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Implementation Plan for Air Force Environmental Noise Assessment Center

Robert B. Braid
John H. Reed

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Energy Division

IMPLEMENTATION PLAN FOR

AIR FORCE ENVIRONMENTAL NOISE ASSESSMENT CENTER

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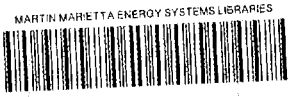

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ABBREVIATIONS AND ACRONYMS

AAMRL/BBE	Biodynamics and Bionics Division, Armstrong Aerospace Medical Research Laboratory
AFENAC	Air Force Environmental Noise Assessment Center
AFESC	Air Force Engineering and Services Center
AFLC	Air Force Logistics Command
AFNET	Air Force-wide computer network scheduled for deployment in 1995
AFRCE	Air Force Regional Civil Engineer
AFRCE-BMS	Air Force Regional Civil Engineers, Ballistic Missile Support—possible organizational "home" of Air Force NEPA center
AFSC	Air Force Systems Command
AICUZ	Air Installation Compatible Use Zone
ASAN	Assessment System for Aircraft Noise
BASEOPS	See Table 5
BOOMAP2	computer program for analyzing noise from supersonic aircraft operations
PCBOOM II	See Table 5
CASE	Computer Aided Software Engineering
CCMS	NATO Committee on the Challenges of a Modern Society
CERL	Army Corps of Engineers Construction Engineering Research Laboratory
CITASAN	See Table 5
CMB	Configuration Management Board
DEV	Directorate of Environmental Management
DOS	Disk Operating System
EA	environmental assessment
EIS	environmental impact statement
GEIS	Generic Environmental Impact Statement for Air Force Low Altitude Flying Operations
GRASS	Geographic Resource Analysis and Support System—a mil standard geographical analysis package
HSD/YA-NSBIT or NSBIT	Noise and Sonic Boom Impact Technology, Human Systems Division
HQ AFESC/DEMP	Directorate of Operations and Maintenance, Pavements Division at Air Force Engineering and Services Center
HQ AFESC/DEV	Directorate of Environmental Management at Air Force Engineering and Services Center
HQ AFESC/RDV	Directorate of Research, Air Force Engineering and Services Center
HQ AFESC/TIC	Technical information center at the Air Force Engineering and Services Center
HQ AFLC/DEV	Directorate of Environmental Management, Air Force Logistics Command
HQ USAF/LEED	Community Planning Division, Office of Deputy Chief of Staff for Logistics and Engineering

HQ USAF/LEEV	Environmental Division, Office of Deputy Chief of Staff for Logistics and Engineering
HQ USAF/XOOSA	Airspace and Air Traffic Services Division, Office of Deputy Chief of Staff for Plans and Operations
IBAN	International Bibliography on Aircraft Noise
IPR	In-Progress Review
MAJCOMs	major commands (Air Force)
NATO	North Atlantic Treaty Organization
NEPA	National Environmental Policy Act
NOISECHECK II	See Table 5
NOISEFILE	See Table 5
NOISEMAP	See Table 5
OEHL	Occupational and Environmental Health Laboratory
ORACLE	Relational database management system available from private vendors
ORNL	Oak Ridge National Laboratory
QA	quality assurance
QC	quality control
R&D	research and development
RISC	reduced instruction set computing
ROUTEMAP	See Table 5
SSM	Systems Support Manager
TDY	temporary duty
TSM	Technical Support Manager
UNIX	operating system for some types of personal computers
USM	User Site Manager
WORM	write once read many

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EXECUTIVE SUMMARY

This report details an implementation plan for establishing the Air Force Environmental Noise Assessment Center (AFENAC). However, changes that have occurred in the Air Force since this effort began have provided other alternatives that were not considered in this report. Thus, the report's findings are tentative. When Air Force organizational changes are completed, a follow-on study may be warranted.

AFENAC would serve as the Air Force's single center for environmental noise assessment and manage the use of noise assessment technologies that the Air Force has developed or will develop. Public concern over aircraft noise around air bases and under low altitude and supersonic airspaces has been growing, and these assessment technologies are intended to help the Air Force develop better environmental and community planning documents that address these public concerns.

For AFENAC to fulfill its mission as a premier environmental noise center, it should be able to

- serve as the Air Force's single office of environmental noise assessment (including supporting SAF/MIQ and USAF/LEEV by providing draft responses to public and Congressional inquiries),
- maintain and upgrade computer software developed for assessment technologies,
- assist MAJCOMs and bases in using technologies,
- suggest appropriate mitigative actions,
- train environmental and operations personnel in using technologies,
- maintain a field assistance team,
- maintain a strong quality assurance function,
- update literature and other databases,
- recommend research and policy initiatives, and
- serve as a strong advocate for noise analysis.

Figure ES.1 shows a possible organizational structure for AFENAC. If AFENAC were a stand alone center, an estimated 12½ staff members and perhaps 2 graduate student assistants would be required. Some of these individuals might not be needed full-time; and, depending upon qualifications, one individual could fill two part-time slots. If AFENAC were collocated with the center associated with AFRCE-BMS that will deal with issues falling within the scope of the National Environmental Policy Act (NEPA), the estimated number of staff would be 9, since some positions could be shared.

Because of the close working relationship that must be established between AFENAC and the NEPA Center in order to develop strong NEPA documentation, the report recommends that the two organizations be collocated. Databases, analytical expertise, and computer hardware could be shared, as necessary, and major command (MAJCOM) and base personnel could visit a single location to resolve common issues. If this option is not selected, an alternative would be to site AFENAC as a stand alone office at Wright-Patterson AFB, possibly within the organizational framework of the Air Force Logistics Command's logistics operations centers. This configuration would place AFENAC physically near several noise-related organizations, with whom AFENAC might interact periodically. At this time, however, the Air Force is undergoing substantial reorganization. The outcome of such reorganization could change the advantages and disadvantages of the options considered and could even produce new options. The ultimate siting decision must await resolution of the many organizational changes being considered.

Approximately 3000 ft^2 of floor space would be required for AFENAC, including adequate space for computer and plotting equipment required for technical support, a training and conference room, office space, and storage room needed for the data librarian and archival functions. AFENAC would require 15 computer workstations and associated networking and long distance telephone hardware and software costing about $20,000 each. Each user at the

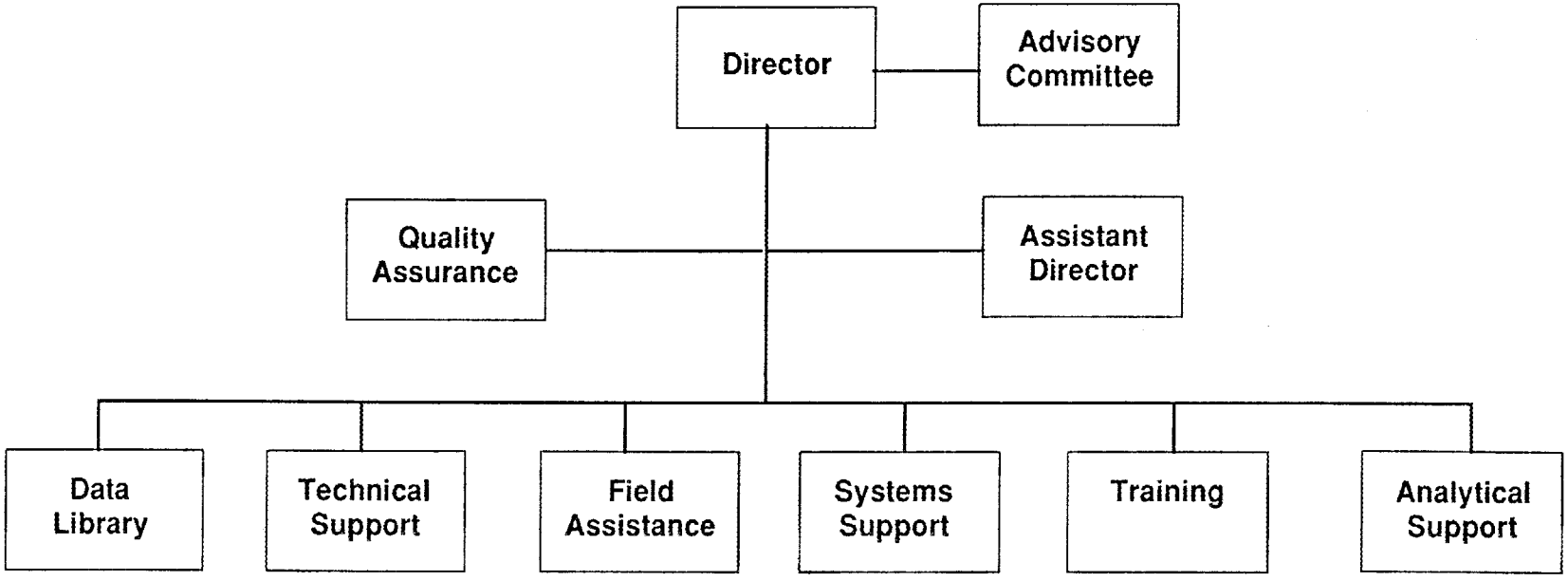

Fig. ES.1. Proposed AFENAC Organization

MAJCOM and base level would require similar capabilities. Assuming that 75 sites with 2 stations per site would be required, approximately 150 workstations would be needed and the estimated cost would be $3,000,000. This equipment could be purchased in one or two large "buys" on an existing desktop or small computer Air Force-wide contract to ensure that MAJCOMs and bases would be able to use the assessment technologies properly and to interact effectively via phone lines with AFENAC. (The report discusses other alternatives in regard to computer requirements and acquisition that are less ambitious but probably less effective.)

For AFENAC to be operating with a minimal staff by 1 October 1991, a decision to establish AFENAC would be required by HQ USAF/LE no later than 31 March 91. Excess personnel slots in other LE organizations would need to be identified and reassigned to AFENAC, and funding for fiscal year 1992 would need to be allocated. A director should be identified by 30 June 1991, and job descriptions for several important positions must be developed, graded, and advertised as early as possible.

1. BACKGROUND

This report details an implementation plan for establishing the Air Force Environmental Noise Assessment Center (AFENAC or the "Center") to serve as the Air Force's single center for environmental noise assessment. AFENAC would be staffed by the Air Force's experts in applied environmental noise assessment and community planning[1] and would be responsible for implementing various technologies throughout the Air Force to calculate expected noise levels from different aircraft operations. More specific AFENAC responsibilities are discussed in Sect. 2. AFENAC would be important in facilitating the Air Force's flying mission, in view of growing public concern over noise-related issues around air bases and beneath low altitude and supersonic airspaces as well as encroaching land uses around air bases.

If such concerns lead to public opposition, some Air Force flying units and air bases could find it difficult to carry out their missions. The Air Force must be able to develop and operate low altitude and supersonic airspace so that aircrews can train in environments that simulate war time conditions. Incompatible civilian development near existing runways and take-off and approach patterns also threatens the Air Force mission because air bases experiencing such encroachment may have to alter their missions or even close, if no satisfactory alternatives are available. However, public concern over Air Force flying operations can be reduced by developing and operating airspace and interacting with local planning officials in ways that are responsive to such public concerns or help the public understand Air Force operations better.

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[1]The primary programmatic requirements that AFENAC would support are activities related to the National Environmental Policy Act and the Air Installation Compatible Use Zone program. For ease of discussion both programs are combined frequently under the general term of "environmental." Thus, this term includes environmental analysts and community planners.

The Air Force and others have conducted considerable research and development (R&D) in recent years as a result of increasing concern over the environmental effects of aircraft noise. This R&D has been conducted primarily by the Noise and Sonic Boom Impact Technology (HSD/YA-NSBIT or "NSBIT")[2] program and the Armstrong Aerospace Medical Research Laboratory (AAMRL/BBE), both at Wright-Patterson AFB. It has focused on the impacts of aircraft noise and sonic booms on humans, animals, and structures. Much of the work has been directed at development of computer models (technologies) for calculating aircraft noise levels from specified input data. Based on these noise levels, impacts can be estimated and then used in documents such as environmental impact statements (EISs), environmental assessments (EAs), air installation compatible use zone (AICUZ) reports, and base planning documents that help Air Force units accomplish their flying missions.

