

STATEMENT OF MR. WILLIAM H. KOCH, ASSISTANT CHIEF, SYSTEM DESIGN AND INTEGRATION DIVISION, OFFICE OF SYSTEMS ENGINEERING MANAGEMENT, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY, CONCERNING "THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY." SEPTEMBER 15, 1981

I WELCOME THE OPPORTUNITY TO APPEAR BEFORE YOU TODAY TO DISCUSS OUR DEMONSTRATION PROJECT, "FIELD IMPACT EVALUATION OF THE ELECTRONIC TABULAR DISPLAY SYSTEM." THIS PROJECT FOCUSED ON THE INTERACTION OF HUMAN AND ORGANIZATIONAL NEEDS WITH THE INTRODUCTION OF NEW TECHNOLOGY IN THE WORKPLACE. MY INVOLVEMENT IN THE AREA OF POTENTIAL WORK FORCE IMPACT RELATED TO THE INTRODUCTION OF NEW TECHNOLOGY BEGAN IN 1977 WHEN I SERVED ON AN AGENCY TASK GROUP CHARGED WITH ANSWERING THE QUESTION: HOW CAN THE ASSESSMENT OF HUMAN/TECHNICAL SYSTEM INTERFACE BE IMPROVED TO ENSURE THAT THE INTRODUCTION OF NEW TECHNOLOGY IN THE AIR TRAFFIC CONTROL SYSTEM MAXIMIZES EFFICIENCY AND PRODUCTIVITY? DURING THE COURSE OF THE TASK GROUP'S ACTIVITY, I FOCUSED ON HOW THE GROUP WAS ASSESSING NEW TECHNOLOGY AND THE WAYS IN WHICH THEY ADDRESSED WORK FORCE IMPACT ISSUES WHILE AT THE SAME TIME SEEKING TO MAXIMIZE SYSTEM PERFORMANCE. OUT OF THIS CAME A CONCEPT OF SENSITIVITY ASSESSMENT (TO IDENTIFY THE IMPACT OF NEW TECHNOLOGY INTRODUCTION AND MEANS BY WHICH NEGATIVE IMPACT COULD BE MINIMIZED AND SYSTEM EFFECTIVENESS MAXIMIZED). THE NAME WAS LATER CHANGED TO FIELD IMPACT ASSESSMENT TO AVOID ANY CONFUSION WITH SENSITIVITY TRAINING OR "T" GROUPS.

THE ETABS SYSTEM, WHICH REPRESENTED AN INTRODUCTION OF NEW TECHNOLOGY, WAS SELECTED AS A VEHICLE TO TEST THE CONCEPT OF DOING A FIELD IMPACT EVALUATION. THE MOST INNOVATIVE ASPECT OF THIS WORK WAS ITS APPLICATION AT THE FRONT END OF THE DESIGN AND DEVELOPMENT EFFORT RATHER THAN DURING OR SUBSEQUENT TO FIELD IMPLEMENTATION. SINCE INSTALLATION OF THIS NEW SYSTEM IS NOT SCHEDULED UNTIL THE MID-1980'S, WE CANNOT FULLY ASSESS THE EXTENT OR MAGNITUDE OF THE IMPACT OF THE PROJECT. HOWEVER, SUBJECTIVE EVALUATIONS BY BOTH DEVELOPMENT AND FIELD OPERATIONS MANAGERS HAVE IDENTIFIED POSITIVE IMPACTS ON THE QUALITY OF THE SYSTEM DESIGN AND ON ACCEPTANCE ATTITUDES OF THE FIELD ORGANIZATION AND WORK FORCE.

AS NEAL BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR ENGINEERING AND DEVELOPMENT, SAID IN A RECENT SPEECH BEFORE AN AIR TRAFFIC CONTROL SYMPOSIUM:

"OVER THE LAST 25 YEARS, THE AIR TRAFFIC CONTROL SYSTEM HAS EVOLVED FROM A "MANUAL" CONTROL SYSTEM BASED PRIMARILY ON PROCEDURAL SEPARATION TECHNIQUES TO AN AUTOMATION-AIDED SYSTEM WHERE MANY OF THE ROUTINE TASKS HAVE BEEN TAKEN OVER BY COMPUTERS. RADAR CONTROL PROCEDURES FORM THE BASIS FOR AIRCRAFT SEPARATION THROUGHOUT MOST OF THE NATION'S AIRSPACE.

DURING THE LATE 1960'S AND EARLY 1970'S, COMPUTERS WERE INSTALLED IN THE DOMESTIC CENTERS AND THE TOP TERMINAL FACILITIES. A

CURRENT PROGRAM WILL RESULT IN INSTALLATION OF A LOWER CAPABILITY AUTOMATED SYSTEM AT A NUMBER OF ADDITIONAL LOWER DENSITY RADAR TERMINALS. OUR CURRENT MAJOR SYSTEM DEVELOPMENT PROGRAMS WILL RESULT IN AUTOMATION OF SOME OF THE DECISIONMAKING FUNCTIONS ASSOCIATED WITH AIRCRAFT SEPARATION ASSURANCE AND METERING, SEQUENCING, AND SPACING OF AIRCRAFT DURING THE 1980'S."

MR. BLAKE'S REMARKS LEAVE NO DOUBT AS TO THE FAA'S COMMITMENT TO THE APPLICATION OF AUTOMATION AND NEW TECHNOLOGY IN THE EVOLUTION OF OUR NATIONAL AIRSPACE SYSTEM. THUS, THE NEED TO CONSIDER HUMAN AND ORGANIZATIONAL CONCERNS ENGENDERED BY THE CONTINUING ADVANCE OF TECHNOLOGY APPLICATION IS REAL.

ONE ASPECT TO BE CONSIDERED IS THE RAPID AND UNEVEN INTRODUCTION OF TECHNOLOGY INTO WHAT HAS BEEN A TRADITIONALLY HUMAN-OPERATED SYSTEM OF AVIATION SERVICES. THIS PRODUCES IMPACT ON BOTH THE TECHNICAL SYSTEM OF EQUIPMENT AND THE HUMAN SYSTEMS WHICH OPERATE WITH THE TECHNICAL SYSTEM.

