As per your request, the following is submitted for input on aerodynamics in answer to Mr. Roy P. Jackson's questions in the July 15 memorandum to Kayten, subject: ATT Study Contracts.

1. What specific items of information do we want to get from the contractor results?

   It has become apparent that the hard aerodynamic data required to realistically study an alternate to the high performance configuration will not become available until late in the contract study period. Therefore, at least in the field of aerodynamics most of the results of the study will pertain to the high performance configuration even though from an overall standpoint this might not be the way we would like it. We should expect the following specific items of information with regard to the high performance configuration.

   (a) Definition of possible practical aerodynamic problems such as trim drag, deep stall, and balance.

   (b) Definition of possible structural and arrangement problems for the wing such as those which might be associated with the incorporation of the landing gear and flap system.

   (c) Definition of the possible aerodynamic balance and weight problem associated with the engine arrangement.

   (d) Definition of the arrangement problems and the weight and cost penalties for an area-ruled fuselage.

   (e) Definition of the weight and associated cost penalties of flying at an altitude at least one corridor higher than the highest present corridor.
(f) Of particular importance, a thorough analysis of the interplay of the effect of engine and wing sizing resulting from item (e) on the reduction of noise for landing and takeoff.

(g) An analysis of the effectiveness of SAS in reducing the trim drag for cruise and providing other improvements in the aerodynamics.

During the latter part of the program, a preliminary definition of the relative DOC's for airplanes incorporating supercritical technology designed for various cruise Mach numbers between those of present transports and Mach one will be obtained. Also, during the latter part of the program, a preliminary analysis of the relative aerodynamic and structural advantages and disadvantages of various engine arrangements will be accomplished.

Why do we want them?- We at NASA have a strong capability in basic aerodynamics and outstanding facilities to develop aerodynamic concepts. However, industry has far more experience than we do with regard to the practical problems associated with designing real airplanes. The information, to be provided by this study will define some of these problems.

How we will use them after we get them?- Our research will be redirected in an attempt to solve problems of the real world.

How will we make coherent use of 2 engine and 3 airframe inputs?- It is expected that the various contractors will arrive at similar conclusions for many of the facets of this study. However, in a number of cases, divergent conclusions will be reached. To attempt to provide coherence, a thorough study must be made of the basic assumptions and analyses of the several contractors to determine the reasons for the divergent conclusions. Nevertheless, since airplane design is still an extremely complex art and no two human beings have exactly the same ideas on a given subject, we undoutbedly will end up with unresolvable differences.

Are the contractors working in a way to get what we want?- In many cases they are; however, in several areas they are designing the
study airplanes the way they designed the last generation of airplanes. In particular, at this point at least, they are not considering the impact of noise reduction as fully as is required. Also, as discussed in the first answer, the contractors can not at this point consider an alternate configuration as fully as would be desired.

If not, how do we change it? - The management level of the NASA must put a continual pressure on the management level of the contractors to obtain what we want. However, it must be remembered that we cannot change people's thinking, developed over long careers, by edict. We must continually try to convince all of the people working on these contracts there is a need for thinking a little differently. A study of the alternate configurations as fully as desired would probably require an extension of the contract period.

How do you demonstrate your conclusions? - The undersigned knows of no way to demonstrate these conclusions in the required "concise" statements. However, a long dissertation will be provided if needed.

Should we have a group discussion with the contractors? - We already have had one group discussion and several other individual discussions with the contractors. During these discussions, the Langley Deputy Director and the undersigned made impassioned pleas on the need for thinking a little differently. Similar pleas in another group discussion would begin to sound a little redundant.

If so, what form should it take? - Perhaps thorough discussions with all the working troops on the contracts and not just the managers would be helpful in providing the needed impetus to advanced thinking on these studies.

Richard T. Whitcomb
Memorandum

TO: RT/Mr. Gerald G. Kayten, Director
    Supercritical Technology Office

FROM: R/Associate Administrator for Advanced Research and Technology

SUBJECT: ATT Study Contracts

I spent several hours at Boeing on July 13 discussing the subject program with Lloyd Goodmanson and his staff. My conclusion is one of concern. I feel the program will not result in what we want without additional direction to the contractors.

Before deciding firmly that we will meet with the contractors, and what direction we will give them, I need from you and your task force, in the form of well-thought and concise statements, answers to the following:

- What specific items of information do we want to get from the contracted results?
- Why do we want them?
- How will we use them after we get them?
- How will we make coherent use of two engine and three airframe inputs?
- Are the contractors working in a way to get what we want? If not, how can we change it?
- How can you demonstrate your conclusions?
- Should we have a group discussion with the contractors? If so, what form should it take?

I feel we ought to have your response no later than Wednesday, July 21, so that we can call the contractors together the following week, if we choose to get with them.

Please take all appropriate action.

Roger F. Jackson

cc:
   LaRC/Cortright
   LaRC/Lundin
   T-A/Armstrong
   LaRC/William J. Alford, Jr.,

RPJ:jd