards were consistently cited, although several of the TCAE personnel felt that camouflaging the vehicles while wearing MOPP IV gear could be hazardous. Loading and unloading the MECAs was not discussed as they were emplaced in an expandable van throughout the trials.

- Tracking messages requires the aid of the system supervisor as the operator's message number and the VAX message number are not the same. This results in lost time and is a source of aggravation.

- Most of the operators felt that the concept behind the AIM system was good, but that the implementation left something to be desired. Lack of adequate software and the slow speed of response were considered to be the major shortcomings.

Discussion of AIM operator interviews. The fact that substitute equipment and only a very preliminary version of the software were available for the trials undoubtedly gave rise to many of the negative comments received during the interviews. It is assumed that many of these reported shortcomings, such as slow system functioning, have been recognized by the developer, and therefore, that steps will be taken to minimize their impact in the objective equipment. Nevertheless, there were some points made during the interview discussions which it is felt need to be considered in the future hardware and software development:

One, considerable time was spent in reporting problems with cables and cabling. In addition to labels being lost or becoming illegible, operators reported that caps came off the cables and that connectors became dirty. Threads were considered to be too fine and subject to stripping. Operators also felt that the number of cables was excessive and could be reduced. One group suggested that the Power Load Bank be permanently mounted on the generator trailer and hard wired. This would not only reduce cabling but would eliminate the wait for the Power Load Bank to cool down when preparing for movement.

Two, the operators felt that it would be easy to accidentally corrupt the Order of Battle (OB) records. An attempt to prevent this was made by having only one operator change OB records and only with approval by the System Supervisor. Nevertheless, the operators felt that in the heat of battle the files could get corrupted, and thought that a less easily corrupted system was needed. It was also pointed out that each page of an OB record must be deleted separately. Failure to eliminate all pages would result in corruption of the OB file.

Three, lack of adequate geographical area coverage was the main reason cited for not using the maps available on the monitors at the MICROFIX stations. However, clutter was also cited as a reason during the interviews. Overlap of symbols made it very difficult to determine what symbols were actually present at some locations. Smaller symbols or some form of "see through" symbols should be considered.

Four, concurrency problems were a headache for system supervisors. Software to aid the supervisor in resolving competing requests should be developed.

Five, operators reported that many functions available at the MICROFIX stations were not used and that many needed functions were not available. Due to the MANPRINT staff member's limited familiarity with the AIM(6) and the jobs the analysts were expected to perform, specifics were not requested. Software developers need to survey analysts to determine exactly what functions are needed and ensure they are included in later releases.

Personnel Supervisor/Observer Questionnaire Findings

A total of 10 questionnaires were returned, seven from the 522d MI Bn and three from 2d Armored Division G-2 personnel. The small number of responses precludes any comparisons between the groups. The responses to the items are presented in Tables 8 and 9.

- Table 8 presents the responses of all 10 personnel to the question "As a supervisor/observer, did the system seem to provide support to the following areas?" A summary of the major themes in the comment sections is provided below the table and is keyed to the Roman numerals at the left of the table.

Table 8

Ratings of Support for System Operations

	No support	Inade-quate support	Ade-quate support	Good support	Very good support	Meets all needs	No response
I. DTOC AIM to DTOCSE	0	3	1	2	0	0	4
II. CEWI AIM to MI/Bn TCAE	0	3	4	2	1	0	0
III. FSIC to Intelligence/ EW Communications	0	1	2	6	1	0	0
IV. AIM(6) FSIC System as a Whole to Division I/EW Operations	0	4	5	1	0	0	0

Note. These comments were received from the 10 supervisor/observers:
Transmission was unreliable.
System provided rapid communications when working properly.
The system reliability was inadequate.
The system was not user friendly.

- Respondents were asked to indicate the major strengths and weaknesses of the system from alternatives provided. They were encouraged to check as many of the alternatives as they felt applied. Space for comments was provided where additional strengths and weaknesses could be listed or where explanatory statements concerning alternatives checked could be made. Table 9 presents the data for the "problem areas" and Table 10 presents the data for the "best points." Below each table are brief statements representing the major themes found in the comments sections.

Table 9

Responses to the Question "What are the Major Problem Areas of the System?"

Problem Area	Number of Responses
Complexity	6
Lack of software to support functions	5
Poor hardware design	1
Poor software design	3

Note These comments were received from the 10 supervisor/observers:
The software doesn't meet the operators' needs.
Software is too inflexible.
Procedures for composing messages are too cumbersome.
Power distribution system is poor.

Table 10

Responses to the Question "What are the Best Points About the System?"

Best Points	Number of Responses
Communications ability	6
Ability to deal with large volumes of data	6
Speed of response	3
Ease of operator interface	0

Note. The comment was received: Disseminates information quickly.

Discussion of Supervisor/Observer Findings. It is obvious from Table 8 that the supervisors/observers as a group gave the system rather poor ratings except for its communications capability. This sentiment was echoed in the question on the system's good points (Table 10) as well as in the written comments. However, only one rater attributed fault to the hardware, with most stating that software was the major source of system problems (Table 9). Complexity was considered a problem, but this may have been due to software as only three respondents felt the system placed too large a memory burden on the operators. Two of these stated that it was the FSIC operators who were overburdened. (AIM 6 operators did not agree. Eleven of 26 responding operators felt the system placed too large a memory burden on the operator.)

Many of the comments received were comparable to those obtained from operators. The cabling system was strongly derided by one respondent, who added that the labeling could not be read in the dark and suggested color coding for daylight operations and "brailleing" for night operations. Quick disconnects were also suggested.

The inability to enter and leave programs at any point was criticized as was inconsistency between comparable inputs among programs (e.g., date-time group). Generation of queries was seen as too complicated and message formats were seen as being unwieldy.

Physical Measurements

Selected physical measurements were made inside of the FSIC shelter to determine compliance with standards set forth in OTEA Test Operations Procedure 1-1-059 (Soldier-Computer Interface Test Procedures, 30 November 1985). A list of the measurements obtained is shown in Appendix I.

- The diameter of the keys on the GRIDSE-T keyboard, the spacing of the keys on the keyboard, and the size of the characters on the GRIDSE-T display were all within the standard.

- The height of the home row of keys on the keyboard was 825mm above the floor which is somewhat above the 720mm $\pm$ 25mm given in the standard.

- The width and height of the legroom available were within the standards, but the depth of approximately 400mm was below the 460mm minimum required.

- Kick space was adequate as it was somewhat above the 100mm minimum given in the standard.

- The seat when adjusted to a minimum height measured 440mm, which is out of compliance with the minimum of 380mm given in the standard. The maximum height adjustment of 552mm more than met the standard of 535mm.

- The workspace for writing measured 8.5 x 13 inches which is well below the required 16 x 24 inches.

- The noise level measured at the approximate location of the operator's head was 75.5db(A) with all equipment functioning except the printers, and 77db(A) with the printers operating. These measurements are well within the safe exposure limits for steady-state noise but slightly above the contractor's target of 75db(A) maximum. (The operators were questioned about the effects of noise during the interviews. None of them felt that the noise was excessive nor that it interfered with their effectiveness, although four reported they

experienced excessive noise in responding to the questionnaire. However, since the operators normally wore headsets, the actual noise reaching the ears was considerably attenuated from that measured in the shelter.

Two of the measurements which were not in compliance with the TOP (legroom depth and writing workspace) were reported as being deficient by the operators. Two others (keyboard height and minimum seat height) were not. Six of the eight operators were 5'11" or greater in height, so minimum seat height and actual height of the keyboard would not be expected to cause a problem. The two shortest personnel were 5'7" and 5'8" in height. However, neither of them reported that the vertical seat adjustment was inadequate.

CONCLUSIONS

Virtually everything about the "field trials" of the ASAS was limited. Only one of the equipment modules, the Forward Sensor Interface and Control (FSIC) represented the objective system (the system to be developed). The other modules were substitutes whose similarities and dissimilarities of operation, compared to the objective system, will not be known until the objective system can be fielded and operated. System software, which strongly defines the capabilities of the objective system, was present only in a first version that substantially lacked features intended for later software versions.

Insufficient lead time was available to enable the human factors (MANPRINT) investigator to receive the SCO clearance necessary to give access to the system during actual operation. Data collection was therefore further limited. Nevertheless, as a result of these field trials, it is probable that ASAS system developers incrementally advanced their knowledge and readiness to proceed with ASAS system development.

APPENDIX A

FSIC OPERATOR QUESTIONNAIRE

The responses recorded in the first column for each item are those of the forward FSIC operators. Those in the second column are those of the CEWI FSIC operators.

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FSIC OPERATOR

QUESTIONNAIRE

INFORMATION PRIVACY ACT STATEMENT

1. Authority: 5 USC 301, 10 USC 3012, Authority for the Secretary of the Army to Issue AR's; 44 USC 3101, Authority for Collecting Necessary Data.