THE NEED FOR A DETAILED, COMPREHENSIVE, AND SPECIFIC TECHNIQUE WHICH COULD BE USED TO EVALUATE ALTERNATIVE TECHNICAL APPROACHES AND ASSESS ATTENDANT WORK FORCE IMPACTS WAS CLEAR. SINCE CONSIDERATION OF WORK FORCE IMPACTS AND THEIR RESOLUTION, INDEPENDENT OF OTHER SYSTEM PARAMETERS (SAFETY, COST, CAPACITY, SERVICE TO USER, ETC.) COULD RESULT IN IDEALISTIC, COST-INEFFICIENT, OR CAPACITY-INHIBITING

RECOMMENDATIONS, THE SCOPE OF THE PROJECT WAS EXPANDED TO INCLUDE ALL SYSTEM PARAMETERS WHICH HAVE A RELATIONSHIP TO WORK FORCE IMPACT CONSIDERATIONS. THUS, FOR EXAMPLE, IF A TECHNOLOGICAL IMPROVEMENT/CHANGE WAS PROPOSED WHICH APPEARED TO HAVE MAJOR NEGATIVE WORK FORCE IMPACTS, IT WOULD NOT BE ACCEPTED OR REJECTED WITHOUT CAREFUL CONSIDERATION OF ITS CONTRIBUTION TO SAFETY, CAPACITY, OR OTHER SUCH BENEFIT. RATHER, SOME SORT OF TRADE-OFF BETWEEN THE TWO DIVERGING IMPACTS WOULD BE SOUGHT IN AN EFFORT TO MAXIMIZE THE POSITIVE CONTRIBUTION WHILE MINIMIZING AND FULLY UNDERSTANDING THE NEGATIVE FEATURES.

THE SELECTION OF ETABS AS THE TRIAL VEHICLE FOR A FIELD IMPACT ASSESSMENT WAS BASED ON SEVERAL FACTORS. FIRST, WHILE THE PROGRAM HAD BEEN ENTERED INTO THE FORMAL DEPARTMENTAL SYSTEMS ACQUISITION MANAGEMENT PROCESS, KEY DECISION POINTS WERE STILL SEVERAL YEARS IN THE FUTURE. THUS, REAL IMPACT ON THE PROGRAM SHOULD BE POSSIBLE. SECONDLY, WHILE THE TECHNOLOGY WAS NEW, THE BASIC FUNCTION WOULD REMAIN THE SAME, MUCH AS A CRT TERMINAL WORD PROCESSOR REPLACES PAPER AND A TYPEWRITER. THIRDLY, THE EXTENT OF THE CHANGE WAS ORGANIZATIONALLY CONFINED, CLEARLY IDENTIFIABLE, AND WOULD NOT BE APPARENT TO USERS OF THE NATIONAL AIRSPACE SYSTEM OUTSIDE THE FAA. FINALLY, THERE WAS AVAILABLE A REASONABLE QUANTITY AND FIRMNESS OF DOCUMENTATION ON THE ETABS SYSTEM; THERE WAS NO APPARENT PRE-EXISTING ORGANIZATIONAL OR WORK FORCE HOSTILITY TO THE CHANGE; AND THE PROGRAM MANAGER WAS RECEPTIVE TO THE NOTION OF INVOLVING THE FIELD WORK FORCE AND ORGANIZATION IN HIS DEVELOPMENT PROGRAM.

THE STRUCTURE, ORGANIZATION, AND OPERATION OF THE FIELD IMPACT EVALUATION PROCESS MADE USE OF A DIAGONAL SLICE GROUP SELECTION AND OPERATION CONCEPT.

A. DEFINITION OF DIAGONAL SLICE. DIAGONAL SLICE GROUPS ARE COMPOSED OF MEMBERS SELECTED BECAUSE OF THEIR DIFFERENT ORGANIZATIONAL PERSPECTIVES. A TYPICAL DIAGONAL SLICE GROUP WOULD INCLUDE OPERATING PERSONNEL, FIRST-LEVEL SUPERVISORS, MIDDLE MANAGERS, AND HIGH-LEVEL MANAGERS. THIS TYPE OF GROUP DIFFERS FROM A HORIZONTAL SLICE (PEER GROUP) IN THAT SEVERAL DIFFERENT ORGANIZATIONAL LEVELS ARE REPRESENTED. IT DIFFERS FROM A VERTICAL SLICE GROUP IN THAT NO MEMBER HAS DIRECT CONTROL OR SUPERVISORY RESPONSIBILITY OVER ANY OTHER MEMBER. IN OTHER WORDS, NOBODY'S BOSS IS IN THE GROUP. FIGURE 1 ILLUSTRATES, IN OVER-SIMPLIFIED FORM, THE DIFFERENCES AMONG THESE THREE GROUPS.

B. PURPOSE. TO BE EFFECTIVE, A DECISION, PROBLEM SOLUTION, OR RECOMMENDATION MUST BE HIGH BOTH IN QUALITY AND IN ACCEPTANCE.

IN TERMS OF SOLUTION, QUALITY DIAGONAL SLICE GROUPS HAVE THE ADVANTAGE OF POSSESSING MULTIPLE ORGANIZATIONAL PERSPECTIVES FROM WHICH TO VIEW THE PROBLEM. NOT ONLY ARE DIFFERENT FUNCTIONS REPRESENTED BUT DIFFERENT ORGANIZATIONAL LEVELS ARE ALSO INCLUDED. SOLUTIONS GENERATED FROM SUCH HETEROGENEOUS GROUPS WOULD HAVE MET THE TEST OF A MULTITUDE OF ORGANIZATIONAL PERSPECTIVES AND, THEREFORE, SHOULD BE OF HIGHER QUALITY. IN ADDITION, THE SPECIFIC TYPES

