Report

For The Future

AVIATION DEVELOPMENT CENTER

To

Assistant Secretary of the Army (R&D)
Department of Army
Washington, D.C. 20310

Sets out steps to get [illegible] adopted
to [illegible] in time. Not break up [illegible] [illegible] [illegible].

Prepared By
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May 15, 1976

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SUMMARY

The chief observation of this study, which included visits to the Aviation Systems Command in St. Louis, MO and all elements of the Air Mobility Research and Development Laboratory, is to confirm the observation of all previous studies of the Army's aviation research and development process. This process is now severely handicapped by the geographical separation of its key elements. The factors that make it difficult to collocate all these elements in the near future are recognized. However, the chief recommendation of this study is that the Army establish a long-range plan for the Aviation Development Center which would establish an organizational set-up to be reached over the coming years in an evolutionary fashion. This plan should then be followed as the opportunities present themselves and the organizational moves can be made in such a manner as to minimize critical program disruptions, cost, and turbulence. Each move, including the currently planned "Reorganization in Place" move, should be examined to be sure that it moves in the direction of the end goal, or at least does not invest more money in a set-up that will make it more difficult to achieve the desired collocation.

This study makes major use of the most recent studies which deal with the Army's aviation research and development mode of operation. These are the AMARC Study; the Concept Study for the Aviation Development Center; and the most recent Peer Group Review. Based on these studies, plus visits to each of the organizational elements of the Aviation Development Center, optimum organization is defined--then the nearer term evolutionary steps that should be taken to arrive at this are indicated.

The optimum organization compromises with the objective of total collocation in that it is based on a maintenance of organizations at the present centers of excellence which are "site-connected". These include the organizational elements at Ames, Langley, and Lewis which derive a major benefit from existing NASA facilities that will not be practical to duplicate. The flight test group should also be maintained at Edwards, and the Avionics group at Fort Monmouth, for similar reasons.

With the exception of the above, all the remaining elements now at St. Louis and Fort Eustis should be collocated in the Moffett area. The choice of Moffett represents a selection from the several alternatives selected in the Concept Study. Since the selection between the Moffett and Langley areas is a close and difficult one with which previous studies did not deal at great depth, this study and report have dealt with it in greater depth than on other aspects. In addition, a different position is taken from previous stidies on what to do with the Eustis Directorate; this point also is discussed at greater length.

The latter part of the report deals with successive steps that should be taken with some emphasis on the nearer term moves.

In conclusion, the chief observation of this study is reemphasized. The effectiveness and efficiency with which the Army utilizes the results of its in-house R&D is severely handicapped by the geographical dispersion of the organizational elements involved. The state of flux in which this situation has been over the past years due to interim solutions at variance with the recommendations of various study groups has aggravated this situation. Thus, an established plan which will be recognized as a permanent solution is strongly recommended, even though it will not be practical to implement it immediately.

INTRODUCTION

This study has been conducted in accordance with the Terms of Reference (Attachment A). It has been further influenced by a statement by the Army to Congress on 1 April 1976 indicating a plan to "reorganize in place". Under these circumstances it did not appear useful to suggest any immediate plans in conflict with those described to Congress. However, Congress was informed that the current plan "does not foreclose future options as required."

The current study, therefore, has been directed at defining what future options are recommended in response to the four specific areas defined in the Terms of Reference. The first section addresses an "optimum" organizational set-up and location for an Army Aviation Research Center. The second section of this report then defines a "road map" which identifies steps in an evolutionary process consistent with the desired final optimum organization.

Much groundwork has been laid for this study by previous studies. The most recent of these studies have been the following:

a. The report of the Army Materiel Acquisition Review Committee (AMARC), Washington, D.C., 1 April 1974.

b. The Concept Study for the Aviation Development Center, January, 1976.

c. Peer Group Review of the Army Air Mobility Research and Development Laboratory, February, 1976.

These studies have been relied upon heavily both for factual data and judgments pertinent to such recommendations that are made herein. In addition, one-day visits were made to various organizational segments of the Aviation Development Center. They included the Headquarters, Army Air Mobility Research and Development Laboratory; the Aviation Systems Command in St. Louis, MO and its associated functional groups located there; the Office of the Deputy Chief of Staff for Research, Development, and Acquisition, Department of the Army, Pentagon; and the functional groups of the AMRDL at Lewis, Langley, Eustis, Ames, and St. Louis. Time did not permit visits to Army rotorcraft manufacturers who might have significant inputs into a study as this. The lack of such inputs should be noted.

There are two ongoing studies which should have significance with regard to conclusions of the present study. There is an ASAP study on the Army's simulator needs being chaired by Professor H. Curtiss of

Princeton University. Also, a study by the NASA as to the desirability of a roles-and-missions assignment to Ames or Langley for the "Aeromechanics" portion of rotorcraft research. The pertinence of both of these studies to the present one is apparent. Since they will not be completed in time, discussions were held with Professor Curtiss and Dr. Lundin to gain an understanding of the status of their studies. An attempt has been made in the present study to consider the impact of the various alternative recommendations these studies might arrive at.

