OPENING SESSION

July 13, 1948

The opening session of the 1948 Biennial Inspection of the Ames Aeronautical Laboratory started in the Auditorium at 10 a.m. on July 13, 1948, and included the following speeches.

John F. Victory

Gentlemen: You are listening to John F. Victory, Executive Secretary of the NACA, whose privilege it was to extend in the name of the Committee the invitations in response to which you are assembled here this morning. I am sorry to have to announce to you that our Chairman, Dr. Hunsaker, is enroute and is delayed. He will not be able to reach here until about 12 noon. In his absence our Vice Chairman, Dr. Alexander Wetmore, will now speak to you.

Dr. Alexander Wetmore

Thank you, Mr. Victory. Gentlemen: It is my pleasure to welcome you here today in the name of the National Advisory Committee for Aeronautics to the second Biennial Inspection of Ames Aeronautical Laboratory, an inspection arranged for the aeronautical fraternity, both military and civilian. The attendance here is highly gratifying to us. We hope that it may be mutually valuable to all of us to have this contact and to show you what we are trying to do here at the Laboratory.

I have, in addition to the pleasure of extending to you this welcome, one sad duty to perform. I am sure you will share

with me the sense of profound regret at the news of the sudden death yesterday of Dr. George Lewis, long-time, for 30 years, Director of Aeronautical Research in the NACA. Dr. Lewis devoted his life to the development of the NACA to its present stature. He was one of our strongest advocates of research preparedness. He literally sacrificed his health that this country gain the strength of survival to the scientific advancement of aeronautics. It was Dr. Lewis who originated the regular inspections of the NACA laboratories. He felt that the periodical summary of NACA research activities was important to the continued successful application of research data by industry and by the armed services. The attendance here today and tomorrow is testimony to the foresight typical of Dr. Lewis and to the value of his ideas.. In honor of his memory, may I ask you to stand for one brief moment, - - - -

Thank you, gentlemen.

I would like to present to you now Mr. Smith J. DeFrance, Director of Ames Laboratory, and our host for today. Mr. DeFrance-

Smith J. DeFrance

The work of the NACA brings us in close association with representatives of the aircraft industry and the armed services and other government agencies. We are always very happy to welcome our friends that we have made through our contacts with the industry and the government services. However, today I am especially happy to extend to you on behalf of the staff of Ames Laboratory a hearty welcome. I want to assure you that it is the desire of the staff that your visit here today be pleasant, and they will do everything within

their power to assist you in making it a very pleasant stay.

We at this Laboratory, the same as the Laboratory at Langley Field, share the station with one of the armed services. In this case, it's the Navy, and I want to say that we have had wholehearted support and cooperation from the Navy. It is a pleasure at this time to present to you the Commanding Officer of the Moffett Field Naval Air Station, Captain Olney. Captain Olney—

Captain A. C. Olney

In behalf of the Navy, I wish to extend to this very distinguished group a most cordial welcome to Moffett Field. Mr. DeFrance in a way stole my thunder because I was going to invite attention to the very fine spirit of harmony and cooperation that exists between the Service and Ames Laboratory. I am sure you are going to find a very fine presentation here this morning and in conclusion of this presentation, I wish to extend a most cordial invitation to all hands to use the facilities of our Officers' Club and relax a little.

Smith J. DeFrance

Thank you, Captain Olney. It is my pleasure now to present the Director of Aeronautical Research of the NACA, Dr. Hugh Dryden.

Dr. Hugh L. Dryden

Thank you, Mr. DeFrance. First, I want to assure you that all the remaining gentlemen on the platform are not going to make speeches and that mine will be very brief. I wanted simply to state the purpose of an inspection so that there might be no misunderstanding. The general purpose of such a visit as this is to form some general impression of the state of the art and the kinds of problems

on which the Committee is working. We do not expect to give you a great host of technical detail. We have found that a more effective mechanism for bringing to you the details of technical results is that of the specialized conferences on particular subjects. This is sort of a chance to give you a general look-around to tell you what kinds of questions you may hope to get some answers to, and to encourage you to bring your problems to us in a smaller group than this so that we might try to help you. You will hear a little bit later of the details of what you are going to see today. Thank you.