ORGANIZATIONAL SLICES

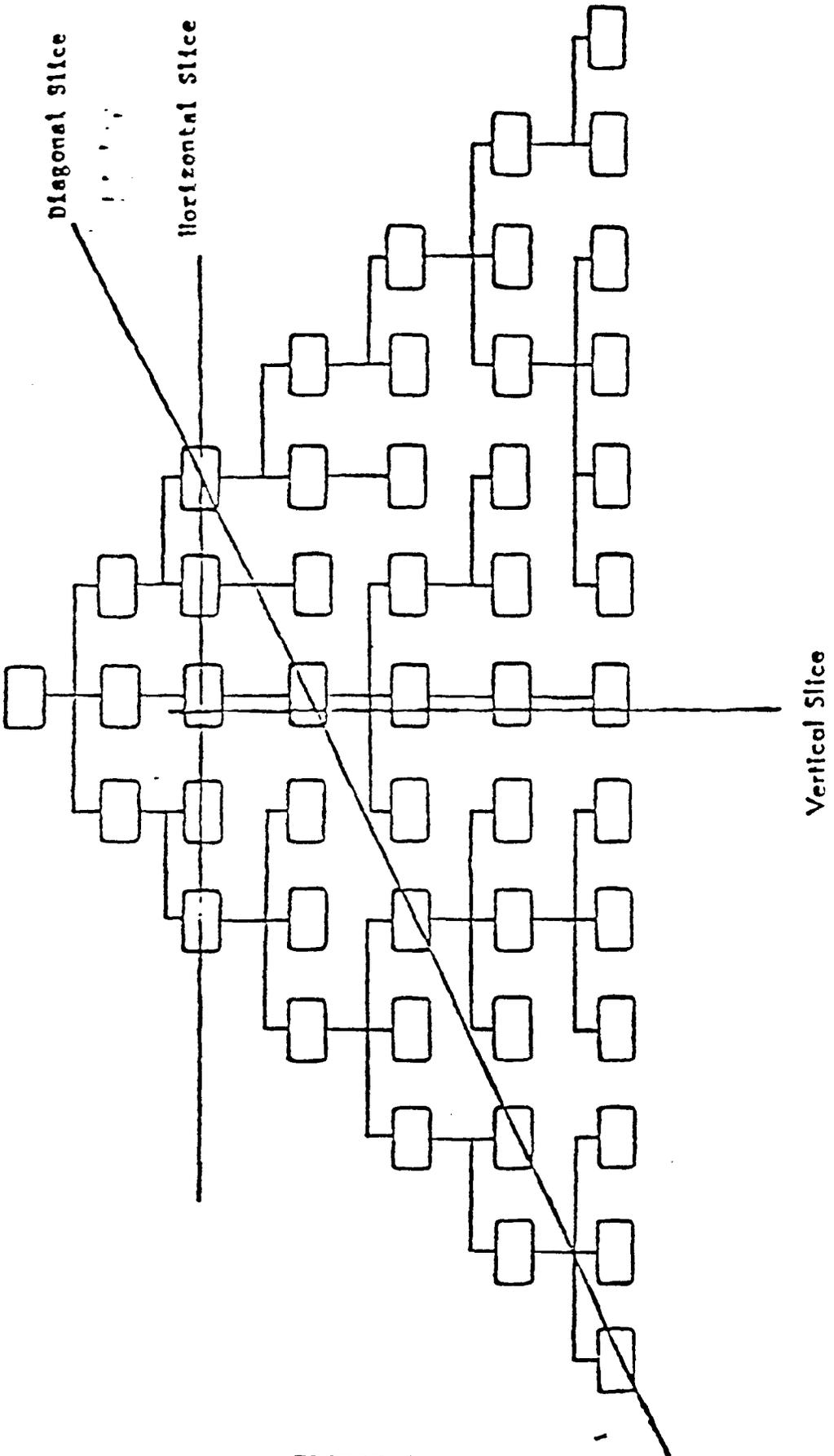


FIGURE 1

OF ORGANIZATIONAL PERSPECTIVES INCORPORATED IN DIAGONAL SLICE GROUPS ARE IMPORTANT IN INCREASING THEIR POTENTIAL FOR HIGHER QUALITY SOLUTIONS.

ACCEPTANCE ADVANTAGES OF PRODUCTS FROM DIAGONAL SLICE GROUPS REST CHIEFLY ON THE FACT THAT THOSE TO BE AFFECTED BY THE SOLUTIONS WERE REPRESENTED IN THE FORMULATION OF THOSE SOLUTIONS. A DIAGONAL SLICE GROUP REPRESENTS A MICROCOSM OF THE ORGANIZATION. A SOLUTION ACCEPTABLE TO THIS MICROCOSM SHOULD HAVE A GREATER CHANCE OF ACCEPTANCE BY THE ORGANIZATION THAN SOLUTIONS FROM OTHER TYPES OF GROUPS (SEE FIGURE 2).

. MAKE-UP AND SIZE OF THE GROUP. THE MEMBERS OF THE DIAGONAL SLICE GROUP SHOULD REPRESENT A CROSS SECTION FROM ALL LEVELS WITHIN THE FAA WHO WILL MAINTAIN, OPERATE, AND MANAGE THE NEW OR MODIFIED SYSTEM. CONSIDERATION SHOULD ALSO BE GIVEN TO INCLUDING MEMBER(S) FROM USER ORGANIZATIONS. IN SHORT, MEMBERSHIP OF THE GROUP SHOULD BE DISPERSED FUNCTIONALLY AND ORGANIZATIONALLY TO TAKE ADVANTAGE OF NUMEROUS ORGANIZATIONAL PERSPECTIVES IN ASSESSING THE NEW SYSTEM. DIAGONAL SLICE GROUPS ARE GENERALLY LARGER THAN OTHER PROBLEM-SOLVING GROUPS. THEY RANGE IN SIZE FROM 4 TO 15 MEMBERS. THE LARGER SIZE IS NECESSARY TO PROVIDE FOR REPRESENTATION FROM MOST ORGANIZATIONAL LEVELS. THE PROBLEMS ASSOCIATED WITH LARGE WORKING GROUPS EMPHASIZE THE NEED FOR SELF-MANAGEMENT AND FACILITATION FUNCTIONS. LARGER GROUPS CAN OPERATE PRODUCTIVELY IF EFFECTIVE USE