2. Principal Purpose: To collect data to evaluate the human factors/manpower/ personnel/health hazard/and safety training aspects of the All Source Analysis System (ASAS) during operational testing.

3. Routine Uses: The data collected with this form are to be used for research purposes only. They will not become a part of any individual's record and will not be used in whole or in part in making any determination about an individual.

   The identifiers (name or Social Security Number) are to be used for administrative and statistical control purposes only. Full confidentiality of responses will be maintained in the processing of these data.

4. Mandatory or Voluntary *Disclosure and Effect on* Individual Not Providing Information - Your participation in this research is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of the research, but there will be no effect on the individuals not providing all or any part of the information.

   This notice may be detached from the rest of this form and retained by the individual answering the questionnaire if so desired.

FSIC OPERATOR QUESTIONNAIRE

Name: _____

Rank: _____ SSN: _____

Approximate height: _____ft _____inches

Approximate weight: _____lbs

Age _____years _____months

Time in service: _____years _____months

Current MOS: _____

Time in current MOS: _____years _____months

Have you worked on TCAC? ___Yes ___No

If "Yes," in what position (job title) _____

If "Yes," for how long? _____years _____months

Highest level of civilian education (Circle letter which applies to you):

a. No high school diploma
b. GED
c. High school graduate
d. 1-2 years of college
e. 3-4 years of college
f. College graduate (list degree and major): _____
g. Advanced degree (list degree and major): _____
h. Graduate or trade school (list speciality): _____

Do you own a personal computer? _____Yes _____No

What were your favorite subjects in high school?

_____

_____

If you received any civilian training beyond high school, what was(were) the primary area(s)?

_____

_____

Do you plan on making the Army a career? _____Yes _____No

Regardless of your current career intentions, what would be your civilian occupational choice(s)? Please be realistic.

_____

_____

INSTRUCTIONS

This questionnaire contains multiple-choice items asking you to respond on a point scale or to chose one of several alternative answers. Read each item carefully and mark the one rating value or answer that most closely agrees with your personal opinion on the subject being considered.

The questionnaire also contains items in which you are asked to provide written information. Provide all the information you think appropriate.

If you have any questions concerning the meaning of any items, please ask the monitor for clarification.

1. Rate your pretest understanding of the tasks required of you:

0	1	Very good
1	1	Good
2	1	In between
0	1	Poor
0	0	Very poor
1	0	NR (No Response)

2. Rate your posttest understanding of the tasks required of you:

0	1	Very good
1	3	Good
1	0	In between
0	0	Poor
1	0	Very poor
1	0	NR

3. In general, how easy-difficult was it to select a site for the FISC vehicle so that it could be leveled?

1	0	Very easy
3	3	Easy
0	0	In between
0	0	Difficult
0	0	Very difficult
0	1	NR

4. Once the FSIC vehicle was in place on the selected site, how easy-difficult was it to level it within limits?

1	1	Very easy
3	2	Easy
0	0	In between
0	0	Difficult
0	0	Very difficult
0	1	NR

5. Do you feel you should have been given instruction on the operation of any of the following devices at the beginning of training?

	Yes	No	Yes	No
RT-524 radio	0	1	4	3
KY-57	0	1	4	3
HYX-57	3	1	1	3
RT-1283a radio	3	1	1	3
K684A	4	1	0	3
TD 1289	3	2	1	2
C-6533	3	2	1	2

Note. NR indicates either no response or a statement that the item was not applicable to the respondent.

6a. How easy-difficult and fast-slow was it to establish and maintain Sync when setting up communications?

1	2	Easy and quick
2	1	Easy but time consuming
0	0	Difficult but quick
0	0	Difficult and time consuming
1	1	Other (explain)

_____

_____

6b. On the average, during a 12-hour shift, how often did you lose sync (any or all lines) and have to reestablish?

0	0	0
1	1	1-2 times
1	2	3-4 times
2	1	5-6 times
0	0	7 or more times

7. What percentage of the voice messages incoming on the H-161 headset were interfered with by receipt of another voice message on the other channel?

_____%

Forward range: 0-10% CEWI range: 1-30%

8. How easy-difficult was it to understand voice radio communications?

0	1	Very easy
3	2	Easy
1	1	In between
0	0	Difficult
0	0	Very difficult

9. Could you read the output of the Journal printer without moving and/or lifting the paper?

2	3	Yes
2	1	No

If "No," did you have to stand up to read it?

1	0	Yes
2	1	No

(one "yes" respondent completed this item)

10. Could you read the output of the Audit printer without moving and/or lifting the paper?

1	1	Yes
3	3	No

If "No," did you have to stand up to read it?

2	2	Yes
1	1	No
1	1	NR

11. Were you able to hear the alarm on the DCT when critical or flash messages were received?

0	1	Practically always
0	0	Usually
0	0	Half the time
1	1	Seldom
2	1	Practically never
1	1	NR

12. Were the tools supplied adequate to meet your needs for set-up, tear-down, and conducting PMCS?

4	2	Yes
0	1	No
0	1	NR

If "No," please explain:

_____

_____

_____

13a. Did you have any problems remembering how to make interconnections when the equipment first arrived at Fort Hood?

2	2	Yes
2	2	No

13b. Are interconnections adequately coded so that you would have no difficulty making connections after a layoff of 60 days?

3	1	Yes
1	3	No

If "No," please explain:

_____

_____

_____

14. How easy-difficult to read were the labels on the equipment such as hazard indicators, dials, switch positions, etc.?

2	0	Very easy
1	2	Easy
1	2	In between
0	0	Difficult
0	0	Very difficult

15. Please list, if any, those labels, dials, markings, etc., that you had difficulty reading:

_____

_____

_____

16. How adequate-inadequate was the lighting for each of the following?

	Very adequate	Adequate	In between	Inade-quate	Very inadequate
Making red patch panel connections	0 1	1 1	1 2	2 0	0 0
Viewing the GRIDSE-T keyboard	2 2	2 2	0 0	0 0	0 0
Reading the GRIDSE-T Display (was light level too high?)	2 2	2 2	0 0	0 0	0 0
Setting the Crypto devices	1 1	2 3	1 0	0 0	0 0
Reading printouts from the Journal printer	2 2	2 2	0 0	0 0	0 0
Reading printouts from the Audit printer	2 1	2 2	0 1	0 0	0 0
Sanitizing messages	1 1	3 3	0 0	0 0	0 0
Reading labels, dials, meters, etc.	1 1	0 3	3 0	0 0	0 0
Tuning TD 1289	0 1	2 3	1 0	1 0	0 0

17. How adequate-inadequate was the workspace in the FSIC shelter for each of the following factors?

	Very adequate		Ade-quate		In between		Inade-quate		Very inade-quate		NR	
Leg room	0	0	2	2	1	1	1	1	0	0	0	0
Elbow room	1	0	0	2	3	2	0	0	0	0	0	0
Seating												
Horizontal adjustment	1	0	3	3	0	0	0	0	0	0	0	1
Vertical adjustment	1	0	3	3	0	0	0	0	0	0	0	1
Backrest	1	0	3	2	0	0	0	1	0	0	0	1
Cushioning	1	0	3	2	0	1	0	0	0	0	0	1
Storage room (for papers, personal items, etc.)	1	0	0	0	0	1	0	1	3	2	0	0
Other (specify)												
_____		___		___		___		___		___		
_____		___		___		___		___		___		
_____		___		___		___		___		___		
_____		___		___		___		___		___		

18. How frequently did you experience each of the following?

	Frequency	
Cuts	0	2
Electrical shock	0	0
Pinched/mashed fingers/hands	2	3
Excessive noise	2	2
Other	0	1

If you checked any of the above, please explain how:

Other _____
Other _____

If you checked any of the above, please explain how:

_____
_____

19. How many of the following symptoms did you have while operating the FSIC, and how long after your shift began did they appear?

	Yes		No		How long on shift (hours)*
Eyestrain	0	0	4	4	_____
Blurred vision	0	0	4	4	_____
Headaches	1	1	3	3	_____
Dizziness	1	0	3	4	_____
Fatigue	2	1	2	3	_____
Neck and shoulder stiffness	1	1	3	3	_____
General muscle stiffness	0	1	4	3	_____
Finger fatigue	1	0	3	4	_____
Backache	2	1	2	3	_____
Hearing difficulties	0	0	4	4	_____

20. How easy-difficult was it to change ribbons in the printers?

2	3 Did not change a ribbon
0	1 Very easy
1	0 Easy
1	0 In between
0	0 Difficult
0	0 Very difficult

21. How easy-difficult was it to install paper and adjust the paper drive in the printers?

0	0 Did not do
0	0 Very easy
1	2 Easy
3	1 In between
0	1 Difficult
0	0 Very difficult

If you installed paper, how many times did you do this? _____

Time estimates varied from less than one hour to eight hours.