Smith J. DeFrance

Thank you, Dr. Dryden. I am glad you mentioned about the other guests on the stage not being scheduled for talks. At this time I would like to present the other guests on the stage. First, Dr. Henry J. E. Reid, the Director of Langley Laboratory (applause); and Dr. E. Raymond Sharp, the Director of the Flight Propulsion Laboratory at Cleveland (applause); and Mr. E. H. Chamberlin, the Executive Officer of the NACA from Washington (applause).

As you go around the Laboratory on the tour today, there are many things that will be said at numerous times and to clarify those things at this time, I would like to present Mr. Walter Vincenti, who will give you a summary of the visit here today. Mr. Walter Vincenti--

Walter Vincenti

In your inspection of the laboratory today you will hear many research problems discussed in detail. The relationship between these individual problems is perhaps best visualized with the aid of a simple classification diagram (see fig. 3). This diagram is

somewhat of an over-simplification, of course, but it does serve as a useful set of pidgeonholes in which to place the various items you will hear discussed.

All the material to be discussed today comes under the general heading of aerodynamics. The NACA's activities in other fields of aeronautical research, such as structures and aircraft propulsion, will not be covered. The material to be discussed in the field of aerodynamics constitutes a review of the activities of both the Ames and Langley Laboratories in this field.

Under the general heading of aerodynamics, research problems can be classified in two different ways: (1) according to the general flight problem being investigated, or (2) according to the speed range in which the problem is being studied. Foremost among the general flight problems, regardless of speed range, is the problem of aerodynamic performance. This is the fundamental problem of proportioning the airplane so as to obtain the required lift with the least possible drag. Of equal importance is the problem of stability and control. That is, the airplane must be stable in the sense that it must, when set to a given flight condition, tend to return to that condition despite chance disturbances. It must be controllable so that the pilot can change it from one flight condition to another as he desires. In addition to these two fundamental problems, there are many secondary problems which we shall mention again later.

Now, cutting across the division according to the general flight problem, is the division according to speed range. As implied

by the designation of the speed ranges – subsonic, transonic and supersonic – the determining criterion here is the ratio of the speed with which the air moves relative to the airplane as compared with the speed with which sound travels through the moving air. This relationship is usually expressed in terms of the Mach number, which is defined as the ratio of the speed of the air relative to the airplane divided by the speed of sound. When the speed of the air is equal to the speed of sound, the Mach number is, of course, 1. The speed of sound enters the problem, not because sound is important as sound itself, but because the speed of sound determines the rate at which the pressure impulses which are given off continuously by the airplane are propagated through the air.

On the basis of these concepts, there are two possible methods of division of the over-all speed range. The most obvious is to consider simply the flight Mach number, that is, the ratio of the speed of flight to the speed of sound. Since an airplane can fly either faster or slower than the speed of sound, this method of division leads to two speed ranges: the subsonic range, in which the flight Mach number is less than 1; and the supersonic range, in which the flight Mach number is greater than 1. In this system of division there is no third or transonic range, and the line of demarcation between the subsonic and supersonic ranges occurs at the flight Mach number of 1. This method of division was the only one which was used until recent years. It is still used a great deal and is sufficient for many purposes.

In recent years it has been found useful to refine the method

of division of the over-all speed range to include a third range, the transonic. To do this, attention is directed not to the flight speed, but to the local speed that air reaches in passing over the airplane. In flowing about the airplane, the speed of the air is increased or decreased locally as compared with the flight speed. We can thus define a local Mach number which is, in general, different from the flight Mach number and which is equal to the local speed of the air relative to the airplane divided by the speed of sound.