EMPHASIS AT DIFFERENT ORGANIZATIONAL LEVELS

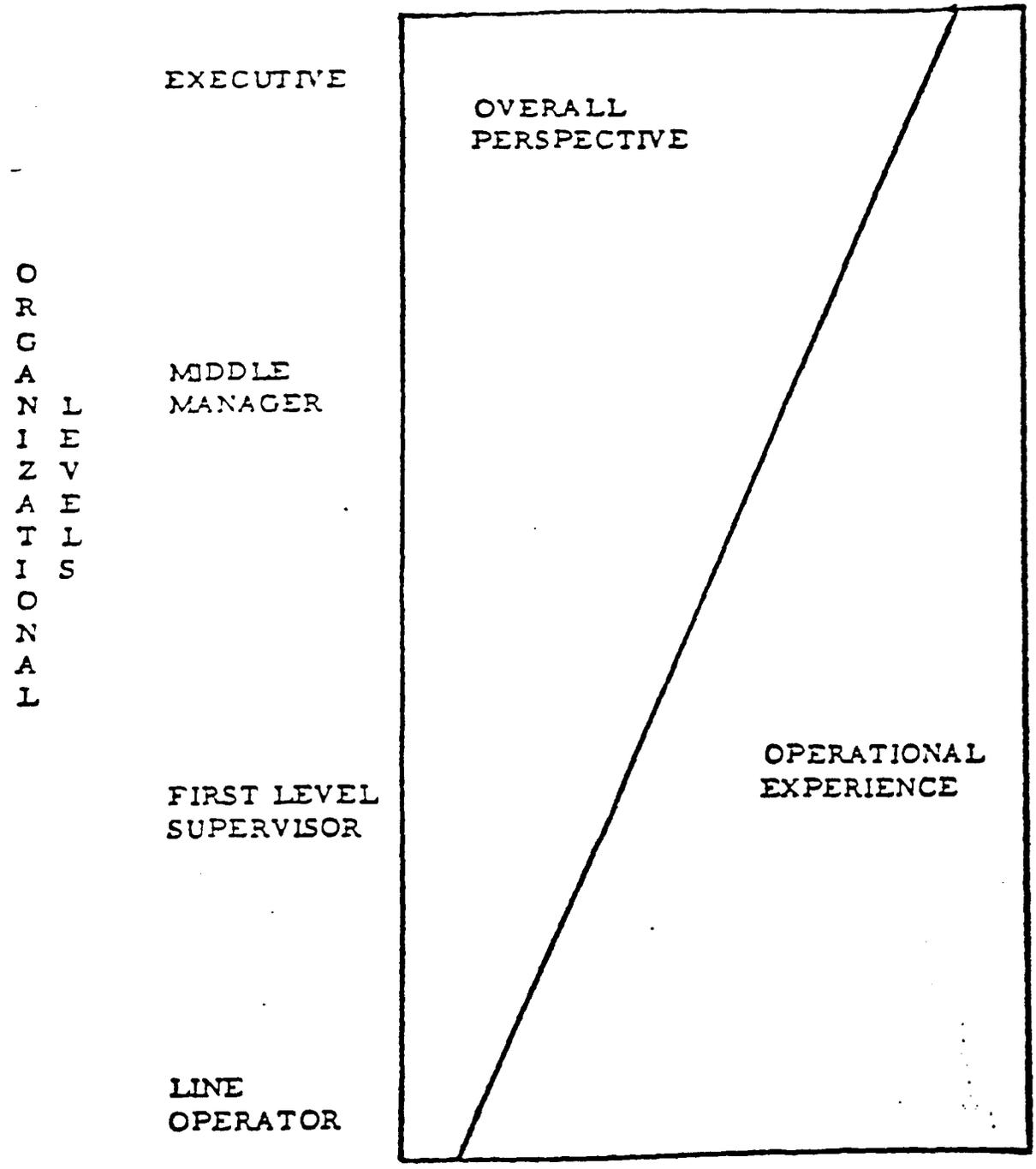


FIGURE 2

IS MADE OF INDIVIDUAL AND ALTERNATING SUBGROUPS. THE GROUP CAN MEET AS A WHOLE TO REVIEW AND DISCUSS SUBGROUP OR INDIVIDUAL PRODUCTS AND TO DEAL WITH GROUPWIDE ISSUES. IN THIS WAY, CONCENTRATED EFFORT CAN OCCUR, WITH THE EVENTUAL END PRODUCT STILL HAVING TO PASS THE TEST OF MULTIPERSPECTIVES BEFORE IT BECOMES THE GROUP'S ACCEPTED SOLUTION.

D. SELECTION OF THE DIAGONAL SLICE GROUP. A PREMISE UNDERLYING THE DIAGONAL SLICE APPROACH IS THAT THERE ARE INTELLIGENT, CREATIVE INDIVIDUALS AT ALL LEVELS IN THE ORGANIZATION. THEY HAVE NOT GRAVITATED TOWARDS ANY ONE LEVEL DUE TO PERSONAL DESIRES, AGE, INDIVIDUAL CIRCUMSTANCES, AND DIFFERENCES IN EDUCATIONAL AND ORGANIZATIONAL OPPORTUNITIES.

IN PULLING TOGETHER A DIAGONAL SLICE GROUP, THERE ARE GENERALLY AMPLE PEOPLE RESOURCES TO CREATE AN EFFECTIVE GROUP.

BESIDES INTELLIGENCE AND CREATIVITY, THOSE SELECTED SHOULD BE HIGH IN THE INTERPERSONAL SKILLS NECESSARY FOR EFFECTIVE GROUP FUNCTIONING. IN A DIAGONAL SLICE GROUP THERE IS LIKELY TO BE A HIGH DEGREE OF AMBIGUITY AND HIGH CONFLICT POTENTIAL. MEMBERS SHOULD BE SELECTED WHO CAN OPERATE IN SUCH AN ENVIRONMENT.

NOMINATIONS FOR GROUP MEMBERSHIP SHOULD BE SOLICITED FROM AS WIDE A SPECTRUM OF THE AGENCY AS POSSIBLE. THOSE SUPERVISORS AND MANAGERS FROM WHOM THE NOMINATIONS ARE SOLICITED SHOULD BE MADE

AWARE OF THE GROUP'S MISSION AS WELL AS THE INDIVIDUAL SKILLS AND EXPERIENCE DESIRED. A MAJOR EMPHASIS NEEDS TO BE PLACED UPON THE CRITICAL PROCESS OF SELECTING GROUP MEMBERS. THE NEED FOR DIFFERENT PERSPECTIVES IS CRUCIAL TO A SUCCESSFUL ASSESSMENT.