Noise assessment technologies would need to be transferred to AFENAC for their maintenance and use by major commands (MAJCOMs) and bases. These technologies and supporting databases are described in Sect. 4. AFENAC would ensure that these technologies would be used appropriately by the many base and MAJCOM users throughout the Air Force. Without the guidance and expertise in environmental noise assessment that would be provided by the Center, the Air Force's ability to use such technologies, apply their results, and respond to public concerns would be reduced considerably. This implementation plan recommends how AFENAC could be established and operated to achieve its purpose. The plan reflects considerable interaction between the authors and a number of Air Force organizations including the program office, HQ AFESC/DEMP, and the associated staff of the AICUZ program; air staff personnel in HQ USAF/LEEV, HQ USAF/LEED, and HQ USAF/XOOSA; NSBIT;

[2]The reader is referred to the list of abbreviations and acronyms (p. v) for definitions of these abbreviations, many of which are Air Force office symbols rather than initials.

AAMRL/BBE; HQ AFSC/XTH; HQ AFLC/DEPR; and various personnel on the environmental community planning, and operations staffs at the Tactical Air Command, Air Force Logistics Command, Air National Guard, and Air Force Reserves.

This implementation plan consists of four major sections. Section 2 sets forth the responsibilities of AFENAC. Section 3 discusses the organization, staffing, and funding of AFENAC. The noise assessment technologies (software) and associated computer hardware that should be transferred to Air Force users through the auspices of AFENAC are detailed in Sect. 4, and Sect. 5 establishes a schedule and procedures for accomplishing these objectives.

2. AFENAC RESPONSIBILITIES

To maximize the benefits of AFENAC, the Center should have considerable authority in conducting and overseeing the application of Air Force noise assessment technologies. Center responsibilities would be partly constrained by existing functions assigned to other components of the Air Force. For example, research on environmental noise issues would continue to be the responsibility of AAMRL and NSBIT, as long as the latter remains functional. Policy making for environmental and community/base planning issues would continue to reside with HQ USAF/LEEV and HQ USAF/LEED, respectively. Pending any future decision to include occupational health programs in AFENAC, all such programs would continue in their present organizational structure.

2.1 SINGLE CENTER FOR ENVIRONMENTAL NOISE ASSESSMENT

AFENAC's primary responsibility would be to serve as the Air Force's single center for environmental noise assessment with the capability to describe, predict, and assess consistently and uniformly the potential effects of aircraft noise on sensitive receptors. The current lack of any such organization is keenly felt by MAJCOMs and bases, as indicated by interviews conducted for this report. At present there is no single source of such technical assistance capabilities within the Air Force for assessing environmental noise issues. Neither the research nor policy organizations can provide ongoing assistance regarding use of these assessment technologies; and because of the number—and in some cases complexities—of such technologies, users are expected to need periodic assistance in their application. In serving as the Air Force's single center, AFENAC should have the requisite technical and analytical expertise to provide substantive

assistance to the user community, comprised of base and MAJCOM environmental and community planners, as well as unit operations officers. It should have to turn only rarely to the research community for technical advice or assistance in handling routine assessments, but it should be in close touch with, and ready to implement advanced technologies coming from, that community.

2.2 MAINTAIN AND UPGRADE SOFTWARE

The second responsibility of AFENAC would be to implement, maintain, modify, and update the software associated with noise assessment technologies. Air Force policy, as recommended by the technology's developer and established by the Air Staff, specifies procedures under which each technology is to be used. It would be the Center's responsibility to ensure that the technologies are used in appropriate situations and that technologies are maintained properly and available for immediate use. Depending upon the complexity of the task and the decision of the Air Staff, either AFENAC (with AAMRL guidance) or AAMRL would modify and update specific technologies, but AFENAC would be responsible for incorporating and distributing such changes in the authorized computer software for each assessment technology. Because AFENAC would be the most knowledgeable office in evaluating the effectiveness of the noise assessment technologies, it would be responsible for identifying and recommending needed modifications and updatings to the Air Force policy and research communities.

2.3 ASSIST USERS

Many of AFENAC's daily operations would involve assistance to the environmental, community planning, and operations staffs at the MAJCOM and base levels who are responsible for preparing the reports that require the results of the noise technologies. This role would be an

inherent component of AFENAC's primary responsibility of serving as the Air Force's single center for noise analysis and would reflect the importance of assessment technologies in fulfilling that responsibility. It is expected that numerous questions would arise from users about when and how to use the assessment technologies, and it would be AFENAC's responsibility to provide answers. The more complex technologies, such as NOISEMAP (and development of the AICUZ report) and Assessment System for Aircraft Noise (ASAN), would require frequent interaction between AFENAC and users. Such interactions would involve computer networking, telephone communication, and occasional visits between AFENAC and users. Additional details are provided in Sect. 3.2.6.

2.4 SUGGEST MITIGATIVE ACTIONS

As AFENAC provides technical assistance to users, questions would be anticipated regarding the seriousness of expected impacts and what the Air Force should do about them. AFENAC would have a small staff of professional analysts who would provide such assistance on what impacts would be expected from calculations made by the noise assessment technologies and what steps the Air Force could take to reduce the severity of those impacts. Additional details are provided in Sect. 3.2.10.

2.5 TRAIN USERS

Ensuring that MAJCOM and base operations, environmental, and comprehensive planning staff are able to use the assessment technologies would be another responsibility assigned to AFENAC. Currently, training is performed by NSBIT and AAMRL, which have developed the technology, but this job typically should not be the responsibility of the research community. As the office responsible for transferring these technologies, it would be within the Center's mission

to provide appropriate training procedures. The training program should be tied directly to the day-to-day functions of the Center and should reduce the amount of interaction required between AFENAC and the individual user. Training procedures are discussed in Sect. 3.2.4.

2.6 MAINTAIN A FIELD ASSISTANCE TEAM CAPABILITY

Another AFENAC responsibility would be to maintain a field assistance team capability to ensure that major noise assessment efforts required by particular users (e.g., completion of a new AICUZ report or development of an EIS for an airspace proposal requiring ASAN) were provided with adequate technical support. Such a field assistance capability has been maintained for about two years by the AICUZ program, where it is known as the In-Progress Review (IPR). The IPR appears to be well received by MAJCOMs, according to interviews conducted for this report. It is reasonable to expect that even with the BASEOPs computer code (designed to simplify data input for NOISEMAP overlays in AICUZ reports), AICUZ and the potentially substantial ASAN data demands on units would require that a field assistance capability be maintained at the Center. The field assistance function is described in greater detail in Sect. 3.2.7.

2.7 PROVIDE QUALITY ASSURANCE

Given the diffused nature in which the noise assessment technologies will be used throughout the Air Force, the infrequent use of many technologies by most personnel, and the importance of accurate results, it would be critical that the Center maintain a credible quality assurance function. Quality assurance would be implemented by AFENAC specifically at several stages: (1) when technologies are transferred to the user community; (2) as personnel are trained in the technologies; (3) as data are put into the software and computerized databases; (4) through

real-time interaction on specific technology applications between AFENAC and the user; and (5) in AFENAC sign-off requirements on all documents incorporating results of noise assessment technologies. An aggressive quality assurance function would improve the quality and consistency of Air Force noise assessment documentation and enhance the credibility of the Center inside and outside the Air Force. See Sect. 3.2.9 for additional discussion.

2.8 CONDUCT LITERATURE UPDATES

Another responsibility of AFENAC would be to stay abreast of scientific developments in noise assessment and provide literature updates to CITASAN and, possibly, its NATO counterpart, the International Bibliography on Aircraft Noise (IBAN). Bibliographies are a key part of applied research in providing sound scientific and theoretical bases for the applied work. As such, it would be important that the Center stay current with developments in noise analysis and that assessments reflect these latest developments, as reported in the scientific literature (see Sect. 3.2.8). Annual updates should be conducted by AFENAC.

2.9 RECOMMEND R&D POLICY INITIATIVES

Another responsibility of the Center would be to recommend new R&D efforts and policy initiatives. Responsibility for proposing research initiatives would lie with AAMRL/BBE, NSBIT, HQ USAF/LEED, and HQ USAF/LEEV, with HQ AFESC/RDV then establishing the research agenda. New policy initiatives would be determined by HQ USAF/LEEV and HQ USAF/LEED. However, as the Air Force's center for noise assessment, AFENAC would have the potential benefit of working directly with the user community. This unique perspective, coupled with real expertise of its own, would make the Center a very useful source of ideas for R&D and policy initiatives. The more effective AFENAC became as an environmental noise assessment center,

the more input it should generate to R&D and policy. The route for such recommendations conceivably could be either through the AFENAC Director or the Advisory Committee, as discussed in Sect. 3.2.11.

2.10 SERVE AS AN ADVOCATE OR SPOKESMAN FOR NOISE ANALYSIS

The final AFENAC responsibility would be to function as a strong advocate or spokesman for environmental noise analysis within the Air Force. Currently, no single point exists for this role. Noise assessment could benefit in terms of its relative priority in the Air Force if AFENAC were to assume such a leadership role. Its close ties to users as well as its noise assessment expertise should provide AFENAC with sufficient knowledge and credibility to serve in this capacity. Over time, assessment of noise issues should benefit as a result of the Center's role as an advocate.

3. AFENAC ORGANIZATIONAL STRUCTURE

3.1 LOCATION, ORGANIZATIONAL AFFILIATION, STAFFING, AND FUNDING

3.1.1 Location and Organizational Affiliation

The following section discusses critical locational, organizational affiliation, staffing, and funding considerations entering into the decision to establish AFENAC. A number of locations were considered, along with the associated organizations to which the Center would report. This issue was perhaps the most difficult to resolve in that an obviously ideal candidate site was not available. The selection also was hampered by current uncertainties over reorganization of various components of the Air Force.

Factors including proximity to other Air Force noise research organizations, travel connections, ease of working with other Air Force environmental and base planning personnel, and cost-effectiveness were considered in proposing AFENAC's location. The capability to facilitate MAJCOMs' and bases' environmental and AICUZ programs was considered to be paramount, given AFENAC's mission. It is expected that AFENAC interactions with the user community would far outnumber those with either the policy or research communities and that the need for close AFENAC/user interface should influence siting and organizational decisions. Options included (1) Tyndall AFB, reporting to a reconstituted HQ AFESC/DEV; (2) Washington, D.C., with no organizational assignment identified; (3) Brooks AFB, within the Occupational and Environmental Health Laboratory (OEHL) or HQ HSD structure; (4) Wright-Patterson AFB, reporting to Air Force Logistics Command (AFLC); and (5) collocation with the proposed organization responsible for conducting assessments under the National Environmental Policy Act (NEPA), which will report to HQ USAF/LEE. Other suggestions included any of the

Air Force Regional Civil Engineer (AFRCE) centers, the Air Force Academy, or in conjunction with the Army Corps of Engineers' Construction Engineering Research Laboratory (CERL). The regional AFRCEs were excluded because their role is to focus on intergovernmental and interagency coordination instead of providing highly technical services. The Air Force Academy was considered to be too far removed from the active Air Force and to have its own unique mission. Likewise, CERL was not considered for the Center because its role emphasizes construction rather than noise, airspace, and zoning implications. Strong arguments could not be made in favor of any of these latter options.

3.1.1.1 Tyndall AFB (Panama City, Florida)

Tyndall AFB holds some advantage because of AFESC and the presence of the AICUZ program, which would be a component of AFENAC. In addition, the presence of the Technical Information Center (AFESC/TIC) could be an advantage in respect to library functions. Locationally, Tyndall is not the easiest base to reach, but this disadvantage may not be a major drawback since the same MAJCOM and base individuals should not have to travel to Tyndall frequently. The major drawback to AFESC is the absence of an environmental organization. Only the AICUZ program is within the current responsibilities of AFESC, and there appears to be little interest in or opportunity for reconstituting a DEV function under foreseeable conditions. Thus, other noise assessment functions are outside AFESC responsibilities. The existence of an environmental organization would greatly facilitate implementation of AFENAC, as the two organizations would be cooperating closely on an every day basis.

3.1.1.2 Washington, D.C., area

The Washington, D.C., area was considered as a possible location. There was a consensus among MAJCOMs that AFENAC would be of greater benefit to them if it were not located in close proximity to policy organizations. An AFENAC objective would be to facilitate noise assessments in the field, and this objective could be impeded if the Center's resources were to become too focused on policy issues.