OPTIMUM ORGANIZATION FOR AVIATION DEVELOPMENT CENTER

General Considerations.

A feature of primary importance which should guide the configuration of an "optimum" Army Development Center is that which encourages the flow of ideas from the research area in which they are conceived and developed to the engineering development phase wherein there is a proof of feasibility of selected concepts, to the eventual application for operational systems. This is the role of the Army Development Center.

The effectiveness with which this is performed will be strongly influenced by the rapport and communication that exists between the various groups involved in it. The quality of the performance of this task in all three services can be traced to the communication between the involved groups and is, in turn, a function of the proximity of each of these groups to the other. The Wright-Patterson Air Force Base Complex which collocates all these groups is an excellent example of the value of collocation in achieving this communication. The present fragmentation and geographical spread of the various components of the Army Development Center must be a severe handicap for which the Army pays in terms of the effectiveness of translating advanced concepts into operational use. The dollar cost must also be significant though difficult to quantify.

The foregoing considerations lead to the first desired characteristic organization, that is, the collocation of the involved groups.

It is not feasible to achieve this somewhat utopian concept for some practical reasons. The chief of these is the need for unique and costly facilities to do the R&D job. These include large wind tunnels, flight simulators, structural, and propulsion test facilities. Good facilities of these types attract good people. Without them, it is difficult to maintain the desired level of competence. To a large extent, the facilities required to do the R&D job and the centers of excellence of people that surround them exists at the Ames, Langley, and Lewis Centers of the NASA. Duplication of the NASA facilities by the Army would be very costly. In

addition, the duplication of NASA facilities needed by the Army at a central location would separate the Army researchers from the Ames, Langley, and Lewis Centers of excellence with whom they are currently operating very effectively.

The foregoing somewhat conflicting considerations--collocation versus proximity to the NASA centers of excellence-- have led to two alternative recommendations in the Concept Study for the Aviation Development Center. They are identified in the Concept Study report as Alternative A, collocation with NASA facilities at Moffett; and Alternative B, collocation with NASA facilities at Langley. Both of these alternatives make an appropriate compromise between the desirability of collocation of people and with the practical consideration that the cost of duplication of facilities would be prohibitive and the separation from NASA Centers of excellence is not desired. Alternative C of the Concept Study, in the words of this report, "does not take full advantage of operational and materiel acquisition improvements achievable through greater consolidation of RD&E management and operating activities." It not only sacrifices collocation, but it also sacrifices the proximity of people to the facilities and the centers of excellence which they need.

The relative merit of the collocation of facilities at Ames, or the collocation at Langley is somewhat more difficult to decide. In the first place, it will be somewhat a function of the current NASA study being chaired by Dr. Lundin. It is understood that this study will consider which of the centers will be the focal point of the helicopter and STOL research. The only thing that the current study can do is to arrive at a recommendation independent of the Lundin Study, but point out that the conclusions should be reviewed in the light of the NASA's eventual actions.

The Concept Study is the most detailed and recent of the Army studies on the organizational alignment for the Aviation Development Center. It therefore will be used as a starting point for the present study. It arrived at three recommendations of pertinence:

a. In all its alternatives, it retained the segments of the Aviation Development Center at Ames, Langley, Lewis, Edwards, and Fort Monmouth. The reasons are those already discussed in this report. This recommendation is fully endorsed and will not be discussed further.

b. It recommended (as did the AMARC Study) the dissolution and fragmentation of the Eustis Directorate. Strong issue is taken with this recommendation for reasons discussed in the following subsection. It is a move away from collocation of a group which is not "site-connected"; it would disperse further the 6.3 activities of the Development Center, and fail to get them close to the Program Managers and the elements of the RDT&E group where it belongs.

c. The Concept Study describes as "feasible" the collocation of the "movable" groups of the Aviation Development Center at either Ames or Langley, but does not choose between these alternatives. This report recommends Ames and discusses the reasons for this recommendation at length.

Importance of the 6.3 Task Function and the Eustis Directorate's Role in This Regard.

The AMARC Study and the Concept Study recommend a dissolution of the Eustis Directorate and its fragmentation and collocation with groups at Ames, Langley, and Lewis. This is the one recommendation with which the present study disagrees. The 6.3 task in which the Eustis Directorate is primarily engaged is cental to the infusion of the 6.1 and 6.2 technology into the 6.4 effort and its introduction to the contractor community. As such, it should be at the hub of the Aviation Research Center activities--rather than scattered. Granted there is no such hub at present, but relocation of Eustis at Ames, Langley, and Lewis would be a step in the wrong direction. The reasoning behind this statement and the alternative proposed is discussed in the remainder of this section.