E. TRAINING AND BRIEFINGS. IN ORDER FOR A DIAGONAL SLICE GROUP TO FUNCTION EFFECTIVELY IN FULFILLING ITS MISSION, SOME TRAINING SHOULD BE PROVIDED. THIS TRAINING NEED NOT BE LONG AND INVOLVED. HOWEVER, IT SHOULD ADDRESS:

1. THE PURPOSE FOR WHICH THE GROUP WAS FORMED.
2. RATIONALE FOR USING DIAGONAL SLICE GROUPS.
3. DETAILED BRIEFINGS CONCERNING BACKGROUND DATA AND ISSUES WITH WHICH THE GROUP MUST DEAL.

F. OPERATING CHARACTERISTICS OF DIAGONAL SLICE GROUPS. DIAGONAL SLICE GROUPS CAN BE OPERATED IN A VARIETY OF WAYS FOR A MULTITUDE OF PURPOSES. THE FOLLOWING CHARACTERISTICS ARE ILLUSTRATIVE OF EFFECTIVE DIAGONAL SLICE GROUPS.

1. EQUALITY. WHILE MEMBERS DIFFER GREATLY IN ORGANIZATIONAL STATUS OUTSIDE OF THE GROUP, IT IS ESSENTIAL THAT THERE BE A SENSE OF EQUALITY WITHIN THE GROUP. SINCE EACH MEMBER REPRESENTS AN IMPORTANT ORGANIZATIONAL PERSPECTIVE, EQUALITY WITHIN THE GROUP ENHANCES THE PROBABILITY THAT EACH PERSPECTIVE

HAS AN EQUAL OPPORTUNITY TO INFLUENCE THE DEVELOPMENT OF THE SOLUTION. THIS CHARACTERISTIC MEANS THAT THE HIGHEST STATUS MEMBER DOES NOT AUTOMATICALLY BECOME THE CHAIRPERSON. WHICHEVER MEMBERS SHOW THE GREATEST CHAIRPERSON SKILLS, REGARDLESS OF STATUS OUTSIDE THE GROUP, COULD BE ASSIGNED THE ROLE, OR IT MAY BE ROTATED AMONG THE MEMBERS. THE EQUALITY CHARACTERISTIC DOES NOT MEAN EVERYONE DOES EVERYTHING EQUALLY: IT JUST MEANS THAT ROLES ARE NOT BASED SOLELY ON A MEMBER'S ORGANIZATIONAL STATUS. THIS CHARACTERISTIC ALLOWS THE DEVELOPMENT OF ROLES BASED UPON PERCEIVED COMPETENCE, CONTRIBUTION, AND DESIRE.

2. CONSENSUS. TO REALIZE THE POTENTIAL OF DIAGONAL SLICE GROUPS FOR MAXIMIZING SOLUTION QUALITY, EACH ORGANIZATIONAL PERSPECTIVE SHOULD BE CONSIDERED IN THE SOLUTION. A MAJORITY VOTE MODE OF OPERATION LEAVES OUT THE MINORITY MEMBERS' PERSPECTIVES IN THE DEVELOPMENT OF A SOLUTION. THIS NEGATES THE VERY PURPOSE OF PUTTING TOGETHER A DIAGONAL SLICE OF THE ORGANIZATION. CONSENSUS IS A MORE DIFFICULT MODE OF OPERATION BUT WITHOUT IT VARIOUS ORGANIZATIONAL PERSPECTIVES ARE NOT REPRESENTED. THIS LOWERS THE PRODUCT'S POTENTIAL QUALITY AND LOWERS THE POTENTIAL ACCEPTANCE BY ORGANIZATIONAL LEVELS WHOSE PERSPECTIVES WERE LEFT OUT IN DETERMINING THE SOLUTION. CONSENSUS DOES NOT MEAN UNANIMITY. RATHER, IT MEANS THAT EACH MEMBER FEELS HIS OR HER POSITION HAS BEEN ADEQUATELY HEARD. IN ADDITION, THE MEMBER IS WILLING TO LIVE WITH THE COURSE OF ACTION PROPOSED EVEN THOUGH HE OR SHE BELIEVES ANOTHER COURSE OF ACTION MIGHT BE MORE

BENEFICIAL. OPERATING BY CONSENSUS, WHILE REQUIRING MORE WORK ON THE GROUP'S PART, MAXIMIZES THE POTENTIAL FOR THE EMERGENCE OF AN EFFECTIVE SOLUTION.

3. FACILITATOR'S ROLE. DIAGONAL SLICE GROUPS USUALLY INCLUDE AT LEAST ONE PERSON PROFESSIONALLY SKILLED IN GROUP DYNAMICS. THIS PERSON SENSES DEVELOPING GROUP PROBLEMS AND FACILITATES THE GROUP IN CONSTRUCTIVELY ADDRESSING AND WORKING THROUGH THESE GROUP PROCESS ISSUES. THE FACILITATOR DOES NOT NORMALLY INVOLVE HIMSELF IN THE CONTENT OF THE GROUP'S TASK, BUT RATHER OBSERVES AND COMMENTS ON THE PROCESS THE GROUP USES TO ACCOMPLISH ITS TASK. ATTENTION TO PROCESS IS A RESPONSIBILITY OF ALL GROUP MEMBERS; THE FACILITATOR'S ROLE IS TO ENSURE THAT THIS RESPONSIBILITY IS CARRIED OUT.