3.1.1.3 Brooks AFB (San Antonio, Texas)

Brooks AFB, under OEHL auspices, was considered as a possibility if AFENAC were to include an occupational health function. Although there is an interest at HQ AFSC/XTH for such inclusion, the Surgeon General's office is taking a wait-and-see approach. Although environmental and occupational health functions both relate in part to noise, it is not clear what advantages would be gained from their close association when their responsibilities are so dissimilar. Interviews with MAJCOMs also indicated opposition to combining both functions in AFENAC for fear of losing the much-needed environmental thrust of the organization.

3.1.1.4 Wright-Patterson AFB (Dayton, Ohio)

The option of locating AFENAC at Wright-Patterson AFB would have some important advantages. The Center would be physically near, although not organizationally a part of, AAMRL and NSBIT, both of which could provide technical advice to AFENAC. Transferring the noise technologies also might be facilitated. Another advantage is the relative accessibility of Wright-Patterson AFB. A perceived disadvantage among some MAJCOMs is that the proposed Center might not be sufficiently responsive if it were organizationally affiliated with the research community. However, this concern should be alleviated partially if the Center were placed within

AFLC; additionally, Air Force policy precludes having an organization such as AFENAC within AFSC. A disadvantage of siting AFENAC within AFLC or any other MAJCOM would be the limited environmental noise assessment capability available at MAJCOMs which is insufficient to support the entire Air Force. AFENAC would work most effectively if it could function in close association with a large environmental and community planning staff with resources sufficient to support the entire Air Force rather than a single MAJCOM.

3.1.1.5 Collocation with NEPA Center

The last option considered would be to locate AFENAC in conjunction with the change of AFRCE-BMS into an Air Force NEPA Center. Although currently located at Norton AFB, California, the permanent site of the NEPA Center remains undetermined. This organization will support the NEPA requirement, much as AFENAC would the environmental noise assessment requirement. Databases and assessment methodologies developed by AFRCE-BMS in support of its earlier NEPA work, along with databases developed for the Generic EIS for Low Altitude Flying Operations, will be available for use throughout the Air Force. The new NEPA Center will act as a liaison between MAJCOM/base environmental planners and HQ USAF/LEEV/ LEED, review NEPA documents, provide technical assistance to planners, maintain a quality assurance function, and facilitate standardization of the environmental impact analysis process. The NEPA Center will also conduct some larger projects itself. Virtually all of AFENAC's assessments would be components of NEPA analyses, AICUZ reports, Congressional inquiries, and responses to noise complaints. In addition, there is considerable commonality in required databases and in the technical expertise required for the analyses that would be conducted by AFENAC and the NEPA Center. Therefore, it is critical that a good working relationship be established between the two centers.

Because of the restructuring of the military and declining funding levels, it is essential that AFENAC incorporate as many cost-saving measures as possible if AFENAC is to be a viable organization. One likely savings in collocating AFENAC and the NEPA Center is reduced staff requirements. AFENAC's work would experience certain ebbs and flows, and rather than staffing for the peak demand, it would be more efficient to establish staff requirements at a more sustainable level and share staff with the NEPA Center as needed. An example would be the field assistance teams formed by AFENAC to assist users with AICUZ reports or in ASAN applications. AFENAC could employ fewer people and rely on NEPA Center staff to serve on such teams as necessary. The same benefit in staff savings would accrue to the NEPA Center. Ideally, some positions in both organizations could be filled with dual assignments. For example, the AFENAC librarian could serve a similar function in the NEPA Center, since the AFENAC slot might not be a full-time assignment. Similar benefits could be gained if AFENAC could borrow scientific staff for human and animal impacts rather than hire its own experts. In addition, environmental personnel needing to visit AFENAC frequently also are likely to need to work with staff at the NEPA Center in order to develop EISs and EAs. Combining two otherwise separate trips into one for users throughout the Air Force could produce considerable financial savings over time not only in direct costs but also in reduced personnel time.

Collocating AFENAC with the NEPA Center would not have the advantage of being close to the noise research capabilities at Wright-Patterson AFB, but the interaction between AFENAC and the NEPA Center would routinely be much more frequent and sustaining than those between AFENAC and other noise-oriented organizations at Wright-Patterson AFB. The potential savings in complementary staff and databases that could be achieved through collocation with the NEPA Center argues for such a siting mode. If collocation with the NEPA Center is not

selected, Wright-Patterson AFB appears to be the next most attractive AFENAC site. However, the AICUZ and NEPA staff at AFLC would require augmentation if AFENAC were to function.

3.1.2 Staffing

Section 3.2 details the recommended functions that AFENAC would perform in order to carry out its mission. Some of these functions could be accomplished with a part-time effort from one individual whereas other functions would require two people plus periodic assistance from additional staff.

If AFENAC were set up as a stand alone organization, such as at Wright-Patterson AFB, an estimated 12½ staff, 2 part-time graduate students, and 2–3 Air Force TDY personnel in training would be required to carry out AFENAC's assigned responsibilities (Table 1). Some personnel savings could be realized if two part-time slots could be assigned to a single person, but this option would depend upon staff capabilities. If this option were chosen, it would be conceivable that AFENAC staff could be reduced to 9 people. If AFENAC were set up in close association with the NEPA Center, approximately 9 staff, 2 graduate students, and 2–3 Air Force TDY personnel undergoing training would be needed to operate the Center. Sharing of several positions between the two organizations would be feasible. The benefits would be greater also in allowing a person to perform the same task for both organizations rather than having a person in AFENAC perform two distinct functions that may have little if any similarity. Sharing of such positions as trainer, librarian, and the analytical support staff would be particularly appropriate.

There would be three options for staffing AFENAC: (1) reallocate positions within the DE community, (2) use a contractor-staffed operation, or (3) employ temporary staff. HQ USAF/LE would decide upon the option to be pursued. The best option from the standpoint of visibility, credibility, and continuity within the Air Force would be to reallocate permanent

Table 1. AFENAC staff positions

Position	AFENAC (stand alone)	AFENAC (stand alone reduced)	AFENAC (collocated with NEPA)
Director	1	1	1
Assistant Director (and QA)	1	0	1
Systems Support Manager	1	1	1
Systems Support Assistant	1	0	0
Technical Support Manager	1	1	1
Technical Support Assistant	1	1	½
Trainer	1	½	½
Field Assistance Manager	1	½	½
Librarian	1	½	½
Analytical Support	2	2	1½
Secretary/Data Encoding	1½	1½	1½
	12½	9	9
Graduate students (part-time)	2	2	2
Air Force TDY personnel (in-training)	2–3	2–3	2–3

personnel slots within the DE community. This would be accomplished by identifying existing positions that could be eliminated and/or given to AFENAC. Incumbents of the current slots would be given 90 days notice that their jobs were being terminated or transferred. The second option, using a contractor-staffed operation, would be more expensive because of higher salaries and would probably take longer, since the funds would have to be budgeted and set aside and then the process would have to be bid competitively. It is unlikely that an organization comprised

of contractor personnel would have the visibility and credibility within the Air Force that a permanent staff of Air Force employees would have. The third option also suffers from this disadvantage and would have a potential problem with employee continuity, since the positions would have to be rebid every 3 years.

For any options selected, HQ USAF/LEE would conduct job studies and write job descriptions for all AFENAC positions. At that point, the civilian personnel office at the base where AFENAC would be located would determine appropriate grade levels; advertise availability of the positions; and, with approval of the AFENAC Director, hire the best qualified candidate for each slot.

In respect to AICUZ staff, the two permanent and two temporary positions could be transferred through the normal transfer process, although it would be unlikely that all of the four incumbents would choose to relocate. It should be noted, however, that the positions being recommended for AFENAC are not generally the same as the four AICUZ slots, and some redesigning of jobs would be required. This redesigning would be necessary because the AFENAC organizational structure is based upon broad functional tasks that cut across all noise assessment technologies rather than on discrete technologies or programmatic areas such as AICUZ or NEPA. Thus, each AFENAC staff member would be expected to work at various times with technologies in all programs. This organizational structure would maximize staff utilization which would fluctuate throughout any year as Air Force requirements change. It is recommended that AICUZ staff be reassigned to AFENAC at an early date for several reasons. First, the AICUZ program is the only one with a staff that implements existing noise technologies, and keeping the two organizations separate would hinder clear lines of authority. Second, its association with AFENAC would help give the new Center credibility and an early mission.

Third, several technologies being developed are associated with existing AICUZ technologies and need to be transitioned to AICUZ as part of AFENAC.

The recommended order for staffing of AFENAC is Director, Secretary, Systems Support Manager, Assistant Director, Field Assistance Manager, Technical Support Manager, Trainer, Librarian, and Analytical Support. An optimal schedule is detailed in Sect. 5, Table 6.

3.1.3 Funding

Table 2 identifies estimated AFENAC costs for stand alone and collocated options. A major cost would be salaries to the approximately 12½ staff members. Assuming that, with benefits, salaries would average $50,000, annual staff costs would total $625,000 in the stand alone option and $450,000 in the collocated. It would be necessary to have temporary duty funds to support active coordination with the policy, research, and user communities, as well as other requirements. The user ordinarily should fund TDY costs incurred by AFENAC in support of the field assistance function. Other travel for more general purposes would be required. Estimated costs could total about $18,750, assuming 25 trips annually at an average cost of $750 per trip with no differences in the options. Office supplies, etc. and telephone charges are somewhat less and very little between alternatives. Other than these costs, almost all funding required for AFENAC would be for computer hardware and software. The costs are essentially one-time charges that must be absorbed at the beginning of the Center's existence. The requirements for each workstation are detailed in Sect. 4. Each workstation is estimated to cost $20,000, including the costs of networking the equipment with any other users at the base and at AFENAC. Generally, there would be two users per MAJCOM or base, environmental/community planning and operations. (Conceivably, a cost-saving alternative could be to place only a single machine at a site and have the two functions share it and tolerate any resulting inconvenience.) Several

Table 2. Estimated AFENAC costs for stand alone and collocated options

	Stand alone	Collocated
One time		
Office space (3000 ft^2 × $20/ft)	$ 60,000	$ ----
(3000 ft^2 × $10/ft)	----	30,000
Furnishings (workstations only)	0	0
Computers (AFENAC) ($20,000 × 15)	300,000	300,000
Computers (users) ($20,000 × 150)	3,000,000	3,000,000
Vehicle	0	0
Word processors (5)	0	0
Annual (at full strength)		
Salaries/benefits	$ 625,000	$ 450,000
Temporary duty	18,750	18,750
Supplies/copying/postage	12,000	12,000
Telephone	12,000	9,000
Utilities	4,800	3,600
Fuel/oil	1,200	1,200
Contracting (students, consultants)	75,000	75,000

individuals in a single office could use the same machine. Assuming that about 75 sites would be included in the AFENAC network, 150 workstations at a total cost of about $3,000,000 would be required by MAJCOMs and bases when ASAN is deployed. Based on visits and observations in early 1990, the equipment then in the field would not support ASAN. The rationale for purchasing new equipment is that the personnel and hardware costs associated with bringing that equipment to specification would exceed the cost of providing turnkey systems. However, the Air Force may want to have another look at the inventory in the field at the point at which ASAN is ready to be fielded (see rationale in Sect. 4.2, pp. 54–55). About 15 machines would be needed

at AFENAC to support the staff, train Air Force personnel, and conduct interactive computing with users (1 machine per staff member plus 4–6 additional; see rationale in Sect. 4.2, p. 55). However, not all the workstations would need to have such equipment as plotters and large storage and computing capacity, so some economies could occur. This equipment could be purchased in one or more Air Force buys on an existing small computer contract rather than require users to purchase their own. The equipment would need to meet AFENAC specifications, and it is doubtful that sites presently have such equipment. Rather than running the risk of incompatible equipment, lack of equipment, incompatible cabling, or delays in trying to upgrade existing equipment, it is advisable for the Air Force to buy the same equipment for everyone. The equipment for MAJCOMs and bases could be purchased in time for it to be used in fiscal year (FY) 1993, when some portions of the ASAN technology would be transferred to AFENAC and then to MAJCOMs and bases. Alternatively, equipment could be purchased over 2 or 3 years to spread the costs. AFENAC should be provided with its equipment by the middle of FY 1992 for it to start interacting with Air Force users on a timely basis with those technologies that do not require the UNIX operating system. Thus, this schedule would require computer purchases of about $300,000 for FY 1992–93 for AFENAC and approximately $3,000,000 for FY 1992–93 for MAJCOMs and bases (or half of this amount if only one computer were provided to each site).

If for budgetary reasons this cost is not feasible, then alternatives such as loaning equipment from AFENAC, perhaps in conjunction with a training program, might be considered. This has its own set of drawbacks including the problem of maintaining inventory and equipment as well as problems of familiarity and obtaining local technical support.