Now, considering the flow field around the airplane as a whole, if everywhere in the flow field – that is, at all points – the local Mach number is less than 1, the flow is said to be subsonic. If everywhere the local Mach number is greater than 1, the flow is said to be supersonic. If, as can happen in the same flow field, points can be found at which the local Mach number is less than 1 and other points at which the local Mach number is greater than 1 the flow is said to be mixed or transonic.

The flight Mach numbers which divide the subsonic from the transonic range, and the transonic from the supersonic range, cannot be defined uniquely but depend upon the shape of the airplane and its attitude of flight. The flow fields and flow problems in the three speed ranges differ in many essential characteristics. In general, the flight problems in the transonic range are the most difficult to study, both theoretically and experimentally.

It is the job of aerodynamic research, of course, to fill in the blank spaces in a table of this type, both by defining the problems which must be answered in each category and by supplying

the answers to the problems. In the days of purely low-speed flight, we had only the subsonic range to consider, and it was thought that the blank spaces in this speed range were pretty well filled. With the penetration of airplane flight into the transonic and supersonic ranges, however, many new problems and developments have arisen. For example, the search for the best possible airplane performance at transonic and supersonic speeds has led to wing plan forms which would previously have been considered rather radical – plan forms incorporating considerable sweep or very low aspect ratio. These plan forms have in turn raised serious problems in stability and control, not only in the transonic and supersonic ranges for which they were designed, but in the subsonic range as well, particularly at the landing condition. In addition, the high flight speeds have raised many secondary problems which were not serious previously. For instance, there is the problem of air induction, that is, of taking sufficient air into the airplane to satisfy the combustion needs of the turbo-jet or ram-jet unit used for propulsion. There is also the problem of aerodynamic heating, that is, the heating of the airplane surface due to the friction of the high-speed air passing over it. This problem must be analyzed in order to keep the surface temperature of the airplane down so as to maintain its structural integrity and make it habitable for a pilot. In addition, there are many other problems, such as flutter and pilot escape, which you will hear discussed in the tour of the laboratory.

As you will see in the tour, much has been done toward filling in the blank spaces in the table. Obviously, however, a great deal

more remains to be done, and much research effort will have to be expended before all the spaces in the table are again as well filled as we once thought they were at subsonic speeds.

# AERODYNAMICS

| | SUBSONIC | TRANSONIC | SUPERSONIC |
|---|---|---|---|
| PERFORMANCE | | | |
| STABILITY AND CONTROL | | | |
| OTHER PROBLEMS (AIR INDUCTION, AERODYNAMIC HEATING, ETC.) | | | NACA A-13385 |

Figure 3.– Classification diagram for aerodynamic knowledge.



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY, MOFFETT FIELD, CALIF.

Smith J. DeFrance

Thank you, Mr. Vincenti. I hope that as you go around the Laboratory today this summary will be filled in and be made very interesting to you.

We have today a former member of the NACA in the audience, and I would like to ask at this time that Dr. William F. Durand stand up (applause). We also have as a former member, Major General John F. Curry, retired. Will General Curry please stand (applause); and Rear Admiral L. B. Richardson, former member of the Committee (applause); and Mr. Burden, former member of the NACA (applause).

We have been informed that a large group of people are leaving tonight on the Southern Pacific Lark for southern California and are planning on attending the Institute of Aeronautical Sciences at Point Mugu Naval Station tomorrow. The Navy will furnish transportation from Santa Barbara to Point Mugu for those people going down on the Lark. We would like to know how many are going to avail themselves of this transportation; so will you please raise your hands at this time. - - - - - Thank you. I understand that breakfast will be some place enroute between Santa Barbara and Point Mugu.

There will be a press conference in the small dining room immediately beneath the Auditorium following this session. Will the press please gather there and meet with Mr. Gene Miller and his assistants. All the other guests will please file out on either side of the Auditorium, and there will be busses there to start the tour. We are ready to start at this time. Thank you.