4. USE OF OUTSIDE RESOURCES. UNLESS A DIAGONAL SLICE GROUP IS ADDRESSING A RELATIVELY SIMPLE PROBLEM, THE QUALITY AND ACCEPTANCE OF ITS PRODUCT MAY BE ENHANCED BY THE SELECTED USE OF OUTSIDE RESOURCES SUCH AS PROFESSIONAL CONSULTANTS. ALTHOUGH VAST DIFFERENCES IN VIEWPOINTS AND PERSPECTIVES WITHIN THE GROUP SHOULD PROMOTE OBJECTIVITY, A POSSIBLE WEAKNESS IN USING A DIAGONAL SLICE GROUP IS THAT ITS SOLUTION MAY BE REGARDED BY SOME AS PAROCHIAL, A PRODUCT OF AMATEUR AND UNSOPHISTICATED THINKING. TO COUNTERACT THIS POTENTIAL WEAKNESS, DIAGONAL SLICE GROUPS SOMETIMES EMPLOY PROFESSIONAL ASSISTANCE. WHEN THE GROUP

IS ADDRESSING COMPLEX PROBLEMS WITH NUMEROUS INTERACTING DIMENSIONS, PROFESSIONAL ASSISTANCE MAY BE BENEFICIAL IN DEFINING THE LIMITS AND BOUNDS OF THE VARIOUS PROBLEM DIMENSIONS. IF CONSULTANTS ARE USED IN THIS WAY, THEIR ROLE SHOULD BE SPECIFICALLY DEFINED AND LIMITED TO PROBLEM ISSUES RATHER THAN ALTERNATIVE SOLUTIONS.

G. INTEGRATING AND APPLYING RESULTS. DUE TO THE WIDE SPECTRUM OF MEMBERSHIP IN THE GROUP, APPLICATION OR INSTITUTIONALIZATION OF RESULTS AND RECOMMENDATIONS CAN PRESENT PROBLEMS. SINCE NORMAL PATHS INTO AN ONGOING ORGANIZATIONAL PROCESS HAVE BEEN BY-PASSED, UNUSUAL CARE, THOUGHT, PLANNING, AND ACTION ARE REQUIRED TO INCORPORATE GROUP PRODUCTS INTO NORMAL WORKING PROCEDURES AND RELATIONSHIPS.

THIS DOES NOT PRECLUDE THE MODIFICATION OF EXISTING STRUCTURE OR PROCESSES; HOWEVER, IT MUST BE CLEAR WHAT IS BEING INTEGRATED, WHERE, AND BY WHOM. TOWARDS THIS END, THE USE OF IN-HOUSE CONSULTANTS OR RESOURCE PEOPLE SEEMS TO OFFER A BRIDGING MECHANISM FOR THE INTEGRATION OR APPLICATION OF GROUP RESULTS. IT IS VERY IMPORTANT THAT THE ROLE OF THESE BRIDGERS BE CLEARLY AND DISTINCTLY IDENTIFIED SO THAT UNWANTED MODIFICATIONS OR DILUTIONS OF THE ORIGINAL GROUP'S PRODUCT DOES NOT OCCUR.

THE PROCESS OF THE ETABS FIELD IMPACT EVALUATION CONSISTED OF FOUR MAJOR ELEMENTS; IMPACT ASSESSMENT, IMPACT QUANTIFICATION, ALTERNATIVE DEVELOPMENT, AND RECOMMENDATIONS/CONCLUSIONS. SEVERAL ADDITIONAL SUPPORTING ACTIVITIES WERE INCLUDED SUCH AS INITIAL TEAM BUILDING EXERCISES, TECHNICAL EDUCATION OF THE TEAM (REGARDING THE ETABS SYSTEM) AND TEAM MAINTENANCE FUNCTIONS. A MODEL OF THE PROJECT IS SHOWN IN FIGURE 3. THE 6-8 WEEK INTERVAL BETWEEN TEAM MEETINGS SHOULD BE NOTED. THIS INTERVAL PROVIDED AN OPPORTUNITY FOR EACH TEAM MEMBER TO INTERACT WITH HIS COLLEAGUES AT HIS HOME FACILITY IN A REAL WORLD SETTING TO FORM AND CONFIRM IMPRESSIONS AND PERCEPTIONS OF IMPACT. THIS INTERACTION OR HOMEWORK PROVIDED BOTH AN INCREASED BASE AND CREDIBILITY FOR IMPACT ASSESSMENTS AND A BROADENED SPECTRUM OF PERCEIVED PARTICIPATION ON THE PART OF FIELD ORGANIZATIONS AND WORKERS. ONE DIFFICULTY IN CONDUCTING A FIELD IMPACT ASSESSMENT OF A MAJOR PROGRAM WHILE IN THE DESIGN AND DEVELOPMENT STAGE IS THE NORMALLY LONG PERIOD OF TIME BETWEEN THE SUBMISSION OF AN IMPACT REPORT AND THE FIELD IMPLEMENTATION PHASE OF THE PROGRAM. THE FIELD PEOPLE MAKING THE INPUT HAVE A VALID CONCERN AS TO WHETHER THEIR SUGGESTIONS AND RECOMMENDATIONS FOR CHANGE HAVE BEEN HEEDED OR FILED WITHOUT ACTION. INTERESTINGLY ENOUGH THE ETABS IMPACT EVALUATION TEAM INCLUDED THE RECOMMENDATION FOR A FOLLOW ON TRACKING AND REPORTING MECHANISM IN THEIR FINAL REPORT. WE PLAN TO RECONVENE THE TEAM AT THE FAA TECHNICAL CENTER IN ATLANTIC CITY, N. J., SOMETIME EARLY NEXT YEAR AFTER THE DELIVERY OF THE ETABS ENGINEERING MODEL. THIS WILL PROVIDE A FIRST REVIEW OF BOTH THE