Other equipment needs for AFENAC primarily would be office furniture, and forthcoming reductions in the Air Force should make this equipment available, thereby requiring no new

purchases. In addition to the 15 workstations, AFENAC would require several personal computers suitable for normal office use that would not be included in the AFENAC network. This equipment should also be available from surplus machines.

In regard to office space, AFENAC would require an estimated 3000 ft^2 to accommodate offices, a computer center for systems support, plotters, work tables, and a training/conference room. Some improvements likely would be required, particularly for the computer center room and training/conference room, but this office space should be available in light of force reductions without the need for any construction.

Table 3 indicates estimated expenditures during its first four operating years with FY 1991 being a very abbreviated operating year. FY 1993 would constitute the first full year of Center operations with all staff and equipment functioning.

3.2 FUNCTIONAL STAFFING

3.2.1 Overview of Organizations

Table 4 details AFENAC organization by function. The actual organization of AFENAC could vary depending on the skill mix of personnel and AFENAC's association with the NEPA Center. Regardless of the structure of the organization, the functions represented in this table would have to be met by AFENAC. Figure 1 portrays the option that appears to be particularly advantageous. The following section is oriented toward this option with variations discussed as appropriate.

3.2.2 Director

The primary responsibility of the Director would be to oversee AFENAC in accordance with Air Force policy. Other tasks are listed in Table 4. Responsibility for day-to-day operations

Table 3. AFENAC costs ($000's) by fiscal year for stand alone and collocated options

	FY 91	FY 92		FY 93		FY 94	
	Both	Stand alone	Collocated	Stand alone	Collocated	Stand alone	Collocated
Personnel	33	350	275	625	450	625	450
TDY	5	19	19	19	19	19	19
Supplies	2	6	6	12	12	12	12
Telephone	1	6	4.5	12	9	12	9
Utilities	.5	4	3	4.8	3.6	4.8	3.6
Fuel	.5	1.2	1.2	1.2	1.2	1.2	1.2
Consultants	0	25	25	75	75	75	75
Office space	0	60	30	0	0	0	0
Furnishings	0	15	15	0	0	0	0
Computers (AFENAC)	0	200	200	100	100	0	0
Computers (users)	0	1,000	1,000	2,000	2,000	0	0
Total	42	1,686.2	1,578.7	2,849	2,669.8	749	569.8

would be delegated to the Assistant Director, as discussed in Sect. 3.2.3. The Director would set the direction and agenda of the Center with guidance provided by Air Force policy and advice from the AFENAC Advisory Committee (Sect. 3.2.11). He or she would convene annual meetings of the Advisory Committee, report on AFENAC activities, and seek its advice. The Director would be the point of contact between other Air Force offices and the Center. He or she would be responsible for long-range planning for the Center and for ensuring that resources (e.g., personnel, funds, facilities, equipment) were adequate to accomplish those activities. Based on the Center's activities in applying noise technologies, the Director would provide advice

Table 4. Description of required functions as organized by staff positions

Position	Functions
Director	• Oversee AFENAC in accordance with Air Force policies and procedures; • Provide general direction and implement policy for AFENAC; • Serve as the point of contact for Air Force and other organizations with collateral interests in the Center; • Periodically convene the AFENAC Advisory Board to report progress and seek advice; • Provide advice on Air Force environmental noise policy and R&D needs; • Arrange for the Center to transfer additional technologies to the field; • Attract resources to the Center; • Provide general staff oversight; • Develop and execute a long-range plan; • Develop and execute staffing plans; • Submit an annual report detailing and evaluating (with input from the Advisory Committee) the performance of AFENAC during the previous fiscal year.
Assistant Director	• Serve as Acting Director during absence of Director; • Oversee day-to-day operations of the Center; • Establish, maintain strong credibility, visibility of the Center; • Set high professional and technical standards for the Center; • Manage routine personnel, budget, facilities, and purchasing matters, and identify future needs; • Ensure implementation of a strong overall quality assurance function.
Trainer	• Develop training requirements for each product to be transferred; • Develop plans to meet the training requirements for each product; • Develop training materials for products being transferred by the Center; • Conduct training for users of the Center's products; • Coordinate on-the-job training with other Center staff; • Establish a QA function specific to needs of training.
Systems Support Manager	• Maintain technology software that has been transferred from AAMRL/NSBIT; • Maintain complete documentation for each version of all software packages at the Center. Consult with AAMRL/NSBIT to set standards for documenting code and ensure they are followed. Where possible, make use of computer-aided software engineering (CASE) tools; • Oversee repair of minor software problems; • At the direction of the Configuration Management Board, develop minor upgrades to software.

Table 4. Continued

Position	Functions
	• Interact with the Configuration Management Board to set priorities for software development (major upgrades being the responsibility of the technology developer); • Upgrade software to take advantage of new hardware; • Maintain and develop the Center's hardware/software interactions; • Evaluate new hardware as it becomes available and make recommendations to the Configuration Management Board about the implementation of software on the hardware; • Institute a QA effort for the AFENAC hardware/software system.
Technical Support Manger	• Oversee interactions with technology users at MAJCOMs and bases; • Maintain daytime telephone and computer lines to provide technical support for software and hardware in the field; • Train technical support staff; • Develop databases to track hardware and software complaints; • Develop databases to track users and hardware and software configurations in the field; • Distribute new versions of software; • In conjunction with the systems software manager, advise users on hardware and software acquisitions; • Maintain an electronic bulletin board for users; • Organize software user's group meetings; • In cooperation with QA manager, develop and maintain a quality assurance function to be used in conjunction with assessment technologies.
Field Assistance Manager	• Support data and analysis activities at MAJCOM and base levels; • Assemble teams for short term assignments at user locations; • Keep an active roster of potential field team members; • Assist users in preparing for team visits; • Recruit and train new field assessment team members including user trainees temporarily assigned to AFENAC, personnel from other organizations; • Perform NOISECHECK studies as required to resolve controversies; • Establish a QA system that ensures accurate data, analyses, documentation in all reports generated.
Librarian	• Oversee annual updating of bibliographic databases; • Oversee maintenance of bibliographic databases; • Maintain archives; • Develop and maintain databases to track archived data; • Develop and maintain national databases for downloading (Census, map data, etc.); • Perform quality assurance and quality control on data received for archiving.

Table 4. Continued

Position	Functions
Quality Assurance Manager	• Review documents incorporating results of noise assessment technologies to ensure that technologies are used correctly; • Make recommendations to the Center Assistant Director with regard to formal approval of documents incorporating environmental noise technologies; • Ensure QA is integrated into all AFENAC functions.
Analysts	• Provide assistance to users in judging impacts resulting from noise levels calculated by noise technologies; • Suggest appropriate mitigative actions; • Review all documentation requiring use of AFENAC technologies to ensure it passes technical peer review; • Provide input to CITASAN, IBAN, and other databases.
Advisory Committee	• Provide advice from Air Force policy, R&D, and user communities; academic community; and scientific community; • Evaluate AFENAC; • Provide link to broader environmental noise community.

regarding Air Force policy and R&D directions. The Director would submit an annual report by 31 October to HQ USAF/LEEV/LEED detailing the activities and evaluating the performance of AFENAC during the previous fiscal year. This report would include a constructive critique of the Center's performance from the most recent meeting of the Advisory Committee.

An important responsibility of the Director would be to develop and maintain close working relationships between AFENAC and HQ USAF/LEEV/LEED/XOOSA, AAMRL, NSBIT, and MAJCOMs. The successful operation of AFENAC would be dependent, in great part, upon the Director's effectiveness in developing close working relationships with each of these groups. It would be essential that the Director maintain contact with the Air Staff (LEEV, LEED, and XOOSA) to stay abreast of Air Force policy and to keep those offices apprised of Center activities, capabilities, problems, and accomplishments. The Director would need to keep

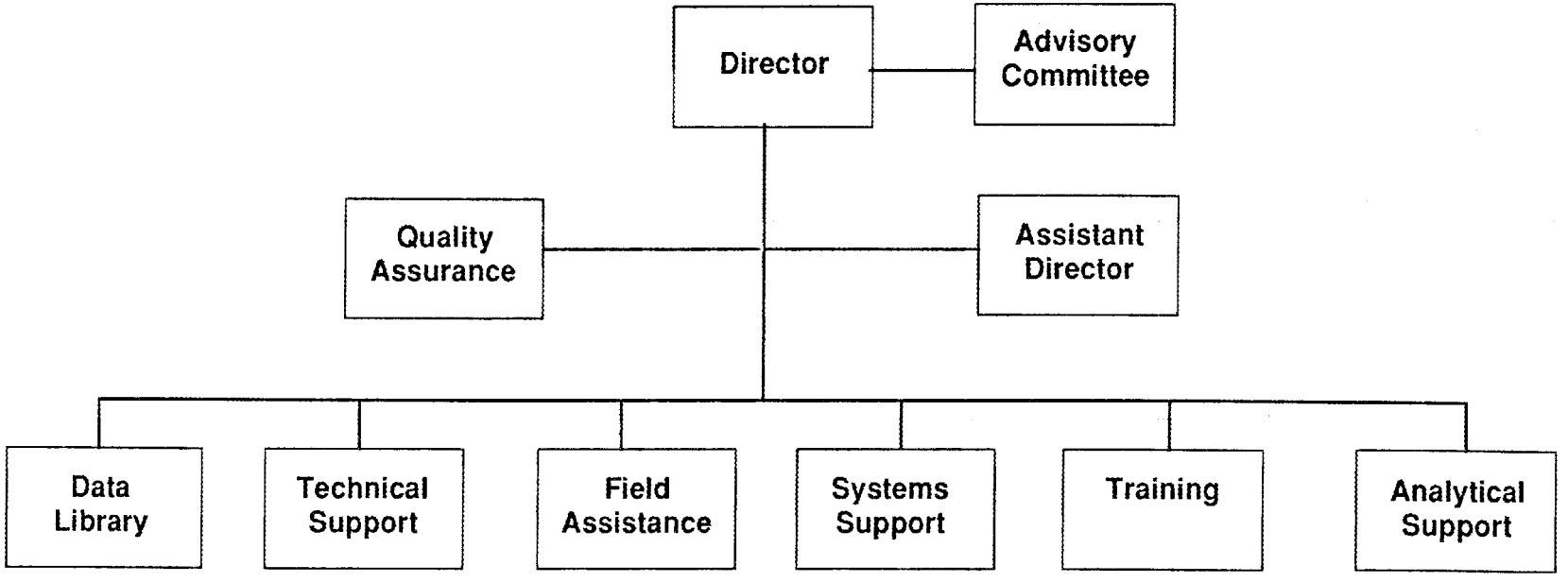

Fig. 1. Proposed AFENAC Organization

in contact with the research community to (1) facilitate required interactions on environmental noise technologies, (2) stay current on noise-related research elsewhere, (3) understand new noise technologies being developed for ultimate transition of the Center, and (4) communicate problems that have been identified in the field or at AFENAC. Lastly, but perhaps most importantly, the Director would need to ensure a close working relationship with AFENAC's clients, the user community in the field. The Center exists to help MAJCOMS and bases meet legal, regulatory, and community environmental noise requirements and thereby facilitate their organization's Air Force mission.

The AFENAC Director should be at least a lieutenant colonel. The individual should have at least a master's degree or equivalent experience in an appropriate physical, natural, behavioral, or social science or engineering discipline. His or her previous Air Force assignments should indicate at least 5–10 years of experience and significant achievements in environmental noise planning and assessment. The first director, in particular, should have a strong record in respect to organizational and recruiting capabilities, as such tasks would consume much of his or her time at the Center. He should be selected by 30 June 1991 in order to participate in early decisions regarding AFENAC and hiring of staff.

3.2.3 Assistant Director

The Assistant Director of AFENAC would serve as Acting Director in the absence of the incumbent. The normal duties are specified in Table 4. The primary responsibility of the Assistant Director would be to function as essentially the chief operating officer of the Center who would ensure that day-to-day activities of the organization were conducted in accordance with established procedures. Duties would include ensuring that assigned work was carried out; required resources were available; future requirements (e.g., personnel, facilities, equipment,

funding) were identified and plans developed for their acquisition; personnel requirements (e.g., qualified staff, assignments, professional development, evaluation) were developed; funds were managed properly; and high-quality results were obtained.