22. How easy-difficult was it to remove, install and check magnetic tapes in the MDR-300?

1	0	Did not do
2	0	Very easy
0	2	Easy
0	2	In between
0	0	Difficult
1	0	Very difficult

If you removed, installed, checked tapes, how many times did you do this?

_____

23. How easy-difficult was it to load/key the crypto devices?

0	0	Did not do
1	0	Very easy
0	1	Easy
2	2	In between
1	1	Difficult
0	0	Very difficult

24. In initializing the system, how adequate-inadequate were the system prompts for each of the following operations?

	Adequate		Inadequate		NR	
Booting the system	4	3	0	1		
CSP initialization (cold start)	4	3	0	1		
CSP initialization (warm start)	3	3	1	1		
Resetting date and time	4	4	0	0		
Configuring message file disks	3	3	1	1		
Terminal sign on						
Downloading GRIDSET	2	3	2	1		
Entering office & operator names	1	2	1	1	2	1
Entering password	2	2	1	1	1	1
Activating communication lines	3	3	1	1		
Initializing DCC	3	3	1	1		
Loading DMT	3	3	1	1		

25. Did you have any problems shutting down the system and preparing for movement?

	Yes		No	
Sending closing message(s)	1	0	3	4
Signing off the terminal	1	0	3	4
Zeroing crypto equipment	1	0	3	4
Connecting radio for convoy ops	1	0	3	4

Other, explain:

_____

_____

_____

_____

_____

26. Approximately how many times did you attempt to recall inactive messages?

1	0 Never
2	1 1-5 times
0	0 6-10 times
0	0 11-15 times
1	3 More than 15 times

27. Approximately how many times did you use each of the following Recall modes?*

3	4 MLN
0	0 CDN
2	1 ORI
1	0 DTG
0	1 TOT
0	0 DAN
0	0 OLD
0	1 ABO

Note. Numbers represent the number of operators who used each of the recall modes.

28. What was the approximate average time you required to recall the desired message?

1	0 Did not recall
1	3 Less than 1 minute
0	1 1-2 minutes
0	0 2-3 minutes
0	0 3-4 minutes
2	0 More than 4 minutes

29. Did you ever fail to obtain any message you tried to recall?

1	0	Did not recall messages
2	2	Yes
1	2	No

30. Overall, how easy-difficult was it to recall messages?

0	0	Very easy
1	3	Easy
2	1	In between
0	0	Difficult
0	0	Very difficult
1	0	NR

31. Did you ever attempt to recover messages from a History tape after a system failure?

0	0	Yes
4	4	No

If "Yes," were you successful?

___ Yes
___ No

Comment:

_____
_____
_____

32. How many times did you attempt to recall messages from the History tape?

3	4	Zero
0	0	Once
0	0	Twice
0	0	Three times
1	0	Four or more times

33. Overall, how would you rate the ease-difficulty with which messages could be Altrouted?

2	1	Very easy
2	3	Easy
0	0	In between
0	0	Difficult
0	0	Very difficult

34. Check appropriate box for the adequacy of each of the Altroutes:

Altrouting a subset	Did not use		Worked adequately		Did not work adequately		NR	
by Precedence code	4	2	0	1	____		0	1
by classification	4	2	0	1	____		0	1
by routing indicator	0	2	4	1	____		0	1
SVC to SVP	2	1	2	3	____			

35. How well-poorly, overall, did the Altroute function work?

1	0	Very well
3	4	Well
0	0	In-between
0	0	Poorly
0	0	Very poorly

36. In general, how easy-difficult was it to perform each of the following tasks?

	Did not perform		Very easy		Easy		In between		Diffi-cult		Very dif-ficult		NR	
Message creation														
Free text	1	0	0	1	1	2	2	1	0	0	0	0	0	0
MISMART	1	1	0	0	1	2	1	1	0	1	0	0	0	0
COMCAT	1	1	0	0	1	2	1	1	0	0	0	0	1	0
Message editing	0	0	0	1	2	3	1	0	0	0	1	0	0	0
Message dissemination	0	1	0	0	2	1	1	1	1	1	0	0	0	0
Message sanitization	0	1	1	0	3	1	0	2	0	0	0	0	0	0
Transcribing messages														
Voice to text	1	1	0	0	0	1	3	1	0	1	0	0	0	0
Text to voice	0	1	0	0	1	3	3	0	0	0	0	0	0	0
Message format														
Error correction	0	0	0	0	2	1	1	0	0	3	1	0	0	0
Monitoring system status	0	0	3	0	1	2	0	1	0	1	0	0	0	0
Adding pilots	1	0	0	0	1	2	1	1	0	1	0	0	1	0
Creating history tapes (CRT command)	2	0	0	0	1	2	0	2	1	0	0	0	0	0
Recovery from a corrupted message file	2	1	0	0	1	1	0	0	0	1	0	1	1	0

37. How many times would you estimate that you used each of the following commands?

	Did not use		1-2 times		3-5 times		More than 5 times		NR	
ARUPTD	2	3	0	1	0	0	2	0	0	0
CHG	4	4	0	0	0	0	0	0	0	0
COM	1	1	0	0	0	0	3	3	0	0
CRG	4	4	0	0	0	0	0	0	0	0
CROFCT	2	4	0	0	0	0	1	0	1	0
DCC	1	1	0	0	0	0	3	3	0	0
INTGEN	4	3	0	0	0	0	0	0	0	1
LML	0	0	0	0	2	0	2	4	0	0
LOGGEN	4	4	0	0	0	0	0	0	0	0
PLS	4	4	0	0	0	0	0	0	0	0
PRT	4	4	0	0	0	0	0	0	0	0
MSGRCL	4	1	0	1	0	1	0	1	0	0
RTC	4	4	0	0	0	0	0	0	0	0
SHS	3	3	0	0	0	0	0	0	1	1
SQS	2	0	0	0	1	0	1	4	0	0
STS	4	3	0	0	0	0	0	1	0	0
SUS	0	1	0	0	0	0	4	3	0	0
SWO	4	4	0	0	0	0	0	0	0	0
OPR	1	3	0	0	1	0	2	1	0	0
UPT	1	3	0	0	0	0	3	1	0	0

38. Did you build an automatic routing data base file (ARMDB__) to reduce your workload in sending specific types of messages to requestors?

0	0	Yes
3	0	No
1	4	NR

39. How easy-difficult was it to understand the rules for determining addresses for ACTION and INFO messages?

0	0	Very easy
0	0	Easy
2	1	In between
0	1	Difficult
1	1	Very difficult
1	1	NR

40. Approximately what percentage of your operating time would you estimate that you spent seeking help (from contractors personnel, the HLP menu, manuals and class notes, other operators, etc)?

0	1	10% or less
1	1	10-20%
1	1	20-30%
2	1	30-40%
0	0	Other (estimate)

41. How many times each day, on the average, would you estimate you used the Help (HLP) command?

1	4	0
2	0	1-2
1	0	3-4
0	0	5-6
0	0	Other (estimate)

42. How adequate-inadequate was the HLP menu in informing you <u>how</u> to enter the commands?

1	3	Did not use
0	0	Very adequate
1	0	Adequate
2	0	In between
0	1	Inadequate
0	0	Very inadequate

43. Did you use checklists in initializing the equipment when the Pilot Studies started on November 17?

4	3	Yes
0	1	No

44. Do you still use any checklists in performing your job?

4	4	Yes
0	0	No

If "Yes," what do you use checklists for?

_____

_____

45. If you received a message (error message, fatal message, informational message, or unusual occurrence message) that you didn't understand, what was the approximate average time required to find out what the message meant and decide what action, if any, you should take?

0	0	Did not receive any of these messages
0	1	Did not receive any messages I didn't understand
0	0	1 minute or less
0	0	1-2 minutes
0	0	2-3 minutes
1	1	3-5 minutes
3	2	More than 5 minutes, please estimate _____ minutes

46. What percentage of the time would you estimate you had to seek help to understand:

	Approximate # messages*		If received % estimate	
Error messages	4	1	50-99	70
Fatal messages	1	1	NR	100
Information messages	1	0	30	-
Unusual occurrence messages	1	1	50	100

Note. Entries are number of operators who received a message of that type.