Central Role of the 6.3 Task. Figure 1 shows the relationship between the 6.1, 6.2, 6.3, and 6.4 tasks by which the various elements of a project are carried through the initial conception to proof of feasibility as a subsystem in a prototype aircraft. This figure has been constructed in such a manner as to emphasize the central role of the 6.3 task, the Advanced Development Phase. It is in this phase where there is a convergence of the results of the 6.1 and 6.2 tasks, most of which is done in the in-house laboratories. It is here where the technology developed by this in-house basic R&D is introduced to industry for application and use in a subsystem as a 6.3 task. The end result of a successful 6.3 task will be a subsystem ready for incorporation in a prototype. Contact with the end user as well as the Program Manager to aid him in incorporation of this technology or subsystem in his 6.4 system specification is desirable. The preliminary design and system integration should be strongly influenced by the 6.3 results.

The central role played by the 6.3 type of task in the advance of an RFP for a feasibility demonstration in a prototype system is apparent. The question arises as to how it is best executed. The strong recommendation of the present study is that this 6.3 effort for which the Eustis Directorate is the prime agent, should be collocated with all the other activities that are not tied down to the sites at which their major and unique facilities are located. This means collocation with:

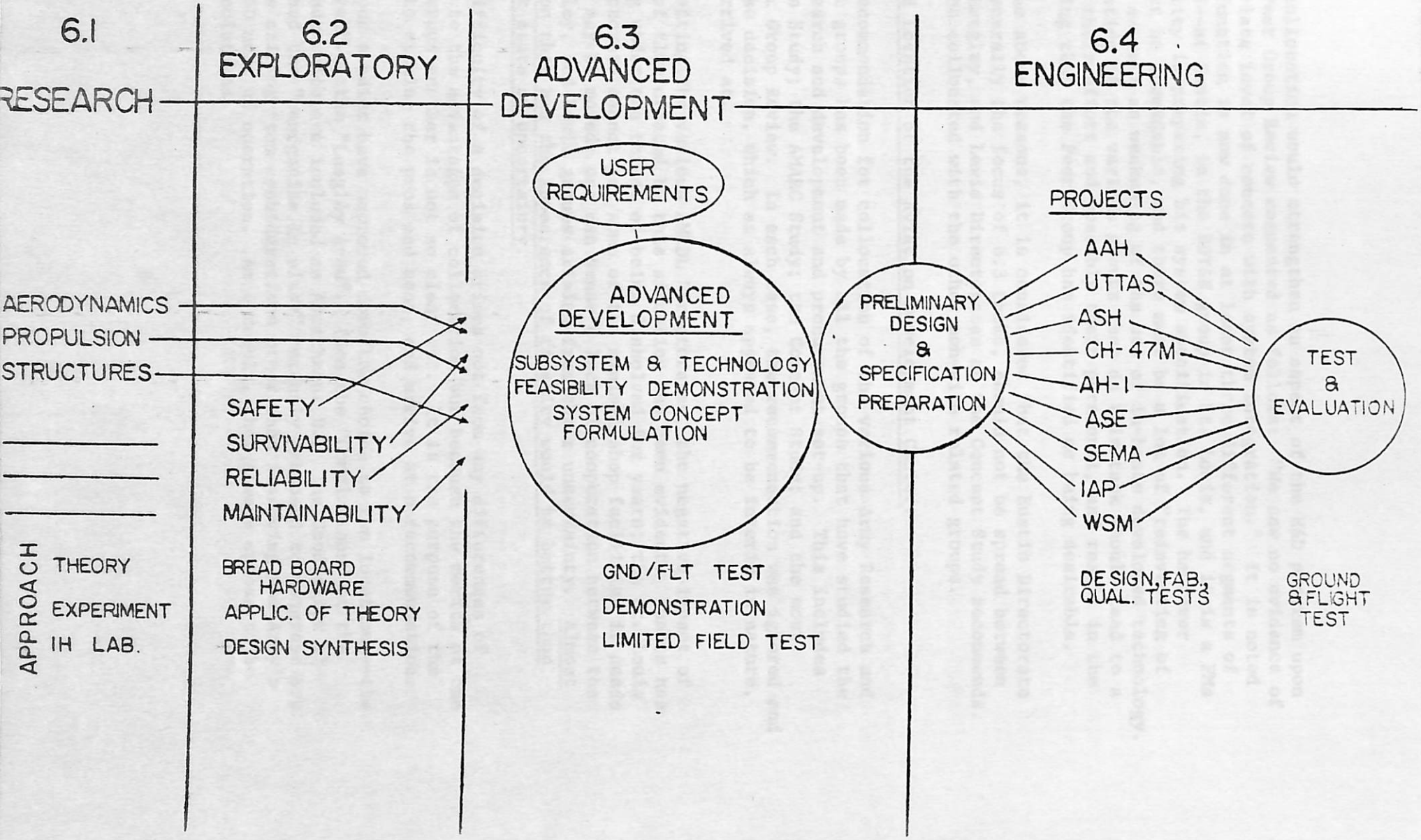
a. The Air Mobility R&D Laboratory Headquarters' group who oversee overall R&D 6.1/6.2/6.3 programs.

b. With the R&D segments of the present RDT&E Directorate, who do similar types of work, who are involved in a portion of the now scattered preliminary design and systems integration work, and who support PMs in the preparation of the Work Statement that is part of an RFP.

c. With the PMs and their engineering support, including the R&D required of the RDT&E group, who should use 6.3 type of work in their planning and execution of programs.