The Assistant Director would be responsible for maintaining the long-term continuity of AFENAC. He or she should be a civilian with a strong (i.e., national or international) reputation as an environmental noise scientist. This individual should have well-developed professional ties to the Air Force and civilian research communities. The person selected should provide the Center with early visibility and credibility that would be sustained, in part, through successors with similar reputations. The Assistant Director would be particularly committed to the quality assurance function because of its importance in developing and maintaining legally and scientifically defensible documentation and, consequently, enhancing AFENAC's reputation. He or she should set the tone for AFENAC as an extremely capable body of applied environmental noise professionals whose work would reflect the organization's high performance standards.

The Assistant Director would be at the GM-14 grade level and should have either a Ph.D. degree and 5–10 years of relevant experience or a master's degree with 10–15 years of relevant experience. Graduate education should be in one of the physical, natural, behavioral, or social sciences or engineering disciplines, and professional experience should demonstrate the combining of this education with noise-related issues in applied environmental research. This position would be advertised in appropriate professional journals at the beginning of AFENAC, and the candidate selected should be at the Center on a permanent, full-time basis by 28 February 1992, in order to assist with the AICUZ transfer and selection of other staff.

3.2.4 Training Manager

The Training Manager would ensure that appropriate MAJCOM and base environmental and operations staff were proficient in the use of noise assessment technologies. Such proficiency would be accomplished primarily through initial and followup training programs, although an effective quality assurance program, as described in Sect. 3.2.9, would also enhance user proficiency.

A number of training techniques could be used to develop initial skills, including workshops, self-directed instruction from manuals, tutorials accompanying the assessment technology software, instruction by AFENAC at user sites, and on-the-job training at AFENAC. It should be noted that user manuals are and will continue to be written by the developers of all assessment technologies. The main question is whether such manuals will be sufficient. With simpler software such as ROUTEMAP and CITASAN, it should be possible for users to teach themselves from the user manual with backup technical assistance provided by AFENAC staff. Larger, more complex technologies such as BASEOPS/NOISEMAP/AICUZ report and ASAN (including data gathering and analysis) likely would require a more ambitious AFENAC training effort. The most effective training in these situations would be workshops followed by on-the-job training programs at AFENAC for about 3 weeks. A 2-day workshop could be conducted for two or three people at a time who anticipate a near-term need for specific technologies. Workshops would focus on knowledge, data, and assessment procedures underlying the technologies and would be followed by hands-on use. On-the-job AFENAC training would then occur for the remainder of the 3-week period. During this time the trainees would assist AFENAC staff in conducting various noise assessments, reviewing NOISEMAP plots, writing AICUZ reports, improving ASAN databases, serving on field assistance teams, and developing other documentation of assessment technologies.

This type of training should be ideal for several reasons. It would be focused on those individuals with an identified need for a particular assessment technology; many environmental and operations staff will seldom, if ever, use some of these technologies because of rather infrequent requirements at many bases. In addition, small workshops can work more effectively and expeditiously with a handful of users. Finally, on-the-job training should help both the trainee and AFENAC. The trainee should learn more easily in an applied, real-life setting as he or she was integrated into the AFENAC staff, perhaps even serving on an IPR team or similar field assistance effort. Also, AFENAC would benefit in two respects: the permanent staff and associated costs could be kept smaller, if AFENAC were assured of such regular on-the-job trainee augmentation, and the visibility and credibility of AFENAC would be enhanced throughout the user community.

For situations such as ASAN, in which a complex technology requiring the collection of considerable data in a consistent format must be accomplished, it is likely that larger workshops for all MAJCOMs and major bases should be conducted before the technology is transferred to the Air Force. This approach is recommended because ASAN will be used more frequently than most technologies. It will require much data gathering at the base level; and because these data will be used occasionally by other MAJCOMs and bases, they must be compatible with similar data gathered by other bases throughout the country.

Initial instruction by AFENAC staff at user sites probably would not be as effective as on-the-job training and could be costly in terms of AFENAC personnel's time and availability for other requirements. In addition, it would probably not be as effective in enhancing the Center's reputation, would not provide users with personal contact with Center facilities, would not supplement AFENAC staff, and would probably be too oriented to specific user needs at the expense of more general knowledge of noise assessment.

Follow-up instruction could be accomplished through periodic tutorials, occasional applied problems conducted by telephone and computer networking, and the quality assurance function discussed earlier. Discussions of assessment technologies in the AFENAC newsletter, particularly in regard to "frequently asked questions," important problems, case study reports, or previews of new or updated technologies, could all be used to keep the user community current on assessment technologies. An effective training function would ensure that users were qualified to conduct noise assessments, increase the visibility and reputation of AFENAC, reduce the assistance required by AFENAC staff, enhance quality assurance, and supplement AFENAC staff at little cost to the Center.

The Training Manager should have at least a B.A. or B.S. degree and several years of training experience. He or she should have experience in working with computer based technologies.

3.2.5 Systems Support Manager

The System Support Manager would play a central role in computer configuration management. This function would be responsible for documenting, maintaining, debugging, and upgrading the software being transferred to the user community as well as maintaining the in-house systems required to support this and other functions. The System Support Manager should maintain a series of 2–5 year plans for meeting these requirements.

The System Support Manager would review all software before it was accepted by the Center. Software should not be accepted from developers until the operation of the software was understood, and it was verified that the software functions properly through a software acceptance test, for example.

The following items would be required when software was transferred to the Center:

- a complete and current functional description of the software;
- a complete and detailed set of specifications for the software, including data flow diagrams and data dictionary;
- the fully commented source code; and
- all data files associated with the software.

In the case of complex pieces of software, much of this material could be transferred as data files associated with a CASE (Computer-Aided Software Engineering) tool.

It would be the responsibility of the Systems Support Manager to keep the systems documentation for all software current and to maintain a historical record. To the extent possible, this should be done using CASE tools. The Systems Support Manager would plan for the support and upgrading of the CASE software. The Training Manager would have the responsibility for maintaining training materials for each system.

One of the major difficulties in managing software at dispersed sites is keeping the software synchronized. There is a temptation to make quick fixes or for people at the sites to revise the software, thereby making technical support of software extremely difficult. For each piece of software, the Systems Support Manager should develop a maintenance and upgrade plan that should be reviewed and concurred with by the Configuration Management Board (Sect. 3.5). Changes to software should be done through releases, with all sites receiving releases at the same time. Release of a new version of software would be the responsibility of the Technical Support Manager (Sect. 3.2.6).

The Systems Support Manager would supervise the maintenance and upgrade of the software. He or she would ensure that all software met applicable military standards and that is was adequately tested and verified before final release.

In addition to responsibilities for maintaining and upgrading software to be transferred to the user community, it would be the responsibility of the Systems Support Manager to develop a plan for the hardware and software requirements of the center and to see that the plan was implemented and the hardware and software maintained. This plan would be developed in conjunction with other AFENAC managers. Currently, it is envisioned that AFENAC would not have a mainframe but would do its work using networked microcomputers and workstations. Such a system is described in Sect. 4.

Another area of responsibility would be hardware and software evaluation. Hardware and software are evolving rapidly and there likely would be requirements that could be met by new types of hardware.

The Systems Support Manager would be responsible for chairing the Configuration Management Board. He or she also would be required to work closely with the Technical Support Manager, the Training Manager, and the Librarian.

The Systems Support Manager would have broad skills. He or she should have a bachelors degree in computer science or computer programming. This person would have to be knowledgeable about hardware, operating systems, systems software design, and CASE tools and be capable of developing and executing plans for the management of software and hardware. In addition to management responsibilities, the Systems Support Manager would do some programming.

3.2.6 Technical Support Manager

The User Site Manager (USM), as defined in Sect. 3.3, would turn to the Technical Support Manager when users were experiencing hardware and software problems in the field. At least initially, technical support could be integrated with the systems support function. However,

if the users of the software became numerous and/or if there were numerous products to support, the technical support function should become a separate activity.

The Technical Support Manager could be contacted by phone or, in certain instances, during the off-hours through electronic mail. He or she would be available to answer questions about hardware and software. If it were clear that a problem was hardware related, the USM should contact local personnel for maintenance. If the problem were unclear or were a software problem, USMs should contact the Technical Support Manager. AFENAC should be contacted before using local experts because users who are unfamiliar with the hardware or software could make changes in operating parameters that could cause subsequent problems. The remote workstations should be equipped with software diagnostic routines which could be run upon request of AFENAC.

In addition, technical support should be equipped so that remote machines at bases could be slaved to a machine at AFENAC. This would permit technical support to examine the contents of memory registers and files at the remote site. It also would enable technical support to observe the operations of the remote system or actually to operate it.

Technical support should also maintain several databases. One database should contain records of complaints received from the field. The database should include identification of the source of the complaint, whether the complaint was software or hardware related, identification of the software and hardware configuration, the context in which the problem occurred, the actual nature of the complaint, and the resolution of the complaint. This database would serve as a resource for dealing with similar complaints and as a way of identifying problems that needed to be corrected when the software was revised.

The Technical Support Manager would also handle all software releases. He or she would track the version of the software that was currently in the field as well as information about the

equipment on which the software was being run. Software would be updated by sending disks through the mail or by downloading electronically to all users at the same time. Often software in the field is not upgraded when new releases are provided and version control is a significant problem. Whenever and wherever possible, technical support should download releases electronically. This would help to maintain synchrony of the software in the field.

Technical support should also maintain an electronic bulletin board that would serve a number of functions. The bulletin board could be used as a way of uploading and downloading data and software. Also, information could be provided through the bulletin board, and it would provide a way of exchanging messages at times convenient to its users.

Another responsibility of the Technical Support Manager would be to supply "report ready" maps, noise contour printouts, overlays of noise-sensitive resources, and other graphics to users. In the absence of comparable high-quality equipment at the MAJCOMs and bases, the Air Force would need access to excellent plotting and graphics capability at AFENAC, particularly for official documents that required accuracy and high resolution.

Technical support should also be responsible for organizing users' meetings. Users' meetings are often a valuable forum for the exchange of information such as "work arounds" for bugs, shortcuts, new uses for the system, and uncovering requirements that could be met in future releases of the system. Users' meetings could be held in conjunction with other meetings where many users would be in attendance.

The technical support function should be staffed by personnel who are extremely knowledgeable about hardware and software and who also have some understanding of technical noise issues. Such persons should preferably be users of the software. At least in the early stages of transfer, there may not be enough users to warrant full-time technical staff. Technical support staff could have other responsibilities and function on an as-needed basis.

Technical support staff would not individually need the full array of equipment required for technical support as long as there was a technical support area in which to work. The technical support area should be equipped with dedicated equipment which would allow the technical support person to simulate locally the problem at the remote site, while being electronically slaved to the remote machine. This would require a minimum of two machines at each work place in the technical support area. The number of such work areas would be dependent on the level of support required.

The Technical Support Manager should have a B.A. or B.S. degree with several years of experience in computer support working with analytical tools.

3.2.7 Field Assistance Manager

The responsibilities of the Field Assistance Manager (itemized in Table 4) can best be visualized as implementing AFENAC in the field. This function would involve as few as one or as many as a team of half a dozen people providing on-site assistance to users at the MAJCOM and base levels. A strong consensus exists among MAJCOMs that this function would be essential if the noise technologies are to be employed successfully by users. Few bases would have the technical resources available to do a complex AICUZ report or a major EA or EIS and would require field assistance from AFENAC much on the order of the AICUZ In-Progress Review effort.

The field assistance function would be to develop, maintain, and implement the capability to apply all noise assessment technologies at user sites. This mission would require that the requisite staff, equipment (e.g., portable computers, modems, printers, and software), and travel funds be available. The potential staff would be comprised of most AFENAC personnel, user site managers or other user personnel undergoing training at AFENAC (see Sect. 3.2.4), staff from

the NEPA Center (if collocated), and environmental/community planning staff from the AFRCE and MAJCOM associated with the user installation. In addition, consultants and qualified graduate students employed at AFENAC could also serve on field assistance teams. Drawing from a pool of people this large would enable the Center to set up tailor-made teams to fit user needs in the most cost-effective manner. AFENAC would not be required to maintain a sizeable dedicated staff but could call on Air Force-wide personnel as required for assignments of approximately 1 week. Temporary-duty costs would be borne by the user. At the same time participants would benefit from the experience—a useful training effort for all—and AFENAC could benefit from exposure throughout the Air Force and from the expertise brought by non-AFENAC personnel.