47. Did you ever generate a:

	Yes		No		NR	
Queue Statistics Report?	1	3	2	1	1	0
Station Status Report?	2	3	1	1	1	1
System History Report?	1	2	2	2	1	0
PLA Statistics Report?	1	1	2	3	1	0

48. How useful to you were each of the following displays?

	Very useful		Useful		Moderately useful		Of little use		Of no use		Did not see	
CSP dynamic status display	0	2	0	1	1	0	0	0	0	1	3	0
Station status report	0	0	1	1	1	0	0	1	1	2	1	0
Queue statistics report	2	0	2	1	0	0	0	1	0	2	0	0
System history report	0	0	0	1	1	0	0	1	0	2	3	0

	Very useful		Useful		Moderately useful		Of little use		Of no use		Did not see	
Line logging report	1	0	0	1	0	0	0	1	0	2	3	0
Plain language statistics report	1	0	0	0	0	0	0	1	0	2	3	1
CSP system configuration report(s)	1	0	0	0	1	0	0	1	1	2	1	1

49. How easy-difficult to read were the displays on the GRIDSE-T?

3	0	Very easy
1	4	Easy
0	0	In between
0	0	Difficult
0	0	Very difficult

50. How easy-difficult to read are the numerals, letters and/or commands on the GRIDSE-T keyboard?

2	0	Very easy
2	1	Easy
0	0	In between
0	1	Difficult
0	2	Very difficult

Note. The two keyboards differed. The commands on the CEWI FSIC keyboard were pasted over the keys, and with use, the print rubbed off and became difficult to read.

51. Does the GRIDSE-T keyboard provide an adequate typing "feel?"

4	1	Yes
0	0	No

52. How easy-difficult would it be to use the GRIDSE-T wearing MOPP IV gear?

0	0	Very easy
0	0	Easy
0	0	In between
1	1	Difficult
3	2	Very difficult
0	1	NR

53. Does the system provide adequate prompts to prevent operator errors?

0	0	Nearly always
2	2	Most of the time
1	0	Many additional prompts are needed
0	2	A few additional prompts are needed
1	0	Some additional prompts are needed

54. Does the system provide adequate prompts to correct operator errors?

0	1	Nearly always
2	1	Most of the time
0	2	Many additional prompts are needed
1	0	A few additional prompts are needed
1	0	Some additional prompts are needed

55. How adequately-inadequately did the FARM function work for intercepting the particular messages you wished to see?

0	0	Very adequately
0	1	Adequately
3	0	In between
1	1	Inadequately
0	0	Very inadequately
0	2	NR

56. Do you feel that operating the FSIC places too large a memory burden on the operators?

0	1	Yes
4	3	No

57. During peak workload times did your performance of any tasks become less effective?

3	2	Yes
1	2	No

58. Did your performance of any task become unsatisfactory during peak workload times?

3	2	Yes
1	2	No

59. Are there any tasks or functions during which it would be possible to accidentally erase or modify the system's files?

0	2	Yes
2	2	No
2	0	NR

60. Do you feel that system response time to any commands was excessive?

1	2	Yes
3	2	No

If "Yes," list those commands below:

_____

_____

_____

61. Are there any functions or tasks that you feel are more difficult to accomplish with the FSIC than with procedures you employed before?

Please list any such functions or tasks:

_____

_____

_____

62. Compared to times when the FSIC was fully operational, how easy-difficult was it to keep up with your work during degraded operations (e.g., during a communications failure)?

0	0	Very easy
0	0	Easy
3	2	In between
1	1	Difficult
0	1	Very difficult

63. How easy-difficult do you feel it would be for a sophisticated enemy force to locate the FSIC by electronic means?

4	2	Very easy
0	1	Easy
0	0	In between
0	0	Difficult
0	0	Very difficult
0	1	NR

64. How easy-difficult do you feel it would be for a sophisticated enemy force to locate the FSIC by acoustic means?

1	1	Very easy
1	0	Easy
2	2	In between
0	0	Difficult
0	0	Very difficult
0	1	NR

The FSIC is designed to provide an automated and manual interface between sensors and the MI battalion TCAE. To help us evaluate how well this worked please assess the FSIC's performance in the following areas:

65. Providing data communications between sensors and the TCAE, and converting messages into common formats.

0	0	FSIC failed to perform these tasks
1	1	Performance was inadequate
1	2	Performance was adequate, but the FSIC has major problems
2	0	Performance was good, but there are still some problems
0	1	Performance was very good
0	0	Performance was excellent

66. Providing a capability for transcribing voice messages into automated message formats.

0	0	FSIC failed to perform these tasks
1	1	Performance was inadequate
1	0	Performance was adequate, but the FSIC has major problems
1	1	Performance was good, but there are still some problems
1	1	Performance was very good
0	0	Performance was excellent
0	1	NR

67. Providing data communications between the MI Battalion TCAE and the sensors:

1	0	FSIC failed to perform these tasks
1	2	Performance was inadequate
1	0	Performance was adequate, but the FSIC has major problems
0	1	Performance was good, but there are still some problems
1	1	Performance was very good
0	0	Performance was excellent

68. Assisting in the identification, sanitization and routing of combat information to the Brigade.

1	0	FSIC failed to perform these tasks
1	2	Performance was inadequate
1	0	Performance was adequate, but the FSIC has major problems
1	0	Performance was good, but there are still some problems
0	1	Performance was very good
0	0	Performance was excellent
0	1	NR

69. Providing Automated Interface with the AIM:

0	0	FSIC failed to perform these tasks
0	1	Performance was inadequate
0	1	Performance was adequate, but the FSIC has major problems
2	1	Performance was good, but there are still some problems
0	1	Performance was very good
0	0	Performance was excellent
2	0	NR

70. What are the major problem areas of the system?

3	3	Complexity
0	1	Lack of software to support functions
0	2	Poor hardware design
0	2	Poor software design
1	2	Other (specify)

71. What are the best points about the system?

3	1	Communications capability
2	2	Ability to deal with large volumes of data
1	1	Speed of response

APPENDIX B

AIM OPERATOR QUESTIONNAIRE

The responses recorded in the first column for each item are those of the DTOC AIM operators. Those in the second column are those of the CEWI AIM operators. Those in the third column are the combined responses of all AIM personnel including the supervisors. Exceptions to this scheme of recording are noted on the questionnaire for specific items.

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AIM OPERATOR/INTELLIGENCE ANALYST

QUESTIONNAIRE

INFORMATION PRIVACY ACT STATEMENT

1. Authority: 5 USC 301, 10 USC 3012, Authority for the Secretary of the Army to Issue AR's; 44 USC 3101, Authority for Collecting Necessary Data.

2. Principal Purpose: To collect data to evaluate the human factors/manpower/ personnel/health hazard/and safety training aspects of the All Source Analysis System (ASAS) during operational testing.

3. Routine Uses: The data collected with this form are to be used for research purposes only. They will not become a part of any individual's record and will not be used in whole or in part in making any determination about an individual.

   The identifiers (name or Social Security Number) are to be used for administrative and statistical control purposes only. Full confidentiality of responses will be maintained in the processing of these data.

4. Mandatory or Voluntary Disclosure and Effect on Individual Not Providing Information - Your participation in this reseach is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of the research, but there will be no effect on the individuals not providing all or any part of the information.

   This notice may be detached from the rest of this form and retained by the individual answering the questionnaire if so desired.

AIM OPERATOR/INTELLIGENCE ANALYST QUESTIONNAIRE

Name: _____

Rank: _____ SSN: _____

Approximate height: _____ft _____inches

Approximate weight: _____lbs

Age _____years _____months

Time in service: _____years _____months

Current MOS: _____

Time in current MOS: _____years _____months

Have you worked on TCAC? ___Yes ___No

If "Yes," in what position (job title) _____

If "Yes," for how long? _____years _____months

What is your position (job title) for the current ASAS field trials?

_____

Highest level of civilian education (Circle letter which applies to you):

a. No high school diploma
b. GED
c. High school graduate
d. 1-2 years of college
e. 3-4 years of college
f. College graduate (list degree and major): _____
g. Advanced degree (list degree and major): _____
h. Graduate or trade school (list speciality): _____

Do you own a personal computer? _____Yes _____No

What were your favorite subjects in high school?

_____

_____

If you received any civilian training beyond high school, what was(were) the primary area(s)?

_____

_____

Do you plan on making the Army a career? _____Yes _____No

Regardless of your current career intentions, what would be your civilian occupational choice(s)? Please be realistic.

_____

_____

INSTRUCTIONS

This questionnaire contains multiple-choice items asking you to respond on a point scale or to chose one of several alternative answers. Read each item carefully and mark the one rating value or answer that most closely agrees with your personal opinion on the subject being considered.

The questionnaire also contains items in which you are asked to provide written information. Provide all the information you think appropriate.

If you have any questions concerning the meaning of any items, please ask the monitor for clarification.

1. Rate your understanding of the tasks required of you at the completion of training at Martin-Marietta:

2	2	6	Very good
5	6	16	Good
2	1	5	In between
1	0	1	Poor
0	0	0	Very poor

2. Rate your understanding of the tasks required of you at present:

3	4	8	Very good
2	3	8	Good
2	2	7	In between
3	0	4	Poor
0	0	1	Very poor

3. In general, how easy-difficult was it to select a site for the AIM shelter vehicle so that it could be leveled?

0	2	2	Very easy
3	1	8	Easy
2	2	4	In between
2	2	6	Difficult
0	0	0	Very difficult
3	2	8	NR

4. Once the AIM vehicle was in place on the selected site, how easy-difficult was it to level it within limits?

0	1	2	Very easy
4	2	9	Easy
2	1	4	In between
1	2	3	Difficult
0	0	0	Very difficult
3	3	10	NR

5. Answer items 5a through 5d based on your experiences at Martin-Marietta:

5a. How easy-difficult was it to level the vehicle so that movement of the MECAs during on/offloading could be easily controlled?