FIGURE 1

AVIATION DEVELOPMENT CENTER
R&D OVERVIEW



This collocation would strengthen an aspect of the R&D program upon which the Peer Group Review commented as follows: "We saw no evidence of the appropriate level of concern with system integration." It is noted that this function is now done in at least three different segments of the Command--at Eustis, in the RDT&E group in St. Louis, and it is a PMs responsibility in preparing his system specification. The handover problem must be formidable, and there must be a lot of "reinventing of the wheel" as well as weakening of the use of in-house developed technology. The collocation of the various groups that do this task should lead to a merging of their effort and possibly their personnel, and result in the strengthening that the Peer Group has identified as being desirable.

For the above reasons, it is considered that the Eustis Directorate or, more generally the focus of 6.3 tasks, should not be spread between the Ames, Langley, and Lewis Directorates as the Concept Study recommends. It should be collocated with the other non-site related groups.

Recommended Location of the Aviation Development Center.

The recommendation for collocation of the various Army Research and Development groups has been made by all the groups that have studied the Army's research and development and procurement set-up. This includes the Carlson Study; the AMARC Study; the Concept Study; and the most recent Peer Group Review. In each case, the recommendation was ignored and a compromise decision, which as always appeared to be interim in nature, has been arrived at.

In visiting the various AMRDL Directorates, the negative impact of the state of flux created by this situation has been evident. Eustis has been living under the threat of being dissolved for years; the St. Louis RDT&E Directorate cannot get some of the minimal shop facilities it needs because it may be moved; one can sense a lack of cooperation between the Ames, Langley, and Lewis groups arising from their uncertainty. Almost any decision that has the appearance of finality would be better than the present state of uncertainty.

The difficulty of a decision arises not from any differences of opinion as to the advantages of collocation but because the merits of one location versus another is not so clear cut. It is the purpose of the following to examine the pros and cons, and arrive at a recommendation.

Previous studies have narrowed down the choice to two locations--the "Moffett area" or the "Langley Area". (See the "Conclusions" of the Concept Study which are included as Attachment B.) The Goodfellow alternative and the "reorganize in place" recently proposed to Congress are compromises arising from considerations other than improving the Army's aviation R&D mode of operation. As a result, they always appear to be temporary solutions.

The following two subsections of this report examine the relative advantages of the Langley and the Ames locations. It was considered that the chief contribution of the present study would be a recommended choice between these two locations. The views presented below are largely based on one day visits to Langley, Eustis, and Ames.

LANGLEY ADVANTAGES. The primary advantage of a Langley (or Virginia Peninsula) location is that it is closer to the center-of-gravity of rotorcraft "business". By this is meant not just the R&D activities. It includes proximity to the Pentagon in Washington, DC; proximity to HQ TRACOM at Fort Monroe for user inputs or requirements; proximity to Fort Rucker where flight training goes on; proximity (at present at least) with the rotorcraft manufacturers; and proximity to Langley, Eustis, and the Avionics Laboratory at Fort Monmouth. If the "movable" groups as defined in the previous section were located in the Virginia Peninsula area (rather than Moffett) there would be a minimum movement of people since Eustis is already there.

Furthermore, if the decision were based solely on the differences between Langley and Ames, Langley has an advantage in the scope of its research in the basic disciplines pertinent to rotorcraft development. The fields in which Langley has a competence are much broader than those of Ames. This is the impressive strength of Langley and its chief one.

All of these considerations favor a location of the Aviation Development Center in the Virginia Peninsula/Langley Area. They would be sacrificed if the location were at Moffett.

AMES ADVANTAGES. All the previous studies, as well as this one, indicate the desirability of an Army aviation R&D complex. The Wright-Patterson Field complex, which includes the Program Managers, their engineering and other support groups, and the R&D labs that contribute their technology, is an example of what is desired. The ultimate decision for the location of the Aviation Development Center should be strongly influenced by the possibility of such a complex coming into being in the long run. Granting that the "site-connected" capabilities at Langley, Lewis, Fort Monmouth, and Edwards should be maintained, the most feasible way for the Army building up to a "Wright Field-type" complex, is in the Moffett area.