Responsibility for field assistance would lie with the Field Assistance Manager. This individual would be responsible for maintaining a national roster of eligible Air Force personnel and others deemed qualified. Working closely with the user community and HQ USAF/LEEV/LEED, the Field Assistance Manager would schedule field assistance activities, form teams of appropriate size and skills with an experienced leader, coordinate site visits, and ensure that requisite documents are produced. The Field Assistance Manager could be an individual who serves in a similar capacity in the NEPA organization, if the two organizations were collocated. The individual could be either civilian or military at about the grade of captain with at least 3 years of Air Force experience in environmental noise issues. The individual selected should be at the Center on a permanent change of station coincident with or prior to the transfer of the AICUZ staff from AFESC/DEMPO to AFENAC and should be prepared to manage the AICUZ field assistance function without a loss of continuity.

3.2.8 Librarian

A Librarian would be needed for data support. A major difficulty with decentralized systems is often the lack of a systematic back-up function. Thus, data that are compiled for analysis may be lost because of electronic or mechanical malfunctions or because people who know and compile the data move on, and knowledge of the data is lost to subsequent occupants of the position. The Librarian would provide an archival function by retaining the data and analyses developed in the field. It probably would be advisable for AFENAC to establish a document retrieval system that would allow the user to match databases with the documents that were produced.

Data would be transferred to the Librarian by disk sent by mail or by electronic transfer. The electronic bulletin board should have provision for uploading text and graphics data. Upon receipt of the data, the Librarian would run quality control checks to ascertain that the data have been received intact. The data files would then be assigned appropriate names and numbers and backed-up on removable media for safe storage.

The Librarian would maintain a database containing the identification numbers as well as descriptive information about the contents of the data and the physical location where the data were stored. A catalog of user data could be maintained on the electronic bulletin board so that users could identify useful data. The Librarian also would service requests for data. When a request was received, the Librarian would make arrangements to transfer the data by an appropriate method.

There are numerous general databases that could be of interest to users. For instance, it could be useful to know the latest population information or the boundaries of wilderness areas within a region. The Librarian would be responsible for developing a data maintenance plan and for implementing the plan. This might include national databases developed from information

supplied from local installations. The Librarian would provide location specific data in appropriate formats upon the request of users.

An additional function of the Librarian would be to oversee the maintenance of CITASAN. This bibliographic function might be done in-house but more likely would be maintained by a contractor. Recent citations could be placed on the electronic bulletin board in addition to being distributed as updates with revisions of software.

The Librarian could understand data archiving procedures and be adept at the operation of microcomputer systems. The person should be knowledgeable about building and maintaining databases and should have a working knowledge of environmental noise issues. In addition the Librarian should be responsible for knowing which NOISEMAP plot for a base was the official plot used in the base's AICUZ study and suitable for public release.

The Librarian should operate in conjunction with the Technical Information Center (AFESC/TIC) at Tyndall AFB. This system performs all of the tasks described above and could maintain all databases used by AFENAC as a distinct function that could be accessed by AFENAC and its user community. The AFENAC Librarian would be responsible for all modifications and additions to AFENAC noise technology databases.

3.2.9 Quality Assurance Manager

Quality assurance would be a vital, integral component of all the functions discussed above. In respect to AFENAC as the Air Force's center for environmental noise assessment, it would be essential that AFENAC maintain a strong quality assurance function for all noise assessments in which it was involved. Regarding the use of environmental noise technologies, quality assurance would establish measures governing collection of appropriate data, verification of accuracy of input data, proper use of software, development of acceptable documentation, and

peer review of all results. For the training function, quality assurance would be incorporated in the learning process to verify that students had learned what they were supposed to learn and could apply that learning effectively. In the systems support function, quality assurance would establish procedures for ensuring that hardware and software were working properly and that transferred technologies were maintained and used correctly. The Librarian would implement a quality assurance function to ensure that all databases were maintained accurately, updating of databases was done according to established procedures that guarantee accuracy, and annual literature reviews were conducted with appropriate summaries of findings.

The AFENAC Quality Assurance Manager would be the Assistant Director. Because of the individual's strong technical credentials and responsibility for day-to-day operations of the Center, he or she would be the preferred candidate to manage this function. In this capacity, the Assistant Director would establish, document, and maintain an effective quality assurance program for the Center. In cooperation with the Assistant Director, the staff member responsible for each function discussed above would develop, document, and maintain a quality assurance effort as an integral component of his or her function. This quality assurance function would be incorporated into the overall quality assurance program of the Center.

3.2.10 Analysts

Most environmental noise assessment technologies are designed to provide the user with calculated noise levels; the technologies do not provide judgments on levels of impacts to sensitive environmental or community resources. ASAN, however, will provide the user with the types, amounts, and locations of resources that will be affected by aircraft, but the technology still requires the user to exercise technical judgment about the degree or significance of adverse impacts. Even with the findings of the generic EIS on low altitude flights, this need for technical

judgment will still exist for impacts to many resources. Thus, there would be a real need to have analytical expertise available at AFENAC to assist users in determining the impact and recommending mitigation once the technologies had provided data on noise levels. To leave the user in a position of having to interpret impacts strictly from a calculated noise level would be to fall short on the analytical requirements of NEPA and, to a lesser extent, AICUZ documents. In addition, there would be a need to make judgements about proper application of the technologies and to work out problems associated with operating the software in various situations. Clearly, there would be a need for users in the field to have access to scientifically trained staff at AFENAC who could provide assistance in analyzing the output of the noise technologies and in arriving at judgments about potential impacts and appropriate mitigative actions.

It is expected that the Assistant Director as well as some of the functional managers would have varying levels of expertise in environmental and social sciences that could assist users. To guarantee that adequate resources would be available for analytical tasks, however, it would be important that some staff be dedicated to this function. This function should be staffed with two experienced scientists, preferably an environmental scientist to handle wildlife and domestic animal issues and a social scientist to deal with human and community matters. The great majority of NEPA and AICUZ issues would fall within these two general disciplines. Issues falling outside these two areas could be handled by Air Force experts elsewhere or by consultants.

Staff selected for these positions should have Ph.D. degrees or masters with equivalent Ph.D. experience in one of the disciplines that comprise environmental science, social science, and community planning. They should have at least 3 years of experience in NEPA, AICUZ, or related kinds of assessments, along with a demonstrated knowledge of environmental noise issues. They could be among the later staff members employed by the Center, since the analytical work should begin well after AFENAC was established.

One advantage of collocating AFENAC with the NEPA Center would be to reduce and maybe even eliminate the need for these two scientific positions at AFENAC. If personnel of this caliber and training were readily available at the NEPA Center, AFENAC could share such resources. At a minimum it appears that some cost savings could be achieved if resources could be shared rather than duplicated.

3.2.11 Advisory Committee

AFENAC would have an organizational chain of command that would be determined by either its being located in association with the NEPA Center or at Wright-Patterson AFB as a component of AFLC. This command structure would not be affected by the role of the AFENAC Advisory Committee. This committee would function strictly in an advisory capacity, reflecting the diverse perspectives of its membership, most of whom would have some kind of direct interest in AFENAC's activities.

The Advisory Committee would provide a mechanism for the Air Force and the AFENAC Director to establish a link with the broader environmental noise community beyond the Center proper. It would provide input from the policy, R&D, and user communities inside the Air Force plus insights from the academic and civilian scientific communities. Advice and constructive evaluation from such a body should help the Center establish and maintain a high-quality program that would be judged well by its peers.

The Advisory Committee should meet annually to provide advice to the AFENAC Director. It should receive briefings from the Director and any other staff as required. The Committee should provide written comments on the Center's performance to the Director. Important comments from the Committee's meeting should be addressed in the Director's Annual AFENAC Report to HQ USAF/LEEV/LEED submitted by 31 October.

Membership on the Advisory Committee should total 13 people who would serve for staggered 3-year terms. Members should include

- the AFENAC Director (for his entire tenure);
- a senior staff member each from HQ USAF/LEEV and LEED responsible for some phase of environmental noise policy;
- a senior staff member at HQ USAF/XOOSA responsible for the interface between airspace planning and environmental noise assessments;
- a senior staff member of AAMRL;
- the individual to whom the AFENAC Director reports;
- two MAJCOM and two base users representing environmental and operations functions;
- a nationally recognized authority in environmental noise from the academic community;
- a nationally recognized scientist from the private sector; and
- a high-level representative in environmental noise from another federal agency, with such noise specialists.

3.3 USER SITE MANAGER

The operation of the Center actually would begin in the field with the MAJCOM or base user (Fig. 2). The appropriate user organization should designate an individual at the installation as User Site Manager (USM) to act as the coordinator for noise assessment technologies. Some sites may have only a single user, in which case the USM and the user are the same. At sites with multiple users, one individual should be designated as the USM; this individual often would be from the base environmental planning function. The designation of USM should be sufficiently formal so that his or her identity was clear to all users at the site.

The USM would become the point of contact between the field and the Center and would act as the first line of support for assessment technologies. Any problems at that site would be referred to the USM. If this individual were unable to resolve the problem, he or she would contact the AFENAC Technical Support Manager for assistance. The USMs would be the first to be trained in the operation of the hardware and software. The USM would then identify and do the initial training of other users at this site. The technical training for the USM should be

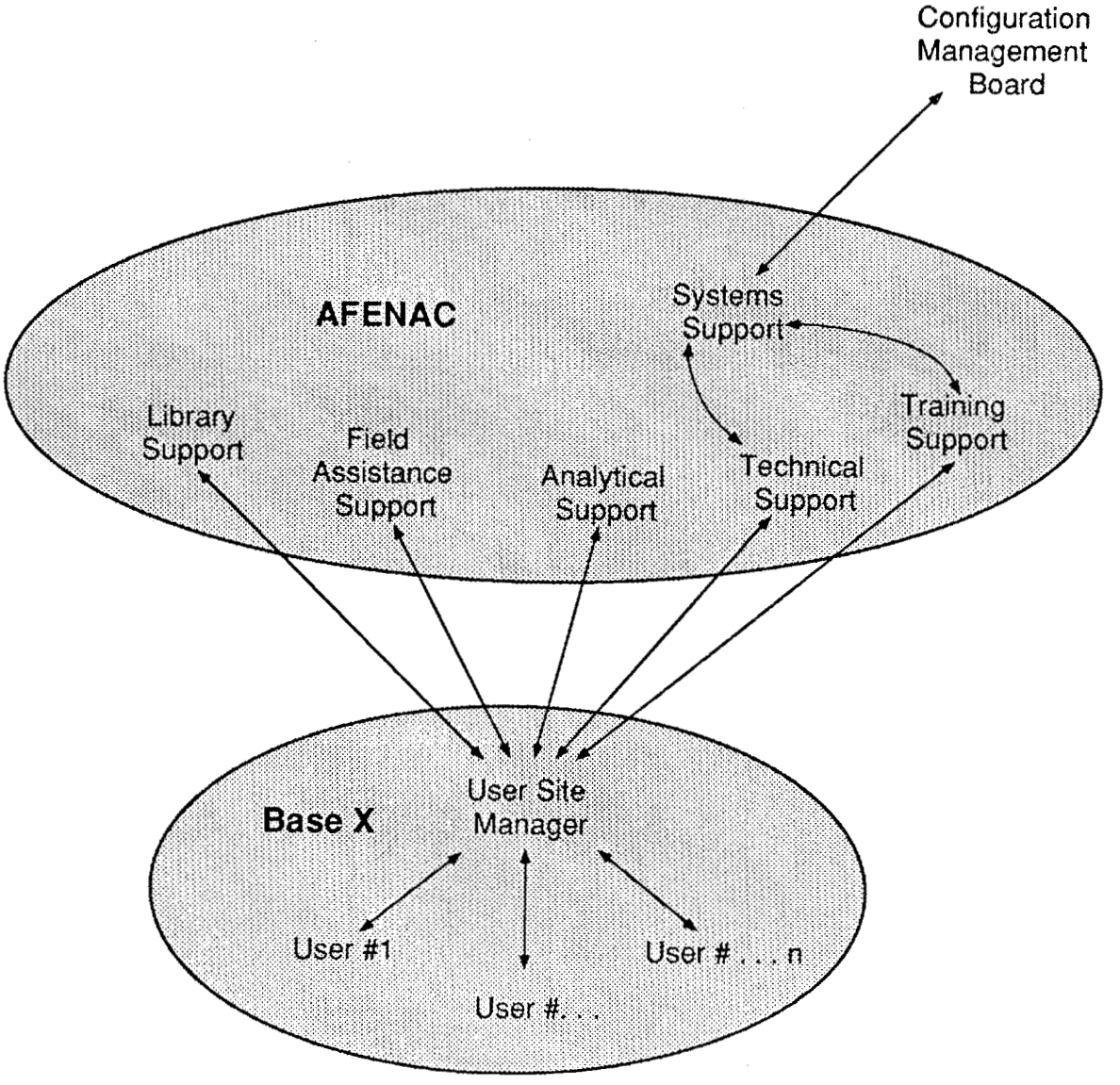

Fig. 2. Typical flow of interactions between users and Center.

sufficient so that this person provides the first level of support in the system. The training would include a basic understanding of

- assessment technologies,
- the technology embedded in the software sufficient to ensure its proper use and to evaluate products produced by the software,
- the operating system (DOS or UNIX) being used,
- the hardware configuration and operation sufficient to allow simple trouble shooting, and
- how to initiate electronic communications with AFENAC for support and data transfer.