2	3	9	Very easy
5	1	7	Easy
1	1	4	In between
1	0	1	Difficult
0	1	1	Very difficult
1	3	6	NR

5b. In offloading MECAs, how easy-difficult was it to attach/detach the MLD from the MECAs?

2	3	5	Very easy
6	1	13	Easy
2	2	7	In between
0	0	0	Difficult
0	0	0	Very difficult
0	3	3	NR

5c. How easy-difficult was it to attach/detach the wheels while on/offloading the MECAs?

2	1	3	Very easy
6	4	15	Easy
2	0	6	In between
0	2	2	Difficult
0	0	0	Very difficult
0	2	2	NR

5d. How easy-difficult was it to move the MECAs to/from the operating positions to/from the vehicle?

2	3	6	Very easy
6	2	12	Easy
0	1	5	In between
2	0	2	Difficult
0	1	1	Very difficult
0	2	2	NR

6. Have you been injured in any way while positioning the MECAs (either at Martin-Marietta or at Fort Hood)?

1	1	5	Yes
9	7	22	No
0	1	1	NR

(If "Yes," please explain:)

7. Were all netting shelter cables, connectors, etc., adequately labeled or coded to insure proper connections without damage to equipment or injury to personnel?

9	5	19	Yes
0	4	8	No
1	0	1	NR

(If "No," specify which connectors and/or cables were easily confused:)

_____
_____
_____
_____

8. Did you know when you were to "bump start" the ECU in the AIM shelter (if "off" for more than 4 hours, or, if exposed to temperatures below 50°F)?

1	1	2	Yes
9	8	25	No
0	0	1	NR

9. Did you follow a checklist when powering up the AIM shelter components?

2	0	4	Yes, every time
4	2	6	Almost every time
2	5	13	Just for the first trials until I learned the procedures
1	2	4	I knew the procedures well before the test started and didn't need a checklist
1	0	1	NR

10. Was lighting in the shelter adequate for powering up and powering down the AIM shelter components?

10	9	28	Yes
0	0	0	No

If "No," please explain where additional lighting is needed:

_____
_____
_____
_____

11. How easy was it to mount the magnetic tape?

0	0	2	Very easy
2	5	12	Easy
0	0	1	In between
1	0	1	Difficult
0	0	1	Very difficult
7	4	11	NR

12. Were all cables and connectors adequately labeled or coded to insure proper connection to the MECAs without damage to the equipment or injury to personnel?

10 8 22 Yes
0 1 6 No

(If "No," specify which connectors and/or cables were easily confused:)

_____
_____
_____
_____

13. Did you have any problems in powering up your workstation?

	Yes		No		NR	
Forgetting proper position of MICROFIX switches	0	0	10	8	0	1
Energizing CPU and disk drive in wrong sequence	0	0	10	8	0	1
Forgetting to unlock head on video player	2	1	8	7	0	1
Loading and adjusting paper in printer	1	3	9	5	0	1
Setting up crypto equipment	0	0	8	7	2	2
Setting up AN/VRC 46 radio	1	0	7	7	2	2

14. Did you use the map displays on your CRT?

5 1 7 Yes
5 7 20 No
0 1 1 NR

If "No," why not?

_____
_____
_____
_____

If "Yes," answer items 14a through 14e:

14a. How easy-difficult is it to read the lettering on the maps presented on your CRT?

1	1	2	Very easy
4	1	5	Easy
3	2	8	Marginal
1	0	1	Difficult
0	1	1	Very difficult
1	4	11	NR

14b. How adequate-inadequate is the coverage of territory on the maps presented on your CRT?

0	1	1	Very adequate
4	0	5	Adequate
2	0	2	In between
2	3	5	Inadequate
1	1	4	Very inadequate
1	4	11	NR

14c. How easy-difficult was it to place symbols on the CRT maps?

0	0	0	Very easy
5	1	6	Easy
1	1	3	In between
3	2	6	Difficult
0	1	1	Very difficult
1	4	12	NR

14d. How easy-difficult was it to move or delete symbols on your CRT maps?

0	0	0	Very easy
6	0	7	Easy
0	2	3	In between
3	2	6	Difficult
0	1	1	Very difficult
1	4	11	NR

14e. How easy-difficult was it to distinguish among the map symbols on your CRT maps?

0	0	0	Very easy
2	1	3	Easy
5	1	6	In between
1	2	4	Difficult
1	1	3	Very difficult
1	4	12	NR

15. Supervisor Only: Overall, how easy-difficult were each of the GESCAN functions to accomplish? Note. Operators were requested verbally to respond if they had performed these functions. Only one CEWI operator

responded and is not recorded. The first column presents the responses of the DTOC operators, and the second includes the supervisors.

	Very easy		Easy		In between		Diffi-cult		Very diffi-cult		NR or Not used	
Creating queries	1	2	2	4	4	8	1	3	1	1	1	1
Editing queries	1	2	3	5	2	7	0	0	1	2	3	3
Choosing correct data bases for queries	1	4	1	4	3	6	1	1	0	0	4	4
Choosing correct terms for queries	0	0	1	2	5	10	1	4	1	1	2	2
Deciding where additional terms should be added to queries (top & bottom)	0	1	0	1	4	8	1	3	1	1	4	5
Determining fields for query terms	0	2	4	4	2	4	0	3	1	3	3	3
Deleting terms from queries	0	2	5	6	1	5	0	0	0	1	4	5
Using Logic equations to narrow or broaden searches	0	0	3	5	1	6	2	3	0	0	4	5
Choosing and using proximity and distance qualifiers	0	0	0	0	0	1	1	2	0	0	9	16
Aborting queries	0	3	3	8	0	0	1	1	0	0	6	7
Copying queries	1	2	3	8	0	0	1	0	0	0	5	9
Deleting queries	1	4	4	8	1	2	1	1	0	0	3	4
Monitoring queries	0	3	5	7	0	2	0	1	0	0	5	6
Printing queries	1	2	2	6	2	2	0	0	0	0	5	9
Renaming queries	1	2	3	7	0	0	2	2	0	0	4	8
Obtaining query directory	1	3	2	5	0	0	1	2	0	0	6	9
Running queries	1	3	4	10	0	1	1	1	0	0	4	4

(item 15 cont'd)

	Very easy		Easy		In between		Difficult		Very difficult		NR or Not used	
Changing qualifiers for existing queries	0	1	2	4	0	2	1	3	0	0	7	9
Obtaining Hit file for browsing	0	4	1	5	1	1	1	1	0	0	7	8
Obtaining Hit file directory	0	3	1	3	0	0	1	1	0	0	8	12
Understanding Hit file directory	0	3	0	2	1	2	1	1	0	0	8	11
Finding specific terms in messages	0	3	1	3	1	2	1	2	0	1	7	8
Editing search results	0	1	1	4	0	3	1	1	0	1	8	9
Tagging Hit files	0	1	1	1	0	2	1	1	0	0	8	14
Annotating Hit files	0	1	1	1	0	2	1	1	0	0	8	14
Printing messages	2	5	3	6	2	3	0	1	0	0	3	4
Deleting Hit files	2	4	3	6	1	3	0	0	0	0	4	6
Creating thesaurus	0	2	1	1	0	2	0	2	0	0	9	12
Using directory of thesauri	0	3	1	4	0	1	0	0	0	0	9	11
Deleting terms in a thesaurus	0	3	1	2	0	0	0	1	0	0	9	13
Copying a thesaurus	0	1	1	3	0	0	0	0	0	0	9	15
Renaming a thesaurus	0	1	1	3	0	0	0	0	0	0	9	15
Changing qualifiers in a thesaurus	0	1	0	1	1	2	0	0	0	0	9	15
Printing a thesaurus	0	0	1	3	0	0	0	0	0	0	9	16
Using a thesaurus in a query	0	1	1	4	0	1	0	0	0	0	9	13
Deleting a thesaurus	0	3	1	3	0	0	0	0	0	0	9	13

16. MICROFIX Workstation Operators Only: How easy-difficult was it to perform each of the terminal control processor operations? Note. Supervisors did not use MICROFIX equipment.