ETABS

Field Impact Evaluation

Team Meetings — Time/Activity Distribution

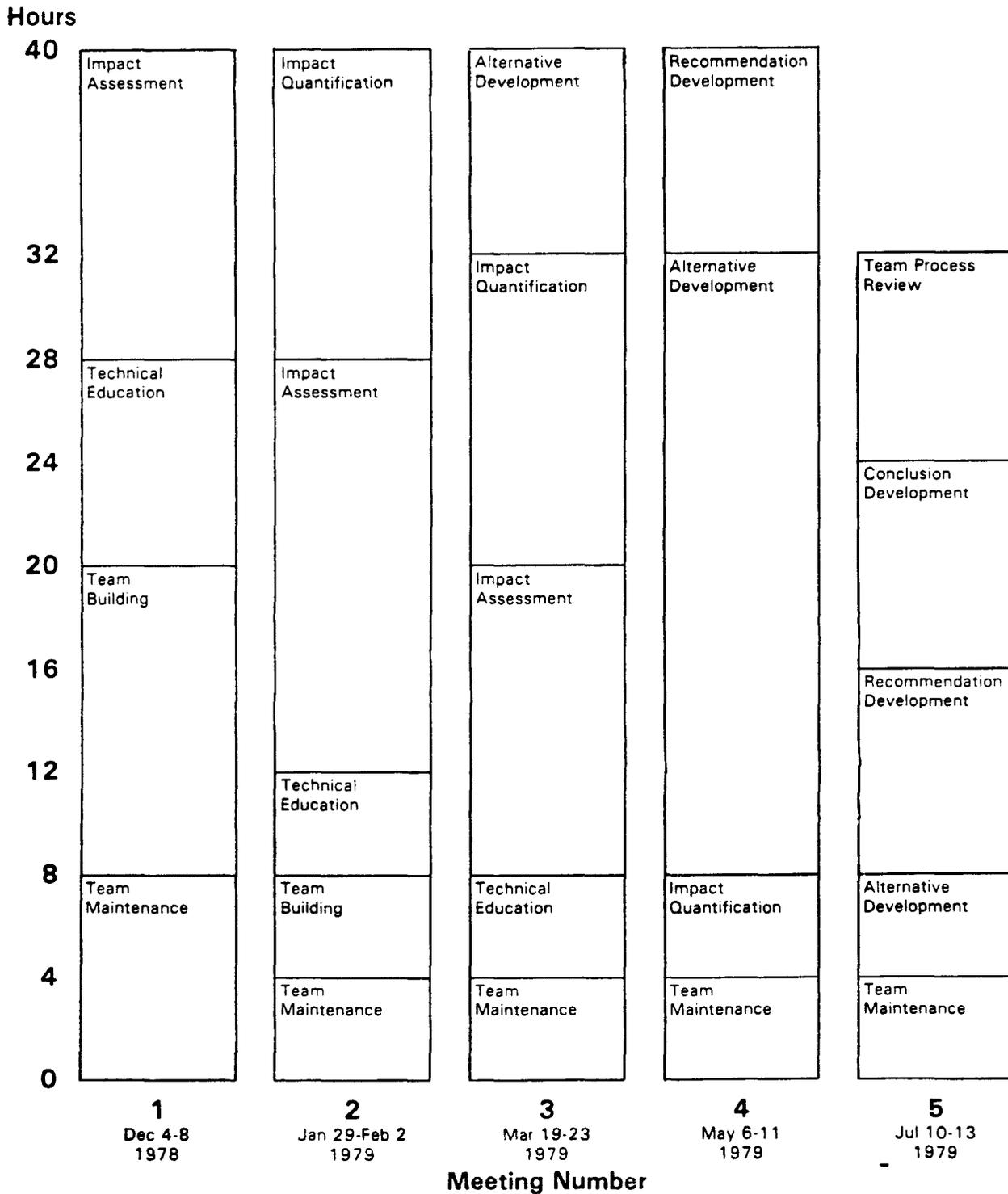


FIGURE 3

VALIDITY OF THE IMPACT ASSESSMENT AND SOLUTION RECOMMENDATION REPORT AND AN APPRAISAL OF THE DEGREE TO WHICH THE RECOMMENDATIONS HAVE BEEN INCORPORATED AND THE RESULTING NEGATIVE IMPACT RELIEF (OR AGGRAVATION).

RESULTS OF THE DEMONSTRATION PROJECT APPEAR IN SEVERAL GENERAL AREAS. THE FIRST IS IN THE DESIGN AND DEVELOPMENT OF THE ETABS ENGINEERING MODEL. THE SECOND IS IN THE AREA OF FIELD PARTICIPATION AND ACCEPTANCE OF SYSTEM CHANGE. IN A LETTER TO THE DEPUTY ADMINISTRATOR, DATED OCTOBER 24, 1979, DISCUSSING THE FIELD IMPACT EVALUATION PROCESS. THE DIRECTOR OF THE GREAT LAKES REGION SAID,

"THE FIELD IMPACT EVALUATION METHOD IS AN EXCELLENT VEHICLE FOR PINPOINTING POTENTIAL PROBLEMS PRIOR TO IMPLEMENTATION OF A MAJOR SYSTEM CHANGE.

FIELD INPUT IS AN ABSOLUTE NECESSITY ON ANY MAJOR CHANGE OR RESEARCH AND DEVELOPMENT PROJECT. THE RECOMMENDATIONS OF THE PEOPLE WHO WILL USE A NEW SYSTEM MUST BE CONSIDERED DURING ITS DEVELOPMENT. THE BENEFITS ARE SIMPLY THAT THERE IS MUCH LESS CHANCE OF SOMETHING BEING OVERLOOKED AND THE FIELD GAINS A VALUABLE RESOURCE. THE DIAGONAL SLICE CONCEPT ASSURES THAT THE FIELD INPUT FROM ALL THOSE AFFECTED WILL BE RECEIVED AND CONSIDERED. TECHNOLOGY ASSESSMENT PROVIDES AN IDEAL STRUCTURE FOR GATHERING AND PRESENTING THEIR RECOMMENDATIONS."

THE THIRD -IS RECOGNITION BY THE ENGINEERING AND DEVELOPMENT ORGANIZATION OF THE VALUE OF THE PROCESS IN PRODUCING A BETTER PRODUCT. IN A LETTER DATED NOVEMBER 20, 1979, TO THE DIRECTOR OF THE GREAT LAKES REGION, THE DIRECTOR OF THE SYSTEMS RESEARCH AND DEVELOPMENT SERVICE SAID,

"IT WAS ENCOURAGING TO RECEIVE YOUR VERY POSITIVE ENDORSEMENT OF THE FIELD IMPACT EVALUATION PROCESS AS APPLIED TO THE ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS). THE ETABS PROGRAM MANAGER SHARES YOUR VIEW OF THE BENEFITS OF THE PROCESS AND WILL FOLLOW THE RECOMMENDATIONS OF THE EVALUATION REPORT TO THE MAXIMUM EXTENT ALLOWABLE WITHIN THE TERMS OF THE DEVELOPMENT CONTRACT.