The USM would be responsible for any technologies transferred to the site by the Center and the hardware on which they run. The USM would initiate the purchase of needed hardware as specified by AFENAC through appropriate channels. The USM would make arrangements to see that hardware was maintained. This could be done with appropriate organizations on site or through contracting.

3.4 SUPPORT CONCEPT

The following section describes a typical working situation between the User Site Manager and AFENAC. It is included to provide a picture of how AFENAC's support concept would operate vis-a-vis the USM.

3.4.1 Types of Support

The USM would require different types of support from AFENAC that would include

- troubleshooting hardware,
- troubleshooting software,
- help in dealing with complex problems,
- help in interpreting results of analyses,
- information about new developments and concepts,
- assistance for field assessments,
- access to data and/or bibliographies, and
- training support.

The USM could receive support from AFENAC managers including technical support, field assistance, and library support; however, the initial point of contact should be the Technical Support Manager in order to establish the appropriate AFENAC manager.

3.4.2 Technical Support

The Technical Support Manager (TSM) would assist the User Site Manager in maintaining software and hardware systems in operating condition, providing expert advice and assistance on use of the noise technologies, and providing answers to technical questions regarding the substantive content of the technologies.

Typically, the USM would initiate contact with the Technical Support Manager for assistance with a software problem, a hardware problem, or a substantive technical question. Often these problems would be intertwined and it would be difficult to determine the exact nature of the problem. There would be four basic modes of contact:

- Direct phone: The USM would place a direct call to the TSM. In many cases, TSM would be able to resolve the problem over the phone.
- Electronic mail/bulletin board: At times when the TSM was not available, the USM could leave an electronic mail message or access a help bulletin board and/or could obtain a mail message from the TSM via electronic mail.
- Direct phone with electronic linking of computers: In some instances problems could be sufficiently difficult to require that the USM and TSM be in voice contact by phone while maintaining interactive computer contact via a second phone line. This could occur when there is a severe problem with the software/hardware or when help was needed in running the software or interpreting the output. In this scenario the USM would contact AFENAC and make arrangements for the electronic hook-up.
- Site visit: Under unusual circumstances the TSM or a designated assistant could visit the user.

3.4.3 Field Assistance

Because of the lack of technical expertise, time constraints, or the need to perform a major assessment (e.g., AICUZ report, EIS), the USM could find that technical support was needed in the field. In these cases, the USM would contact the Field Assistance Manager who would arrange for additional technical support such as establishing a field assistance team to visit the site, conduct an assessment, and write a report.

3.4.4 Training

USMs could have a variety of training requirements either for themselves or for other users at their sites. The mechanisms available for training are described in Sect. 3.2.4. They would include attendance at special training workshops at AFENAC, on-the-job training at the Center, self-directed training from technology manuals, training tutorials obtained from Center personnel, and one-on-one tutorials with AFENAC personnel while linked through voice and electronic means or with center personnel in person. The USM would be responsible for training of other personnel at his or her site.

3.4.5 Librarian Support

The USM would need a variety of assistance from the Librarian, including archival services, a basic data library, and bibliographic search and retrieval. An audit trail for all site analyses would be required and would include all data and analyses that were used. In addition to retaining electronic copies of data and analyses at the user's site, the USM would make an electronic copy of all data and analyses available to the Librarian. This could be done by arranging for electronic transfer via telephone or by transferring data disk media in overnight

mail. The Librarian would ensure that such data were maintained in electronically readable format and that QA/QC checks on the analysis were initiated.

The USM could also contact the Librarian to obtain electronic copies of previous analyses and/or data from general databases applicable to his or her site. Such information could be transferred electronically or by overnight mail service. The USM also would be able to obtain updated bibliographic information from AFENAC.

3.5 CONFIGURATION MANAGEMENT BOARD

Configuration management would be an important element in managing noise assessment technologies in dispersed locations. Left uncontrolled, software and hardware configurations in the field would change as personnel use the hardware for other purposes and alter the software to "fix it," to eliminate bugs, or to make it work the way a specific user thinks it should work. Users would want improvements to the interface and upgrades in its functionality. Programmers would want to make the software run faster or to have the latest interfaces, and technically oriented people would want to have the latest technology embedded in the code. The ability to make authorized improvements would be complicated by resource limitations which would make it impossible to fix every bug or to make all the upgrades to analytic capabilities that might be desirable. Thus, it would be important to have an authorized plan for managing the software and hardware configurations properly and to revise the plan periodically so that resources would be committed to the highest priority issues. Any unauthorized software changes should be prohibited, and documents relying on their results should be disapproved by AFENAC. The Configuration Management Board (CMB) provides the mechanism for decision making for software and hardware issues (see Fig. 3).

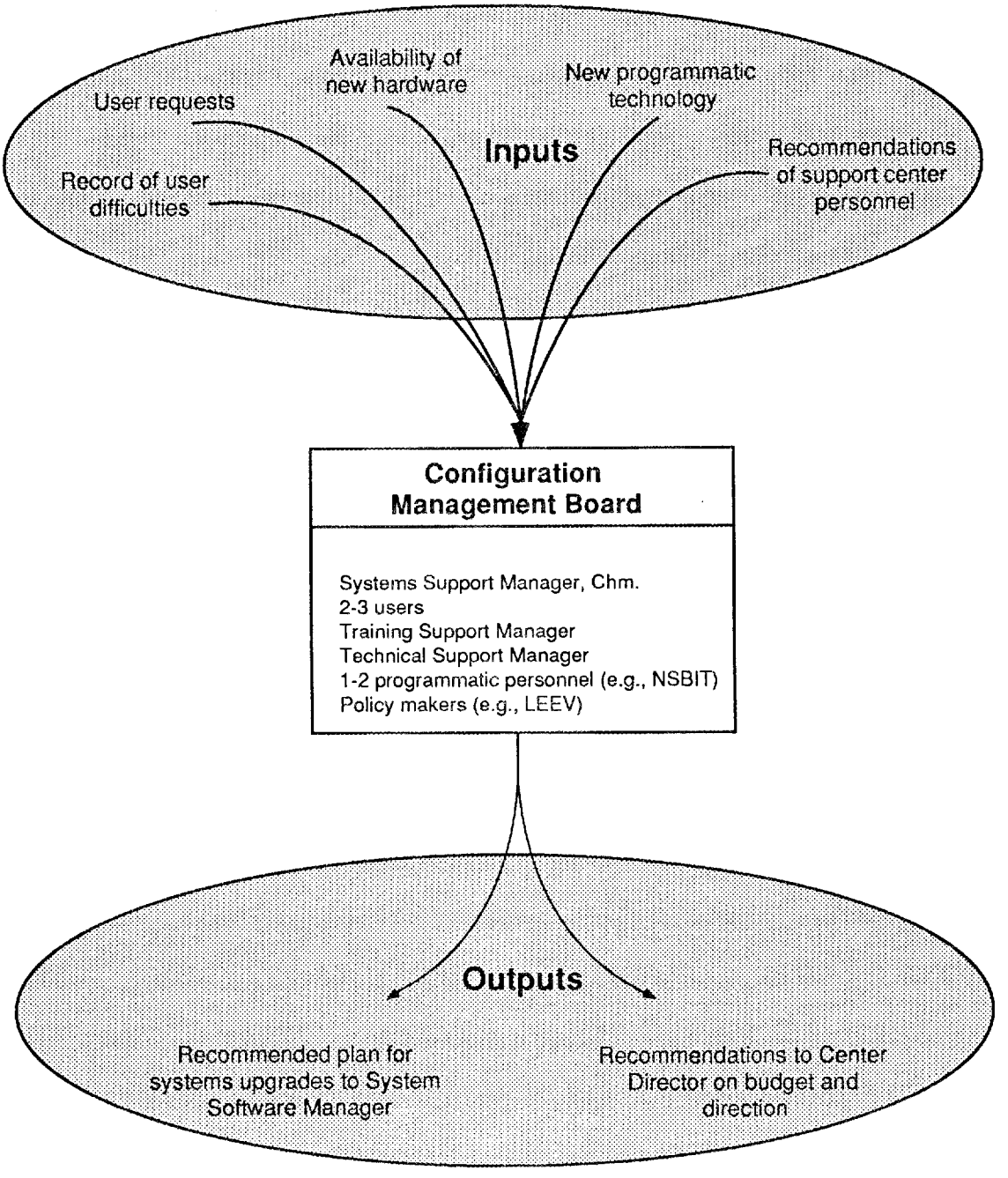

Fig. 3. Organization and operations of the configuration management board.

The Systems Support Manager, the Technical Support Manager, the Training Manager, three users who understand the technologies, a representative from AAMRL, a representative from HQ USAF/LEEV, and the computer systems manager from the Air Force NEPA Center should be represented on the CMB. This diversity would be the key to success because it would allow the full spectrum of technical concerns to be heard. The CMB should meet 2–3 times a year to review how well the assessment technologies were performing and to identify required changes. The CMB should operate fairly informally and should be chaired by the Systems Support Manager.

The inputs to the CMB would include records concerning software problems, user complaints and requests, the concerns of various AFENAC managers working with the technologies, input from AAMRL and NSBIT, and policy makers. There likely would be two important outputs: recommendations to the AFENAC director about budget needs and the recommended plan for software technological evolution.

4. SOFTWARE AND HARDWARE CONSIDERATIONS

4.1 SOFTWARE

The noise assessment technologies (computer software) developed by the Air Force that will be assigned to AFENAC are described briefly in Table 5. Most of these technologies either have been developed in recent years or are under development. The NOISEMAP computer program that supports the AICUZ reports, however, has been in existence since 1974. The technologies range in complexity from fairly easy to use (e.g., ROUTEMAP) to rather difficult (e.g., PCBOOM II) and will require varying levels of support by AFENAC for MAJCOMs and bases. Each technology has a user's manual, and these would be updated and distributed by AFENAC as part of the transfer process.

4.2 HARDWARE

There are two hardware configurations that would be of concern in establishing AFENAC: the hardware configuration to support AFENAC and the configuration required by users in the field. With respect to hardware in the field, most existing hardware would not be sufficient to support all AFENAC noise technologies, particularly ASAN. AFENAC would need hardware/software that can:

- run the various software packages for noise analysis;
- maintain and update software;
- store and maintain datafiles that are "uploaded" from user sites;
- "download" software or software updates;
- serve the user support function;
- maintain and update bibliographic databases;
- provide trouble shooting services either from long distance or through site visits;
- track requests, problems, responses and systems configuration at user sites, and
- provide administrative support (i.e., work processing, spreadsheets, etc.).

Table 5. Noise assessment technologies to be assigned to AFENAC

ASAN	Assessment System for Aircraft Noise. A computer-based system intended to assist members of the Air Force environmental planning community in addressing noise-related issues in developing environmental impact analysis documents.
BASEOPS	Computerized, menu driven, user friendly tool used by base personnel to prepare aircraft operations data around air bases. Output on a floppy disc provides AICUZ office with data for NOISEMAP calculations that generate maps of noise contours used in AICUZ reports.
BOOMAP 2	(Replaces BOOM-MAP). A computer program using a library of data from several supersonic Military Operations Area (MOAs) that calculates various statistics on supersonic operations and then projects expected sonic boom levels on the ground. For use in MOAs but has not been used yet because there have been no supersonic MOA assessments.
CITASAN	Citation literature database originally developed for inclusion in ASAN. Initial version is available to Air Force and later versions will be updated annually by AFENAC. Operates on MS DOS and addresses ORACLE.
NOISECHECK II	System for checking projected NOISEMAP noise levels that uses Larson-Davis 870 noise monitoring devices and upgraded computer hardware and software to establish noise levels around air bases. Complex, expensive process that will be operated by AFENAC only in controversial situations. Prototype will replace NOISECHECK I which has existed about 10 years in late FY 1990 and has been operated by only 2 or 3 contractors in rare situations.
NOISEFILE	Database containing experimental noise measurements from aircraft operating in different flight configurations.
NOISENET	Essentially the NOISECHECK II technology with the noise monitoring equipment networked together. Scheduled to be transferred to noise contour in FY 1993.
NOISEMAP	Computer program operating on CDC mainframe at AFESC that calculates noise level "footprints" at air base from aircraft operations and produces contour maps as input to AICUZ reports.