	Easy		In between		Difficult		NR or Not Used	
Log on to MICROFIX & establish V2 link	9	9	0	1	0	0	0	0
Display summary of queued messages	10	8	0	1	0	0	0	0
Display a specific message	9	9	1	0	0	0	0	0
Execute options on a message	9	9	1	0	0	0	0	0
Transfer a file to V2 for printing	5	6	4	3	1	0	0	0
Upload a message to V2 for transmission	7	6	1	3	1	0	1	0
Review temporary message queue								
Accessing temporary queue	9	4	3	0	0	0	1	2
Selecting message	9	3	0	4	0	0	0	3
Downloading to MICROFIX data base	8	1	2	4	0	1	0	3
Return control to terminal	9	9	0	0	0	0	1	0

17a. How would you rate the response time to commands at your station?

0	0	0	Very fast
1	1	2	Fast
4	2	8	In between
5	3	12	Slow
0	3	5	Very slow
0	0	1	NR

17b. Did you notice any differences in system response time by:

	NR			Yes			No		
Time of day?	0	2	4	0	0	0	10	7	24
Number of stations operating?	0	2	3	7	1	15	3	6	10
Intensity of the situation?	0	2	4	6	2	13	4	5	11
Type of requirement?	0	2	4	5	3	15	5	4	9

18. Is the organization of information displayed helpful for doing your job?

4	4	10	Yes
2	4	12	No
4	1	6	NR

19. Are there enough computer commands which specify various functions to accomplish your job?

8	2	14	Yes
1	5	9	No
1	2	5	NR

20. Overall, how easy-difficult was it to generate MISMART messages?

1	3	4	Very easy
6	4	12	Easy
3	2	7	In between
0	0	2	Difficult
0	0	1	Very difficult
0	0	2	NR

21. Were there any tasks more difficult or time consuming to accomplish with the analyst stations than with previous methods you have used? If so, please list those functions:

_____

_____

_____

_____

22. Are there any tasks or functions during which it would be possible to accidentally erase or modify the system's files without adequate warning?

0	1	4	Yes
7	6	14	No
3	2	10	NR

23a. When you received a response to tasking during normal operations, how would you rate the adequacy of response time to your tasking messages?

0	0	0	Very satisfactory
3	2	8	Satisfactory
3	4	7	In between
4	1	6	Unsatisfactory
0	2	3	Very unsatisfactory
0	0	4	NR

23b. When you received a response to tasking during peak periods of operations, how would you rate the adequacy of response time to your tasking messages?

0	0	0	Very satisfactory
2	3	7	Satisfactory
1	2	4	In between
7	1	9	Unsatisfactory
0	3	4	Very unsatifactory
0	0	4	NR

24. Do you feel that using this system places too large a memory burden on the operator?

4	1	11	Yes
6	8	15	No
0	0	2	NR

25. How easy-difficult was it to understand voice communications?

1	0	1	Very easy
2	2	4	Easy
1	3	5	In between
0	0	0	Difficult
0	0	1	Very difficult
6	4	17	NR

26. How safe did you feel in accomplishing each of the following operations? (Answer based on your experience at Martin-Marietta)

	Very safe			Safe			In between			Unsafe			Very unsafe			NR or Did not do		
Unloading the MECAs from the vehicle	1	1	2	7	2	10	1	1	5	0	2	2	0	2	5	1	1	4
Attaching wheels & handles to the MECAs	1	4	5	7	1	12	1	0	1	4	0	4	0	0	3	1	0	3
Moving the MECAs into position for use	4	4	8	5	3	14	1	2	5	0	0	0	0	0	0	0	0	1

	Very safe			Safe			In between			Unsafe			Very unsafe			NR or Did not do		
Removing wheels & handles from the MECAs when in position.	1	4	7	7	2	13	1	2	4	0	1	2	0	0	0	1	0	2
Attaching cables, connectors, etc.	2	4	9	7	5	16	1	0	2	0	0	0	0	0	0	0	0	1
Operating an Analyst Station	5	6	14	5	3	10	0	0	0	0	0	0	0	0	0	0	0	4
Moving the MECAs to the transport vehicle	3	4	7	6	2	13	0	2	4	0	0	0	0	0	1	1	1	3
Loading the MECAs on the transport vehicle	1	2	3	6	1	8	2	1	5	0	2	2	0	2	5	1	1	5

If you are a DTOC AIM system operator or data collector, answer questions 27a through 27g.

27a. Does the AIM provide a limited ADP support capability to the following DTOC functions?

(NOTE: CEWI AIM personnel did not respond. The first column presents the DTOC operators' responses and the second includes supervisors' responses.)

System Management:

0	0	None
0	2	Inadequate support
5	7	Limited support, but some problem areas
3	4	Very good support
0	0	Fully meets the requirements of my job
2	2	NR

27b. Situation development/assessment (near battle analysts, deep battle analysts):

0	0	None
1	4	Inadequate support
7	8	Limited support, but some problem areas
1	1	Very good support
0	0	Fully meets the requirements of my job
1	2	NR

27c. Target Development:

0	1	None
1	3	Inadequate support
4	6	Limited support, but some problem areas
1	1	Very good support
0	0	Fully meets the requirements of my job
4	4	NR

27d. Collection Management:

1	2	None
3	5	Inadequate support
2	4	Limited support, but some problem areas
2	2	Very good support
0	0	Fully meets the requirements of my job
2	2	NR

27e. All Source Analysis:

0	1	None
1	2	Inadequate support
7	10	Limited support, but some problem areas
1	1	Very good support
0	0	Fully meets the requirements of my job
1	1	NR

27f. Storage, Retrieval and Correlation of Data:

0	0	None
2	3	Inadequate support
5	7	Limited support, but some problem areas
3	4	Very good support
0	1	Fully meets the requirements of my job

27g. Intelligence Reporting:

0	0	None
3	6	Inadequate support
5	6	Limited support, but some problem areas
1	2	Very good support
0	0	Fully meets the requirements of my job
1	1	NR

If you are a CEWI AIM system operator or data collector, answer questions 28a through 28f.

(NOTE: DTOC personnel did not respond. The first column shown is for CEWI AIM operators and the second column includes supervisors' responses.)

28. Does the AIM provide a limited ADP support capability to the following TCAE functions?

28a. System Management:

1	3	None
1	2	Inadequate support
3	4	Limited support, but some problem areas
1	1	Very good support
0	0	Fully meets the requirements of my job
3	3	NR

28b. Mission Management:

1	3	None
3	4	Inadequate support
3	4	Limited support, but some problem areas
0	0	Very good support
0	0	Fully meets the requirements of my job
2	2	NR

28c. Sigint Analysis (Comint and/or Elint):

1	5	None
2	2	Inadequate support
4	4	Limited support, but some problem areas
0	0	Very good support
0	0	Fully meets the requirements of my job
2	2	NR

28d. All Source Input/Analysis:

0	3	None
1	1	Inadequate support
5	5	Limited support, but some problem areas
1	1	Very good support
0	0	Fully meets the requirements of my job
2	3	NR

28e. Storage, Retrieval and Correlation of Data:

1	3	None
3	5	Inadequate support
1	1	Limited support, but some problem areas
2	2	Very good support
0	0	Fully meets the requirements of my job
2	2	NR

28f. Intelligence Reporting:

0	1	None
0	2	Inadequate support
6	7	Limited support, but some problem areas
0	0	Very good support
1	1	Fully meets the requirements of my job
2	2	NR

29. How many of the following symptoms did you have while operating an Analyst Station, and how long after your shift began did they appear?

	NR			Yes			No			How long on shift (hours)*
Eyestrain	1	0	3	6	8	17	3	1	8	_____
Blurred vision	0	0	2	2	3	6	8	6	20	_____
Headaches	0	0	2	4	5	10	6	4	15	_____
Dizziness	0	1	3	1	1	2	9	7	23	_____
Fatigue	0	0	2	7	6	16	3	3	10	_____
Neck & shoulder stiffness	0	0	2	8	4	18	2	5	8	_____
General muscle stiffness	0	0	2	6	4	14	4	5	12	_____
Finger fatigue	0	0	2	1	1	3	9	8	23	_____
Backache	0	0	2	6	4	15	4	5	11	_____
Hearing difficulties	0	0	2	0	2	2	10	7	24	_____

*Response varied from less than one hour to 12 hours.

30. How easy-difficult would it be to prepare the AIM(6) (including Analyst Stations) while wearing MOPP IV gear?

0	0	0	Very easy
0	0	0	Easy
1	1	3	In between
6	1	7	Difficult
3	7	17	Very difficult
0	0	1	NR

What tasks would be most difficult:

_____

_____

_____

31. How easy-difficult would it be to use your keyboard while wearing MOPP IV gear?

0	0	0	Very easy
0	0	0	Easy
4	1	6	In between
5	3	8	Difficult
1	5	13	Very difficult
0	0	1	NR

32. What are the major problem areas of the system?

4	2	10	Complexity
5	3	14	Lack of software to support functions
5	1	11	Poor hardware design
1	8	13	Poor software design
3	2	8	Other (specify) _____

33. What are the best points about the system?

0	1	9	Communications capability
4	5	13	Ability to deal with large volumes of data
0	1	2	Speed of response
2	2	5	Ease of operator interface with the system
5	0	6	Other (specify)* _____

*Responses largely indicated that the system concept was good.