THE ETABS FIELD IMPACT EVALUATION REPORT HAS BEEN BRIEFED TO A LARGE NUMBER OF TOP LEVEL FAA MANAGERS INVOLVED WITH DEVELOPMENT AND IMPLEMENTATION OF FUTURE SYSTEMS. THEY NOW RECOGNIZE THE FIELD IMPACT EVALUATION METHOD AS AN IMPORTANT NEW TOOL WHICH CAN BE APPLIED DURING THE DEVELOPMENT PROCESS TO AVOID FUTURE PROBLEMS. TIMING OF THE IMPACT EVALUATION WITHIN THE LIFE CYCLE OF A PROGRAM, AS WELL AS THE APPROPRIATE SELECTION OF THE FIELD PERSONNEL, APPEARS TO BE THE KEY TO SUCCESS."

SUBSEQUENT TO THE COMPLETION OF THE PROJECT AN INTRODUCTORY SEMINAR ON FIELD IMPACT EVALUATION WAS PREPARED AND PRESENTED TO PROGRAM MANAGERS. IT FOCUSED ON THE KEY ROLE A PROGRAM MANAGER

PLAYS IN DECIDING IF A FIELD IMPACT EVALUATION OF HIS PROGRAM IS DESIRABLE AND COST BENEFICIAL AND IF SO, RESOLVING THE CRUCIAL ISSUE OF WHEN TO DO IT. REGARDING THE QUESTION OF SHOULD IT BE DONE, THE ANSWER IS YES, IF:

- THE PROJECT HAS TROUBLE GETTING A CLEAR AND CONSISTENT STATEMENT OF OPERATIONAL REQUIREMENTS
- THE PROJECT NEEDS EARLY APPRAISAL OF DESIGN APPROACH
- IMPLEMENTATION WILL HAVE BROAD EFFECTS ON FIELD OPERATIONS/ PROCEDURES/MAINTENANCE/TRAINING
- PROGRAM WILL NEED FIELD INVOLVEMENT IN LATER STAGES OF PROGRAM
- OTHER MAJOR FAA ELEMENTS NEED TO BE AWARE OF PROGRAM DIMENSIONS--TO HELP THEIR ADVANCED PLANNING

AS FOR THE TIMING, THE ANSWER IS, DO IT WHEN:

- THE CONCEPT IS DEVELOPED FAR ENOUGH THAT IT CAN BE DEMONSTRATED, NOT JUST TALKED ABOUT
- THE DESIGN IS NOT SO FIRM THAT IT CANNOT BE CHANGED WITHOUT MAJOR COST/SCHEDULE IMPACT

TYPICALLY--THIS IS BETWEEN EXPLORATORY DEVELOPMENT AND ENGINEERING MODEL DEVELOPMENT

ADDITIONALLY, THE PROGRAM MANAGER IS AN ESSENTIAL RESOURCE TO THE FIELD IMPACT EVALUATION TEAM. HE MUST SUPPORT THE TEAM'S PROCEEDINGS. HE CAN EXPECT TO INVEST SIGNIFICANT TIME AND EFFORT IN THE ACTIVITY.

HIS ROLE IN PROVIDING THIS SUPPORT IS NOT TO DEFEND OR SELL A PARTICULAR PROGRAM. RATHER IT IS TO:

- EXPLAIN THE PROGRAM (BACKGROUND, REQUIREMENTS, EXPECTED BENEFITS, RISKS, STATUS)
- PROVIDE STAFF EXPERTISE THROUGHOUT
- ARRANGE FOR VISITS/DEMONSTRATIONS
- CRITIQUE CONCLUSIONS/FINAL REPORT

HE FURTHER:

o MUST BE AS RESPONSIVE AS POSSIBLE

o CAN EXPECT

- REINFORCEMENT/SUPPORT
- CHALLENGES
- QUESTIONS
- SUGGESTIONS FOR CHANGE

- SHOULD PROVIDE FEEDBACK TO FIELD IMPACT EVALUATION AS PROGRAM PROGRESSES

THE SEMINAR PRESENTED THE FOLLOWING CONCLUSIONS:

FOR SELECTED PROJECTS, FIELD IMPACT EVALUATION IS A UNIQUE AND IMPORTANT TOOL

IT IS COSTLY AND TIME CONSUMING

ITS RECOMMENDATIONS/OBSERVATIONS MUST BE TAKEN SERIOUSLY

TURNING TO THE SUBJECT OF NEEDED RESEARCH AND FUTURE WORK, I BELIEVE FUTURE RESEARCHERS NEED TO FOCUS ON ACHIEVING A BETTER UNDERSTANDING AND QUANTIFICATION OF THE CONNECTION BETWEEN SYSTEM PERFORMANCE/PRODUCTIVITY AND HUMAN ATTITUDES AND BEHAVIORS. THE ABILITY TO IDENTIFY SPECIFIC RESULTS SHOULD ENHANCE OPPORTUNITIES FOR THE APPLICATION OF SOCIO-TECHNICAL DESIGN AND IMPLEMENTATION PROJECTS.

ADDITIONAL WORK IS ALSO REQUIRED IN THE AREA OF ORGANIZATIONAL PLACEMENT AND INTEGRATION OF SOCIO-TECHNICAL PROJECTS. CREDIBILITY, PARTICIPATION, AND ACCEPTANCE IS GREATLY AFFECTED BY WHERE AND HOW IN THE ORGANIZATION THE FUNCTION IS PLACED AND CONDUCTED.

FINALLY, WE NEED A BROADER AND TIGHTER COUPLING BETWEEN THEORY AND CONCEPT DEVELOPMENT ACTIVITIES, AND FIELD IMPLEMENTATION AND APPLICATION ACTIVITIES. THESE HEARINGS PROVIDE A VERY POSITIVE STEP IN SUPPORT OF SUCH AN IMPROVEMENT. SUPPORT AND ASSISTANCE IN THE AREA OF DOCUMENTATION, DISSEMINATION AND DISCUSSION OF PROJECT ACTIVITIES WILL ASSIST IN DEVELOPING ANSWERS TO THE QUESTION OF HOW TO DESIGN AND MANAGE NEW TECHNOLOGY SO AS TO INCREASE PRODUCTIVITY AND DEVELOP HUMAN RESOURCES.

MR. CHAIRMAN, THAT CONCLUDES MY PREPARED STATEMENT. AT THIS TIME, I WOULD BE PLEASED TO RESPOND TO QUESTIONS YOU OR OTHER MEMBERS OF THE SUBCOMMITTEE MAY HAVE.