Table 5. Continued

PCBOOM	Computer program that calculates the location and magnitude of sonic boom overpressures on the ground due to supersonic flight from individual military aircraft under standard atmosphere and no wind propagation conditions. Available to users on request.
PCBOOM II	Improved version of PCBOOM made available as needed in January 1990. A "first cut" planning tool that calculates single event overpressures and adds graphical wave forms and regional weather conditions. Not user friendly.
ROUTEMAP	Menu driven computer program operating on MS DOS that calculates the noise level on the ground under a military training route corridor, estimates the probability of high annoyance, and ranks aircraft in terms of highest contributors to noise.
Supersonic Corridor	Computer model being developed to predict sonic boom overpressures for certain corridors (e.g., approaches to supersonic MOAs).

AFENAC hardware would need to be similar to or compatible with that at user installations. The equipment must also be capable of supporting computer-aided software engineering (CASE) tools and such things as version control software. There must be a secure storage area at AFENAC and the capability to back-up data "uploaded" from users. This would require several large-capacity storage devices with removable media. The uploading could be done via phone lines, through the Defense Data Network (DDN), or by the exchange of magnetic media (e.g., 45-megabyte removable cartridges) via express delivery service. The downloading of software or software updates should be handled by magnetic media using express delivery. It is possible that AFNET which is to be in place Air Force-wide by 1995 could also be used.

The user support function would require a dedicated system similar to the ones being used in the field in close proximity to a telephone. The telephone would be the primary mode of communication for the user support function. The maintenance of the databases would require

storage, back-up storage, and a dedicated machine. Troubleshooting would be handled over the phone and by linking the machine requiring troubleshooting to another phone line and making it a slave to a machine at AFENAC using software such as "Carbon Copy." To be used effectively in a trouble shooting environment, a dedicated phone line capable of transmitting at 9600 BPS, would be required. Tracking would require a database management system. Since different AFENAC people would be tracking different things, machines used for administrative tasks should be networked and the database system should be relational and network compatible.

Hardware required in the field would be limited to a machine capable of running the software, appropriate peripherals for inputting and outputting data, and a high-speed modem. As now conceived, ASAN is to run under the UNIX operating system and requires ORACLE (a relational database management system) and GRASS (a military graphical package). The other noise assessment technologies run under DOS. Thus, the machine must be capable of running UNIX and DOS in a UNIX window. This suggests that the minimum configuration for a field site would be as follows:

- 80386 based microcomputer with a minimum of 8 megabytes of random access memory,
- 80387 math coprocessor,
- 600-megabyte hard disk drive with 20-ms or faster access time,
- 760-K internal 5.25-in floppy drive,
- 1.4-megabyte 3.5-in floppy drive,
- external removable 45-megabyte cartridge hard drive,
- high-resolution color monitor and video board,
- laser printer,
- 9600 bps modem with V42 and V42 bis protocol,
- color output device—probably a color dot matrix printer or perhaps a "D" size pen plotter,
- phone line for voice communications, and
- phone line for data communications.

In addition to these items, the users would also need:

- a compatible copy of ORACLE,
- GRASS,

- terminal emulation software capable of controlling a distant machine,
- word processing software, and
- other packages as may be warranted.

Since the ORACLE database is being used as part of the ASAN system, ORACLE should be used for other tasks at the Center.

It is ill-advised to make specific hardware recommendations at this point because implementation is sufficiently far in the future that equipment availability will change. For instance, 80486 machines are likely to be available and in general use. However, there are some general considerations regarding hardware that must be kept in mind.

There are two options for supplying hardware. The first is to use existing hardware that is already in the field and to upgrade it. The second is to make a buy of the required equipment and to place that in the field.

Using in-place hardware would appear to have cost saving advantages and would make the provision of hardware a local requirement. In the short term, using existing equipment until ASAN is deployed is feasible since software uses the DOS operating system. However, once ASAN is deployed the cost advantage may disappear as configuration and maintenance costs become driving factors. It is not clear whether most machines that currently exist in the field can meet the requirement of an 80386 CPU; if they do not they would have to be replaced. Secondly, ASAN is complex software that will require a standard configuration. The organizational costs to ensure that local machines meet the standard may exceed the cost of direct purchase of all hardware. Non-standard configurations will significantly increase the personnel and travel costs associated with trouble shooting. Thus, it is recommended that ASAN be deployed with a turnkey hardware system. The Air Force could use one of the existing "buys" and purchase the specified hardware and provide preconfigured hardware and software directly to user sites. Appropriate equipment is available either through the Desktop III contract (UNISYS) or through

the Standard Multiuser Small Computers Requirements Contract (AT&T). Arrangements can be made through these contracts for engineering support services to define hardware requirements and develop requisitions.

Until ASAN is deployed existing machines probably are adequate. At the present time, Wang systems are being used in the field. The existing software will run on these machines.

The hardware requirements for AFENAC will depend on the number of personnel and functions of the Center. Each technical person would require a basic equipment configuration that includes everything on the preceding list, with the possible exception of the 45-megabyte cartridge hard drive and the color output device. These latter two devices need only be installed on some machines. Several additional machines will be needed to serve specialized functions (a network server, 1 or 2 machines dedicated to software development, 1 or 2 machines dedicated to user support, training, and librarian support). Because of the nature of these tasks, machines assigned to individuals should probably not be used for these tasks in order to avoid conflict. In the case of persons responsible for software upgrading and maintenance, an appropriate alternate might be a workstation specially configured with CASE tools. The architecture of this machine might vary from that of a standard workstation. Thus, the number of machines needed at AFENAC is the number of personnel plus 4–6 additional machines.

In addition to the above, there would be a need for large-volume, removable media storage devices. These might be either the 600-megabyte removable optical storage disks or WORM (write once read many) cartridge drives.

It is recommended that the machines at AFENAC be networked together. Suitable networking products are available through existing contracts. The exact networking needs should be considered at the time of implementation. The network would require a server but the server machine also could be used as the host machine for the large-volume storage devices.

Routine communications can be handled via DDN. However, provision must be made for a separate voice-grade phone line for troubleshooting and some data transfer.

No exact calculations of hardware costs have been made since prices change often. A base configuration machine with laser printer and networking but without software and plotting capability would be about $8,000. Software would add another $4,000 and plotting capability would raise the cost another $5,000. If 150 workstations for the user community were required, then a hardware budget of approximately $3 million would be needed. Because much of the hardware (peripherals) required to run ASAN does not exist at local sites, using existing equipment would be unlikely to lower per-unit workstation costs by more than $2,000–3,000.

5. IMPLEMENTATION SCHEDULE

The suggested schedule below (Table 6) identifies when the Air Force should accomplish certain actions in establishing AFENAC. The schedule is designed as an optimal case and assumes an early decision to implement the environmental noise center concept and its timely inclusion in the budget process. Table 7 describes the important activities that should be undertaken by quarter in order to achieve full AFENAC operations.

Table 6. AFENAC implementation schedule

Action	Responsible Office or Individual	Date
HQ USAF/LE decision to establish AFENAC and budget for FY 1992. Begin search for AFENAC Director. Designate an LEEV person as Air Staff transfer representative. Initiate staffing and funding actions with responsible offices	HQ USAF/LEEV	31 March 91
Identify AFENAC Director	HQ USAF/LEEV	30 June 91
Transmit announcement of AFENAC activation, mission, location, and director to relevant offices.	HQ USAF/LEEV	15 July 91
Advertise search for Systems Support Manager	Director/civilian personnel office	31 July 91[a]
AFENAC activated; Director and clerical support in place; office equipment functioning	Host Organization/ AFENAC Director	1 October 91
Advertise search for Assistant Director	Director/civilian personnel office	1 October 91
Systems Support Manager on board	Director	30 November 91
Transfer CITASAN and IBAN to AFENAC from NSBIT	AFENAC Director/NSBIT	15 January 92
AICUZ staff member begins periodic TDYs at AFENAC	Director and AFESC/DEM	15 January 92
Begin process of identifying members for Advisory Committee	Director/LEEV	15 February 92
Assistant Director in place at AFENAC	Director/civilian personnel office	28 February 92
Transfer AICUZ staff (including NOISEMAP/ NOISEFILE/NOISECHECK, BASEOPS, BOOMAP/BOOMFILE, PC BOOM, Supersonic Corridor model, ROUTEMAP/ROUTEFILE) to AFENAC from AFESC or NSBIT	AFENAC Director/ AFESC/NSBIT	31 March 92
Field Assistance Manager on board	AFENAC Director	31 March 92
Technical Support/Systems Support staff member on board	AFENAC Director	15 May 92
Trainer/Systems Support staff member on board	AFENAC Director/ NEPA Center Director (joint if collocated)	15 May 92
Select Advisory Committee members and schedule late summer meeting	Director/LEEV/LEED (joint if collocated)	15 June 92
Librarian on board	AFENAC Director/NEPA Center Director (joint if collocated)	30 June 92

[a]All following dates are tentative and based upon early decision to establish AFENAC and pursue staffing and funding vigorously.

Table 7. Important AFENAC activities, by quarter, FY 92

1st quarter	First Quarter of FY 92 is initial organizational period for AFENAC. Director must have office functioning 1 Oct. Must develop early understandings with organization to whom he reports about AFENAC's role and how it fits in with that host organization. Essential to begin early briefings with HQ USAF/LEEV, HQ USAF/LEED, HQ USAF/XOOSA, NSBIT and AAMRL, AFESC/DEM (AICUZ) in order to establish good working relationships, understand one another's needs. Must begin to interact with NSBIT and contractor to ensure smooth ASAN transition. Staff development is a must with Systems Support Manager on-board by 30 November and searches to be initiated by civilian personnel office within this quarter for all other functional managers. Contact should be initiated in December with NSBIT to transfer CITASAN and IBAN to AFENAC. Use early transfer as test case of transition process. Plans should be completed on transfer of AICUZ office to AFENAC. Transfer details can be delegated to Systems Support Manager.
2nd quarter	AFENAC Director should have effective working relationship developed with his superior by beginning of quarter. Should be familiar with all major Air Staff, R&D, and MAJCOM players and have good sense of base level requirements and needs by end of this quarter. Director should begin developing a schedule for handling anticipated requests from users for assistance at beginning of the next quarter. Major progress must occur in staffing of functional managers, particularly Assistant Director who reports in late Feb. and Field Assistance Manager who reports at end of March to handle AICUZ/IPR effort. Other candidate functional managers should be identified by end of quarter. Director should pay careful attention to development of each of these positions in order to make any mid-course corrections deemed necessary. Special attention will need to be directed at completing a smooth transition of AICUZ staff to AFESC so that delays in meeting user needs are minimized. An AICUZ staff member should be assigned TDY at AFESC for most of quarter to facilitate transition. Director and LEEV should begin identifying advisory committee members in preparation for a late summer meeting.
3rd quarter	Third quarter is the first in which AFENAC will be providing substantive support to the Air Force. All existing environmental noise technologies will have been transferred to the Center by beginning of quarter, and Air Force users will expect AFENAC to be responsive to their needs. Director should maintain close contact with functional managers and users to review AFENAC operations and responsiveness. Remaining functional managers or candidate mangers should be on-board by end of quarter. Assistant Director should be placing high priority on building a well-integrated team and personally overseeing, instilling a quality assurance consciousness.
4th quarter	By end of quarter AFENAC should be functioning smoothly with all staff integrated into a team effort. Technical support, training, and data library functions should be well defined by end of quarter. Director and Assistant Director should engage in a concerted evaluation of the year's activities and develop corrective measures for any identified shortcomings. Advisory Committee should convene its first meeting in late summer and provide input to this evaluation.

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