APPENDIX C

FSIC OPERATOR INTERVIEW QUESTIONS

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FSIC OPERATORS

Items for Structured Interviews

1. Are the most frequently employed controls conveniently located and grouped for ease of performance? What should be changed?

2. Do you know of any safety or health hazards that were not covered in adequate detail in the questionnaires?

3. What would you most like to see changed in FSIC operating procedures?

4. Did you have any problems in emplacing, connecting, operating, or march ordering the power generation equipment?

5. What areas or what tasks do you think should be particularly emphasized in future training for FSIC operators?

6. Do you have any suggestions for improving the usefulness of manuals and other printed materials?

7. What skills are required on the job by FSIC operators that were not included in your MOS training (or used in selection)?

8. Does the FSIC require any increases (decreases) in personnel to accomplish the equivalent tasks with manual methods?

9. What personnel attributes (aptitudes or aptitude levels, physical requirements, etc.) are required for FSIC operations that are not required for manual operations?

10. What tasks, and why, would be most difficult to accomplish while wearing MOPP IV gear?

11. How would you assess your workload? Did it ever get so heavy that you got significantly behind in processing messages?

12. Stress:

    (a) Name any stressful tasks, procedures or functions which stress the operator sufficiently to reduce effectiveness to unacceptable levels.

    (b) For each: Does the degree or duration of the stress lead to unsatisfactory performance?

Supervisors: What personal characteristics do you feel are required for a competent FSIC operator?

APPENDIX D

AIM OPERATOR INTERVIEW QUESTIONS

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AIM ANALYSTS

Items for Structured Interviews

1. Did your queries produce the information you expected them to produce?

2. Are the procedures for creating queries flexible enough for you to be able to request the information you need?

3. Are the procedures for creating queries complete enough for you to be able to request the information you need?

4. Were the data bases generally adequate to provide the desired data?

5a. What problems did you have in creating queries?

5b. Is it possible to track queries, that is, to determine the status of given queries?

6. Are the most frequently employed controls conveniently located and grouped for ease of performance? What should be changed?

7. Do you know of any safety or health hazards that were not covered in adequate detail in the questionnaires?

8. Did you have any problems in emplacing, connecting, operating or march ordering the power generation equipment?

9. What areas or what tasks do you think should be particularly emphasized in future training for analysts operating computer-based intelligence systems?

10. Do you have any suggestions for improving the usefulness of manuals and other printed materials?

11. What skills are required on the job that were not included in your MOS training (or used in selection)?

12. Does the AIM(6) system as configured require any increases (decreases) in personnel to accomplish the same functions that were previously performed by manual methods?

13. What personnel attributes/aptitudes (aptitude levels, physical requirements, etc.) are required for AIM(6) operations that are not required for manual operations?

14. What tasks, and why, would be most difficult to accomplish while wearing MOPP IV gear?

15. How would you assess your workload? Did it ever get so heavy that you got significantly behind in processing your work?

6. Stress:

(a) Name any tasks, procedures, or functions which stress the analyst sufficiently to reduce effectiveness to unacceptable levels?

(b) For each: Does the degree or duration of the stress lead to unsatisfactory performance?

Supervisors: What personal characteristics do you feel are required for a competent analyst on a computer-based intelligence system?

APPENDIX E

PERSONNEL SUPERVISOR/OBSERVER QUESTIONNAIRE

Responses in the first column are those of CEWI personnel and those in the second column are those of DTOC personnel.

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PERSONNEL SUPERVISOR/OBSERVER

QUESTIONNAIRE

INFORMATION PRIVACY ACT STATEMENT

1. Authority: 5 USC 301, 10 USC 3012, Authority for the Secretary of the Army to Issue AR's; 44 USC 3101, Authority for Collecting Necessary Data.

2. Principal Purpose: To collect data to evaluate the human factors/manpower/ personnel/health hazard/and safety training aspects of the All Source Analysis System (ASAS) during operational testing.

3. Routine Uses: The data collected with this form are to be used for research purposes only. They will not become a part of any individual's record and will not be used in whole or in part in making any determination about an individual.

   The identifiers (name or Social Security Number) are to be used for administrative purposes only. Full confidentiality of responses will be maintained in the processing of these data.

4. Mandatory or Voluntary Disclosure and Effect on Individual Not Providing Information - Your participation in this research is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of the research, but there will be no effect on the individuals not providing all or any part of the information.

   This notice may be detached from the rest of this form and retained by the individual answering the questionnaire if so desired.

PERSONNEL SUPERVISOR AND OBSERVER QUESTIONNAIRE

Name: _____

Rank: _____ SSN: _____

Time in service: _____years _____months

Current MOS: _____

Time in current MOS: _____years _____months

What is your position (job title) for the ASAS field trials?

_____

Have you worked on TCAC? ___Yes ___No

If "Yes," in what position (job title) _____

If "Yes," for how long? _____years _____months

Highest level of civilian education (Circle letter which applies to you):

a. High school graduate
b. 1-2 years of college
c. 3-4 years of college
d. College graduate (list degree and major): _____
e. Advanced degree (list degree and major): _____
f. Graduate or trade school (list speciality): _____

Do you own a personal computer? _____Yes _____No

What military schools or other training have you completed (e.g., officer basic, officer advanced, Sergeants Major Academy, etc., specify branch where appropriate)?

_____

_____

_____

_____

Do you plan on making the Army a career? _____Yes _____No

Regardless of your current career intentions, what would be your civilian occupational choice(s)?

_____

_____

As a Supervisor/Observer, did the system seem to provide support to the following areas?

1. DTOC AIM to DTOCSE Operations:

0	0	a. No support
2	1	b. Inadequate support
1	0	c. Adequate support, but major problems still exist
0	2	d. Good support, but some problems still exist
0	0	e. Very good support
0	0	f. Meets all needs for this function
4	0	NR (No Response)

Comment:

_____
_____
_____
_____

2. CEWI AIM to MI Battalion/TCAE Operations:

0	0	a. No support
3	0	b. Inadequate support
2	2	c. Adequate support, but major problems still exist
1	1	d. Good support, but some problems still exist
1	0	e. Very good support
0	0	f. Meets all needs for this function

Comment:

_____
_____
_____
_____

3. FISC to Intelligence/EW Communications:

0	0	a. No support
0	1	b. Inadequate support
2	0	c. Adequate support, but major problems still exist
4	2	d. Good support, but some problems still exist
1	0	e. Very good support
0	0	f. Meets all needs for this function

Comment:

_____
_____
_____
_____

4. AIM(6)/FSIC System as a Whole to Division I/EW Operations:

0	0	a. No support
4	0	b. Inadequate support
3	2	c. Adequate support, but major problems still exist
0	1	d. Good support, but some problems still exist
0	0	e. Very good support
0	0	f. Meets all needs for this function

Comment:

5. What are the major problem areas of the system? (Check as many as appropriate; put an asterisk (*) by the one you feel is the greatest problem.)

6	2	a. Complexity
5	1	b. Lack of software to support functions
1	2	c. Poor hardware design
3	2	d. Poor software design
1	0	e. Others (specify) _____

Comment:

6. What are the best points about the system? (Check as many as appropriate; put an asterisk (*) by the one you feel is the best attribute of the system.)

6	2	a. Communications ability
6	2	b. Ability to deal with large volumes of data
3	2	c. Speed of response
0	0	d. Ease of operator interface with the system
0	1	e. Others (specify) _____

Comment:

7. Do you feel the system as is places too great a memory burden on the operators?

___ Yes ___ No
3 0 3 3
1 0 NR (No Response)

If "YES," which one(s)?

_____

_____

_____

_____

8. Please list any tasks, subtasks, displays, procedures, or functions which you feel must be changed for the system to be acceptable to you (e.g., creating queries, generating/editing messages, map displays, recalling messages, error correction procedures, etc.):

_____

_____

_____

_____

_____

_____

_____

_____

APPENDIX F

FSIC OPERATOR PERFORMANCE/ATTITUDE/KNOWLEGE RATINGS FORM

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FSIC OPERATOR PERFORMANCE RATINGS

Rater: _____

Please rate each of the FSIC operators on each of the items below using the following scale:

Very satisfactory	=	5
Satisfactory	=	4
In between	=	3
Unsatisfactory	=	2
Very unsatisfactory	=	1

	Operator							
	1	2	3	4	5	6	7	8
Computer literacy								
MOS knowledge								
Overall knowledge of FSIC operations								
Flexibility in using alternative means of accomplishing tasks with the FSIC								
Ability to rapidly sanitize messages								
Attitude towards job								
Adaptability to unexpected or emergency situations								
Ability to work under stress								
Ability to work with others								
Overall performance during test(s)								

Note. Forms given to the raters had the names of the personnel rated at the tops of the columns.