This statement derives from the differences between the Ames Research Center and the Langley Research Center in relation to the Army's rotorcraft R&D needs. Langley has the broader disciplines than Ames, but they are not so specifically related or applied to the Army's rotorcraft needs. Ames has a narrower discipline scope but--largely because of the 40- by 80-foot wind tunnel, the simulator facilities, and the Army-operated 7- by 10-foot wind tunnels--is more specifically devoted to rotorcraft R&D. This has resulted in rotorcraft programs strictly devoted and motivated by the Army's needs. Furthermore, this is not a temporary situation. The very breadth

of the disciplines at Langley means that the NASA must apply them to the total field of aircraft research. The narrower and more specialized capabilities and unique facilities at Ames encourages concentration on rotorcraft problems.

The foregoing is reflected and is partially a result of the difference in the relationship between the Army/NASA groups at Ames and Langley. At Ames, they have an Army identity and are the bell-wethers and motivators of the rotorcraft projects at their Center. At Langley, they are merged into the NASA groups more or less as "working guests". Not only does this lose them their Army identity, but they are not in a position to shape the Langley research programs to the Army's specific needs as effectively as they do at Ames.

The contrast that results from the above situation is most evident from a review of the rotorcraft related programs at Langley and Ames. Both Centers have a command of the aeromechanics oriented disciplines and have facilities required to pursue them. The contrast arises from the type of rotorcraft programs to which they are applied. At Ames they deal very specifically with all the Army's primary interests--the flight regime concerned with "Nap-of-the-Earth" utilization of rotorcraft. Thus, the pilot's ability to make rapid maneuvers, to fly his craft close to the ground, pop-up and rapidly pull 'g', avoid over reaction and inadvertent pitch up--are aspects that emphasized in the Ames programs.

At Langley the emphasis is on a different regime. This is the flight regime concerned largely with instrument assisted approaches to a landing field, or navigation and guidance in a cross-country flight. These regimes are of general interest and of value to the Army but are secondary to its primary needs.

A similar contrast exists in the field of acoustics and noise reduction. The facilities for this type of research are much more extensive at Langley than at Ames and there must be many more people engaged in this type of research. It is applied in the rotorcraft related research to such areas as reducing internal noise (e.g., generated by transmissions) to improve pilot/passenger comfort. The acoustic instrumented range (at Wallops) is directed at measurement of noise in a typical take-off or approach to a landing field. Once again, these are of interest to the Army, but not primary to their mission. At Ames there are relatively few people involved in the discipline, and all in the Army group, as far as could be observed. But the emphasis of their program is on an aspect of primary interest to the Army--the reduction of far-field noise to minimize advance detection of approach by the enemy. The flight program being conducted under Ames direction at Edwards is directed at identifying sources of rotorcraft noise that are most contributory to this noise, in contrast to cabin noise or noise associated with take-off conditions.

Both of these programs are typical of the difference between Ames and Langley in relation to the rotorcraft development needs, and other examples could be given. Both types of development effort are desirable in the rotorcraft field. But if the Army were to assign priorities or make a choice between the two types of programs, the one at Ames would have to be preferred. This emphasis is not readily changed in a given laboratory; it is an ingrained preference of the researchers who do the work, which takes a long time to turn around.*

Shifting the discussion to research facilities, a specific advantage at Ames is its simulation capability (in addition to the more obvious uniqueness of the 40- by 80-foot wind tunnel) for the Army's needs. Simulation will become a major tool in advancing the state-of-the-art on rotorcraft handling qualities to a point where it now is on fixed wing aircraft. Ames has led in this field in the past on fixed wings in part due to the motion simulation facilities that it has built up over the last 20 years. These motion simulators will be important in the Army's Nap-of-the-Earth program. At Ames this type of activity will also benefit from proximity to Hunter Ligget Military Reservation where the Army does its flight test in developing Nap-of-the-Earth tactics. An interchange of pilots flying on both the simulator and the actual flight is useful in this type of research. The Peer Group Review made the same point in the following statement:

*Footnote: The foregoing discussion is pertinent to the current study by the NASA as to a roles-and-missions assignment to either Ames or Langley, in which the Army has a legitimate interest. With an exception or two, there is no real duplication in the rotorcraft work at the two Centers. Elimination of the effort of one Center and concentrating it at the other would cancel out one or the other of these complementary fields of effort.

It is the personal view of the writer of this report that the complementary, but not duplicating effort, has been one of the strengths of the NASA's aerodynamics research--and is directly traceable to the fact that two Centers, Ames and Langley, are engaged in this field. There is a more obvious but parallel situation at Goddard and the Jet Propulsion Laboratory. Both these Centers have orbital mathematicians, tracking specialists and scientists devising satellite-borne experiments. At Goddard these disciplines are directed at earth orbiting satellites, or experiments that view the Earth's clouds, oceans, or terrain. At JPL they are directed to interplanetary trajectories, and the features of the Moon and the planets.

"In the closely related field of stability and control, significant progress has been made, but the goal of substantial improvement in the handling qualities of rotary wing machines seems a long way off. Critical to the development of an adequate design data base is the planned simulator improvement at Ames, to permit man-machine interface experiments of sufficient fidelity to give meaningful data for system design specification. Early approval of the joint Army/NASA plans for the facility is essential if reasonably rapid progress is to be made. While valuable results may be obtained with the variable stability UH-1H, in-flight experiments are inevitably hazardous, relatively tedious, and severely constrained by flight safety considerations."

A final point concerns facilities and floor space into which the Army could expand. The Moffett site, both on and off the Ames plot, offers the best accommodations for those personnel requiring office space only. Of much more importance is the potential availability, at least at the present time, of housing for more pretentious facilities. During the past five years, there has been a phasing out of whole fields of activity at Ames as the NASA assigns specific roles-and-mission responsibilities to each of its Centers. Most recently, JPL is picking up the part of the planetary program that has been done at Ames, thus releasing a whole building. Of more importance is this phase-out of their elastic structures work and some of the hypersonic ballistic test work at Ames. The structures work was done in a special facility which might be adaptable to Army needs. The ballistic facilities appear to be better than those currently in use at Eustis.

This discussion of Ames advantages may seem to belabor the obvious. It has been dealt with in greater depth than other aspects of this study largely because of its relevance to the decision the Army must make as to where to collocate. The Concept Study leaves the choice unresolved by the statement, "The Langley and Moffett alternatives are feasible." The Peer Group Review which looked at the programs and facilities at both Ames and Langley came up with a similar conclusion to the present report but expressed it more succinctly in the following statement.

"It is of the greatest importance that the Program Managers and the Product Managers, as well as responsibility for Flight Qualification activities, be brought where the facilities and technical talent are concentrated. The presence of the 40- by 80-foot wind tunnel, a unique national facility at Ames, together with the presence there of the established AMRDL Headquarters and the propinquity of the Edwards Flight Test Activity argue strongly for collocation at Ames."

Conclusion. Based on the foregoing considerations, it is the recommendation of the present study that the long-term objective should be the establishment of the Army's Research Center in the "Moffett Area" in preference to the "Langley Area". This recommendation is made not only

based on the present situation, but also with a look to the future. If the Army ever hopes to obtain a "Wright Field-type" R&D complex, its best chance is at Ames. The broader scope of the technologies represented at Langley mitigate against the Army ever achieving the exclusive attention to its rotorcraft needs; in contrast, the progressive narrowing of the scope of the R&D field at Ames has already made rotorcraft applied effort its primary role.

Importance of Pending Roles-and-Missions Decision by NASA.

This report is being written before a parallel NASA study is concluded. This is a study being made by a committee chaired by Dr. Bruce Lundin to recommend whether there should be a roles-and-missions assignment for V/STOL "aeromechanics R&D" which includes aerodynamics, flight dynamics, simulation, and flight-test. The relationship of the results of the Lundin Study to the present one is obvious. Thus, the Army should express to the Lundin group its interests so that they get proper weight in the final decision. The following are thoughts as to what the Army's interests are.

The most favorable decision for the Army would be one which left both Ames and Langley as they now are; i.e., neither get an exclusive roles-and-missions assignment for V/STOL. No matter which Center gets such a role, it is inevitable that the R&D applied to rotorcraft at the other Center will be diminished. This is the only way the budgetary objective presumably motivating the Lundin study can be achieved; only by reducing rotorcraft applied research can this objective be achieved. This would be contrary to the Army's interests. (The footnote in the previous section amplifies on this from the Army's point of view.)

Thus, it is suggested that if the Army has any inputs to the Lundin study, it be in the direction of suggesting that no roles-and-missions assignment be made.

If a roles-and-missions assignment must be made, it is in the best interest of the Army that Ames get this assignment for reasons that are obvious from the preceding section.

If, despite these considerations, Langley gets the V/STOL assignment, the recommendations of the previous section should be reviewed in view of the new situation. At an absolute minimum, the Army should request reassurance that the applied rotorcraft research now ongoing at Ames, which is in the Army's primary area of interest, will be continued at Langley even if it has to displace current effort of lesser interest to the Army now in progress at Langley.

Other Considerations.

There are other considerations of obvious importance in influencing an "optimum" end solution which, it may seem, have not been given due weight in the foregoing discussions. The following are some reasons:

Costs. The visible first costs and 20-year costs have been assessed by the Concept Study. No facts can be added by the present study. However, it is thought that any differences that have been identified are within experiemtnal scatter; these differences are probably less than the non-quantifiable savings that will be achieved by collocation. If just one "Cheyenne" problem is anticipated early and resolved quickly due to collocation of the PMs and the technical people, the savings will exceed the first cost difference.

Personnel Turbulence. Previous studies have given considerable weight to the disruption, costs, and loss of personnel due to relocations. These may be correct if the relocations were done all at once. However, as indicated in the subsequent "road map", it is contemplated that this be done gradually. As one program phases out, its personnel in any case would be reassigned or laid off. It is suggested that new programs be started up in their desired locations, probably with different personnel, thus avoiding the problems of a mass relocation.