APPENDIX G

AIM OPERATOR PERFORMANCE/ATTITUDE/KNOWLEDGE RATING FORM

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AIM (6) OPERATOR PERFORMANCE RATINGS

Rater: _____

Please rate each of the AIM operators on each of the items below using the following scale:

Very satisfactory	=	5
Satisfactory	=	4
In between	=	3
Unsatisfactory	=	2
Very unsatisfactory	=	1

	Operator							
	1	2	3	4	5	6	7	8
Computer literacy								
MOS knowledge								
Overall knowledge of AIM(6) operations								
Flexibility in using alternative approaches of accomplishing tasks with the MICROFIX								
Attitude towards job								
Ability to rapidly sanitize messages								
Adaptability to unexpected or emergency situations								
Ability to work under stress								
Ability to work with others								
Overall performance during test(s)								

Note. Forms given to the raters had the names of the personnel to be rated at the tops of the columns.

APPENDIX H

MEMORANDUM TO ASAS TEST PERSONNEL AND DATA COLLECTORS

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Memorandum to: ASAS Test Personnel and Data Collectors

From: MANPRINT Staff

Subject: MANPRINT issues in ASAS.

1. Manpower and Personnel Integration (MANPRINT) is a new initiative which is described in AR 602-2. MANPRINT is an umbrella term encompassing human factors engineering, manpower, personnel, training, health hazard assessment and system safety. The MANPRINT initiative was developed because the US Congress wanted to know "Are the Armed Forces getting what they are paying for in total weapon system performance or are critical resources being wasted to acquire high capability technology that exceeds the bounds of human performance?" AR 602-2 describes the Army's approach to ensuring that the human user will be given full consideration in all phases of system acquisition in the future. The Commanding General, OTEA, is assigned the responsibility to:

a. Ensure MANPRINT Issues are identified, tested, and evaluated during testing and evaluation for which OTEA is responsible.

b. Ensure pertinent MANPRINT data are collected during user testing for which OTEA is responsible and are made available for use by other MANPRINT activities and for continuous comprehensive evaluation.

c. Verify that soldiers used in testing are representative of the user population.

2. Unfortunately, none of the MANPRINT staff has an SCI clearance. Therefore, it will not be possible for them to observe the testing. Normally, hypotheses concerning potential problems in MANPRINT areas are developed during test observation and clarified through the use of questionnaires and posttest interviews. Since direct observation by staff members will not be possible during the current ASAS testing, the staff is asking you to help provide this information. It is realized that you will be kept busy with other duties. However, you may notice such things as signs of extreme frustration during certain activities, errors made in performing specific tasks, behavior which might damage the equipment or lead to personnel injury, or near accidents. If you do, make a mental note and report the incident to CPT Slater. Please report any incident you think might be relevant. Over-reporting rather than under-reporting is desired. By combining reports from all sources, we should be able to find the problems which need correcting.

3. As a further aid to you, brief definitions of the six MANPRINT domains are attached.

MANPRINT DOMAINS*

Human Factors Engineering

A comprehensive technical effort to integrate into Army doctrine, materiel development and materiel acquisition (to insure operational effectiveness) all relevant information concerning:

- Human characteristics
- Skill capabilities
- Performance
- Anthropometric data
- Bio-medical factors
- Safety factors
- Training
- Manning implications

Human Factors Engineering is concerned with the design, development, testing, evaluation and deployment of manned systems so that soldiers would be able to operate and maintain military systems at their optimum performance levels. This includes the systematic investigation of how the design of the soldier's job and the tools that are provided affect his/her capacity to do the job. The major emphasis is on system reliability and performance, soldier-system compatibility, and understanding of cost-benefits and ultimately, the achievement of user acceptance.

Manpower

Manpower is the personnel strength expressed in terms of the number of men and women available to, or required by the Army.

Manpower is concerned not merely with the accumulation of space requirements but also with (1) distribution of quantity, (2) distribution of gender, (3) distribution of skills and experience, (4) consideration of costs and bill payers, (5) force structure changes, and (5) workload and grade structure.

Personnel

The characteristics of an individual soldier (as opposed to a manpower space). Personnel includes consideration of MOS, specialty code, grade, and aptitudes.

The following statement by General Creighton Abrams puts the personnel domain in the proper perspective:

"By people, I do not mean 'personnel.' I do not mean end strength. I do not mean 'percent fill' or any of those labels which refer to people as commodity. I mean living, breathing, serving human beings. They have needs and interests and desires. They have spirit, and will, and strengths and abilities. They have weaknesses and faults. They have NAMES."

*Adapted from MANPRINT PRIMER (Draft), US Army Deputy Chief for Personnel, April 1986.

Training

Imparting the requisite knowledge, skills and abilities to qualify Army personnel for use, operation, maintenance and support of Army systems or equipment.

In the most basic terms, training is the process which prepares soldiers to perform jobs. The soldier is given a series of tasks, aptly named "soldier tasks," which describe what the Army wants the soldier to do. Performance standards are established to measure how well the Army wants the soldier to do the task; and finally, performance reflects the soldier's ability to accomplish the desired tasks.

Health Hazard Assessment

An existing or likely condition inherent to the operation or use of materiel that can cause death, injury, acute or chronic illness, disability, and/or reduced job performance of personnel by exposure to:

Shock/Recoil
Vibration
Noise (including steady state, impulse and blast overpressure)
Humidity
Toxic gases
Toxic chemicals
Ionizing and non-ionizing radiation (including x-rays, gamma rays, magnetic fields, microwaves, radio waves, and high intensity light)
Lasers
Heat and cold
Oxygen deficiency
Blunt/sharp trauma
Pathogenic micro-organisms

System Safety

The optimum degree of safety and health features, within the bounds of operational effectiveness, time and cost, attained by using system safety engineering and management principles to identify hazards and reduce risks throughout a system's life cycle.

APPENDIX I

LIST OF PHYSICAL MEASUREMENTS OBTAINED FOR THE FSIC

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Physical Measurements

Height of keyboard (720mm ±25mm)

Leg room (640mm H x 510mm W, x 460mm D)

Kickspace (100mm minimum)

Adjustment range of seating (380-535mm)

Workspace for writing (24 in x 16 in)

Diameter of keys on keyboard (19-38mm)

Spacing of keys on keyboard (6mm)

Size of characters on GRIDSET (16 minutes of visual angle at 16 inches)

Size of characters on Analyst Displays (16 minutes of visual angle at normal viewing distance)

Noise levels both with and without the printers operating.

APPENDIX J

Requirements from OTEA Database

DATA REQUIREMENTS

1. All questionnaire and interview data will be manually scored, reduced and interpreted.

2. Data relevant to human factors required from data bases (FSIC).

   a. List of and description of circumstances surrounding any injury to personnel.

   b. List of any hardware or software damages due to operator error.

   c. List of times the number of messages in or sent to a queue exceeded 95% of the capacity of the queue (including the DCT buffers).

   d. Time required to sanitize messages (M, σ).

   e. Number of messages awaiting sanitization during normal workload (M and Maximum).

   f. Times between receipt of SCI messages at Forward FSIC and the beginning of transmission of sanitized message (M, σ).

   g. Number of errors made in completing formatted messages, by message type (N, %).

   h. Times to raise each antenna from start of cranking to lock (M, σ, Range). This could be added to the form on p F-21 of Data Management Plan.

   i. List of functions being performed each time the software crashed or hung.

   j. Times required to tune the radios and load the crypto device (M, σ).

   k. Times to prepare freetext messages with the gridset (M, σ).

   l. Times to prepare freetext messages with the DCT (M, σ).

   m. Times required to become operational after the generator is detached and the CUCV stopped (M, σ).

   n. Times required to start road movement after the initial order to move is given (M, Range).

   o. By shift, number of operator prepared (or edited) messages of each type sent by each FSIC:

      1) DCT
      2) Voice to Brigade or Battalion
      3) Voice to sensor
      4) Freetext messages prepared on GRIDSET
      5) COMCAT formatted messages prepared on GRIDSET

   p. By shift, by FSIC, the number of times a HELP menu was requested.

3. Data relevant to human factors required from data bases (AIM/6).

   a. Times required to execute a preprogrammed query (M, σ).

   b. Times required to generate new queries (M, σ).

   c. Times required for the system to provide a response to a query (time from execution to receipt of response, M, σ).

   d. Number of times the system did not accept analyst generated queries, by operator, by shift.

   e. Times required from transmission of sensor tasking message to receipt of response at analyst terminal (M, σ).

   f. Number of errors made in completing formatted messages by message type (N, %).

   g. List and description of circumstances surrounding any injuries to personnel.

   h. List of any hardware or software damages due to operator error.