Floor Space. Other studies have considered the merits, costs, and availability of floor or office space for housing personnel not associated with large research facilities. This is considered to be the least important item. Any of the alternatives can resolve this adequately--though the Moffett alternative seems to offer the best immediately available facilities.

Summary.

This section has defined an optimum organization for the Army's Aviation Development Center along the following lines:

a. The current "centers of excellence" at Ames, Langley, Lewis, Fort Monmouth, and Edwards should be maintained.

b. The "non-site connected" elements of the organization should be collocated in the Moffett area. These include:

1. The present Headquarters, Air Mobility R&D Laboratory group which is already at Ames.
2. The Eustis Directorate, which should be shifted from Fort Eustis.
3. The present RDT&E Directorate, currently in St. Louis.
4. The Program Managers and their engineering support, now in St. Louis.
5. Procurement and other support groups to the above elements, now in St. Louis.

EVOLUTIONARY APPROACH TO THE OPTIMUM ORGANIZATION

It is understood that the Army has already informed in Congress of its intention to "reorganize in place". If this were to be the permanent situation, the previous discussion, like its predecessor reports, would be of little practical value. However, if, in fact, the Army considers its future options to be open, it should have a long range plan which it can implement over the coming years. In these circumstances, the foregoing section will be useful in defining the end goal toward which the Army plans to evolve. Then, as the opportunities present themselves, moves should be made which are in conformity with the long range plan. It is the objective of this section to address some of the nearer term actions and decisions which the Army will have to make if this plan is followed.

1. ANY INVESTMENT THAT IS MADE IN SIMULATOR FACILITIES SHOULD BE APPLIED AT AMES.

An ad hoc group of the Army Scientific Advisory Panel under the chairmanship of Professor H. Curtiss is currently studying the Army's simulator facility needs. At the present time it is not known whether they will identify a need for a dedicated facility or suggest an amplification of existing facilities. In either case, if any expansion takes place, or investment made by the Army, it should be effected at Ames. Both the Ames leadership in this area discussed under "Ames Advantages" in the previous section, plus the eventual location of the Aviation Development Center there make this the desirable location for expansion.

2. A PLAN FOR SHIFT OF THE EUSTIS DIRECTORATE TO MOFFETT SHOULD BE ANNOUNCED AND IT SHOULD BE SEQUENTIALLY IMPLEMENTED.

There are certain elements of Eustis which could be moved almost immediately because all they need is office space. Also, there are elements of this Directorate which would do their job better if collocated with the HQ, AMRDL rather than 3,000 miles away. These elements fall in two categories. One consists of the groups concerned with "illities"--the Military Operations Technical Division. It is believed that all this division needs is office space and that it could do its work from any geographical location. Association with the Headquarters group seems to be the best place for them.

A second group deserving priority attention is the Preliminary Design Group (or possibly the entire Systems Support Division). There is discussion in the Peer Group Review as

to the weakness that exists in the "systems integration" area. It is believed that this is due to the geographical separation of the several groups that contribute to it; one is the Preliminary Design Group at Eustis; a second is the one segment of the RDT&E group in St. Louis; the third being the PMs who have to put together their work statements and design specs. And they all are separated from Ames, Langley, and Lewis which should be the source of the new technology they are integrating. It is suspected that as a result of this, the PMs are forced to rely chiefly on their contractors for systems integration and the in-house effort is not very effectively used. The conclusion is that all the groups doing this job should be collocated and perhaps merged into a single group. The first step should be a move of the Eustis Preliminary Design Group to Moffett.

The next logical subgroup is the Aeromechanics section because of their close association with similar work at Ames. Finally, the Propulsion and Structures groups should be moved. These are associated with facilities at Eustis such as the fatigue test machine. Issue is taken herein to the recommendation in the Concept Study (Goodfellow alternative) which shows these groups at Langley and Lewis. This is dispersion of capabilities rather than collocation. The 6.3 job of these groups is different than the 6.1/6.2 work at the NASA Centers. It should be introducing the new technology to the industry, then--when it is ready--into the systems integration work and the 6.4 programs. It should, therefore, be located where it is in daily contact with their new programs (as distinguished from technology groups.)

A task force should be established to see what facilities could be set up at Ames. As has been previously mentioned, there are a number of buildings at the Ames Center which had facilities in them, now unused. Now is the time for the Army to put in its bid for them; it will make the shift to Ames more acceptable for people who have been wanting "hands on" equipment. (This also applies to R&D group now in St. Louis.)

3. THE R&D GROUPS IN THE RDT&E DIVISION AT ST. LOUIS SHOULD BE SHIFTED TO AMES.

The RDT&E Division at St. Louis can be divided into two broad groups. One is the Operational Systems Division which has to stay close to the PMs (see Step 4). The other is the R&D associated groups that overlap with the Eustis Directorate on certain functions. In the longer run, these functions could be merged. But the first step should be getting them collocated.

Top priority on the above should be the group involved in Preliminary Design and Systems Integration which overlap with similar work at Eustis. This group should be moved first, and promptly!

4. PROGRAM MANAGERS OF NEW PROGRAMS PLUS THEIR ESSENTIAL ENGINEERING SUPPORT SHOULD BE MOVED TO MOFFETT.

Programs that are well along can best stay at St. Louis until they are finished and phased out. However, there are two programs in the very early formation stage, plus future programs, which could be established at Moffett with minimum or no disruption in personnel. They would have their dedicated engineering staff plus elements of the Operational Systems Division (Crawford's group) necessary for their support. It is recognized that the temporary split up of this latter Division would impose some problems, but it would be worth the temporary inconvenience to achieve the end result desired.

It is realized that it takes a more intimate understanding than could be obtained in this study of the interrelations between the various groups to lay out the desired sequence of moves. The foregoing is intended to be illustrative of an evolutionary approach which, it is believed, would minimize the personnel turbulence and disturbances to the present system. The important point is that a top-level decision in principle has to be made to make the move. An in-house task force can then plan the least disruptive way of doing it.

CONCLUDING REMARKS

The value of a study such as this is questioned when it is realized that it has not done much more than reiterate the chief recommendation of all its predecessor studies tracing back at least as far as a Defense Service Board report in 1966. In every one of these reports collocation of the Aviation Research and Development activities was recommended. In two of the three reports cited in the body of this report it was recommended that the appropriate site for such a collocated group would be Moffett Field. The prestigious AMARC report, whose recommendations have been followed in so many other Army Commands made the following recommendation:

> "Evolve to an Air Mobility Development Center at Moffett Field, as a long-term goal by (geographically) consolidating the AVSCOM RD&E Directorate, the Air Mobility R&D Laboratory, and an engineering and systems integration facility."

This study can only emphasize the importance of a prompt decision to initiate such an evolution. Delays are penalizing the Army in terms of the efficiency and effectiveness with which it can perform its Aviation R&D procurement mission. The non-quantifiable cost penalty for such delay

must far exceed any first costs--and the situation will be further aggravated by such investment that has to be made in the recent "Reorganize in Place" plan presented to Congress.

Obstacles to previous actions have been the personnel turbulence created by such a move and the community upset in the St. Louis and Eustis areas. These effects are not underrated. However, it is suggested that they will be moderated if the movement of organizational elements to Moffett is a gradual one. It can be performed as one part of the St. Louis or Eustis activities reach a natural phasing out point and a new one can be initiated at Moffett. To do this, the first stp should be the statement of intent by the Army to reach an ultimate organizational realignment and relocation over the coming years--followed by implementation of this change step-wise as developments permit.

Proposed
Terms of Reference

ASAP Ad Hoc Group
on
Future Aviation Development Center

1. Background

a. The DA Working Group has staffed several alternatives for the organization of the Aviation Development Center in accordance with the Concept Study for the Aviation Development Center. Congressional comments on the alternatives have been solicited and will be forwarded to the DA Staff on or about 15 May 1976.

b. The Assistant Secretary of the Army (R&D) has requested that an independent assessment of the alternatives or variations thereof be made by a competent source of appropriate background and expertise.

2. Terms of Reference

The independent source should address:

a. An assessment of the resources and facilities of NASA Lewis, Langley and Ames Laboratories and how each relates to Army Aviation Development Center location and organization, as well as subordinate organizations and their locations.

b. How and where the Center should be organized, particularly for the long run.

c. The feasibility of any short-term organization measure that appear warranted.

d. An assessment of the costs associated with any recommended long or short-term measures.

3. Termination

The Chairman of the Ad Hoc Group is requested to conclude his efforts no later than 20 May 1976 so that his comments may be considered with those of Congressional delegations expected at about that time.

Attachment A

11. CONCLUSIONS.

The Moffett and Langley alternatives offer collocation with NASA research facilities, while St. Louis offers minimal personnel turbulence and relocation costs. Other alternatives considered offer neither of these advantages, nor any other appreciable advantage over Moffett, Langley, or St. Louis, and therefore were not carried forward as viable courses of action.

The Langley and Moffett alternatives are feasible. They meet the AMARC recommendation of a consolidated AVDC and provide the greatest opportunity to correct weaknesses in the present system. They provide personnel savings over the St. Louis/Goodfellow alternative through consolidation of like functions. Moffett is the lowest 20 year life cycle cost option considering total cost to the government. The availability of technical facilities to meet AVDC requirements favors the Moffett alternative.

The St. Louis/Goodfellow alternative is feasible but does not take full advantage of operational and material acquisition improvements achievable through greater consolidation of the RD&E management and operating activities. It does provide for improved alignment of Laboratory functions and personnel economies through dissolution of the Eustis Directorate. It is the lowest one time cost, least turbulent option. If only Army costs are considered it is the lowest cost 20 year life cycle alternative.