NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

REPORT

of

ELEVENTH ANNUAL AIRCRAFT ENGINEERING RESEARCH CONFERENCE
Section A

Under auspices of the National Advisory Committee for Aeronautics

Langley Field, Virginia

May 20, 1936
Section A of the Eleventh Annual Aircraft Engineering Research Conference of the National Advisory Committee for Aeronautics was held on Wednesday, May 20, 1936, at the Committee's laboratory, the Langley Memorial Aeronautical Laboratory, at Langley Field, Virginia. For the first time the conference was held in two sections. Section A included in general the representatives of aircraft manufacturers and operators and Government officials. Section B, which was held on May 22, included the personnel of governmental agencies using aircraft, representatives of engineering societies, and members of the faculties of professional schools.

The purposes of this annual conference were twofold: First, to afford to the representatives of the industry an opportunity to receive first-hand reports of progress in aeronautical research at the Committee's laboratory and to witness demonstrations of the special facilities and methods used; and second, to enable the Committee to obtain the comments and suggestions of the industry as to the research problems which are deemed of particular importance at the present time and which the Committee is especially equipped to study.

The National Advisory Committee for Aeronautics was represented at Section A of the conference by its officers and members and also by its Committees on
Aerodynamics and Power Plants for Aircraft and by mem-
ers of its laboratory staff.

Most of those attending Section A left Washington at 6:30 p.m., May 19, proceeding by overnight steamer to Old Point Comfort. Breakfast was served at the Chamberlin Hotel, Old Point Comfort, at 6:50 a.m. The party then proceeded by automobile to Langley Field, where they were joined by some who flew direct to Langley Field, and later by others who arrived by train.

MORNING SESSION.

The opening session was held at 8:45 a.m. in the Post Theater at Langley Field, which was made available through the courtesy of the Commanding Officer of the Field.

The Chairman of the conference, Dr. Joseph S. Ames, Chairman of the National Advisory Committee for Aeronau-
tics, was prevented by illness from being present, and in his absence Honorable William P. MacCracken, Jr., a member of the Committee, presided.

Brief addresses of welcome were made by the Pre-
siding Officer on behalf of the National Advisory Com-
mittee for Aeronautics; by Major General Frank M. Andrews, Air Corps, Commanding General of the General Headquarters Air Force; and by Brigadier General Henry C. Pratt, Air Corps, Commanding Officer of Langley Field, also Commander of the Second Wing of the General Head-
quaters Air Force, and a former member of the National Advisory Committee for Aeronautics.

The Presiding Officer then introduced Mr. Henry J. E. Reid, Engineer-in-Charge of the Langley Memorial Aeronautical Laboratory, who after a few words of greet-
ing to the guests called upon certain members of the laboratory staff in turn to present and explain, with the aid of charts, some of the important results of inves-
tigations conducted by the Committee during the past year.

Mr. Elton W. Miller, Chief of the Aerodynamics Divi-
sion of the laboratory outlined in general the investiga-
tions being conducted by the Committee in the improvement
of aerodynamic efficiency, including in particular the best methods of the application of airfoil data to wing design, wing-fuselage interference with elliptical and triangular fuselages, the optimum fuselage form, the effect of rivet heads on aerodynamic drag, and the effect of idling or stopped propellers on airplane lift.

Mr. Fred E. Weick, Assistant Chief of the Aerodynamics Division, discussed the Committee's study of stability and control of airplanes and exhibited charts of some of the results obtained.

Mr. Truscott, Chief of the Hydrodynamics Division, explained the investigations in the N.A.C.A. tank during the past year, including a study of the effect of rivet heads on take-off, the optimum shape of wing-tip float for large seaplanes, a comparison of the take-off performance of various European and American seaplane hulls, and a comparison of single-hull and double-hull flying boats.

Dr. Theodore Theodorsen, Chief of the Physical Research Division, discussed the investigation of the cowl- ing and cooling of air-cooled engines, particularly the analysis of the many factors entering into the design of a successful N.A.C.A. cowling.

Mr. Carlton Kemper, Chief of the Power Plants Division, described some of the principal results of investigations of aircraft engines, including a comparison of the performance of carburetor-type and Diesel-type engines, a comparison of air cooling in flight and on a single-cylinder test engine, the effect of fin spacing on the cooling characteristics of an engine cylinder, and the variation in engine cylinder temperatures with variation in temperature of the cooling air.

Mr. John F. Victory, Secretary of the Committee, requested that the members of the conference consider the material presented at the conference as confidential with the exception of the information included in the press release which had been handed to newspaper and magazine representatives on the boat the preceding evening. He also requested that during the inspection of the laboratory no photographs or actual reproductions be made of any of the charts, although rough sketches might be made by individuals for their own information, but not for publication.
Mr. Victory announced that the party would divide into six groups for inspection of the laboratory according to the color of the tags which had been supplied to and were being worn by the guests. He said that those with red tags would be led by Dr. Briggs, those with white tags by Mr. Warner, those with blue tags by Mr. MacCracken, those with brown tags by Dr. Lewis, those with green by Mr. Victory, and those with yellow by Mr. Reid. He said that it was essential that the members of each group keep together, and that the schedule be followed strictly, in order to avoid confusion and delay.

By a unanimous rising vote, the Presiding Officer was authorized to send a telegram of greetings and best wishes to the Chairman of the conference, Dr. Ames. The following telegram was accordingly sent immediately:

"Dr. Joseph Ames,
Johns Hopkins Hospital,
Baltimore, Maryland

"Those in attendance at the Eleventh Annual Research Conference unanimously authorized and requested me to extend to you their sincere greetings and best wishes for a speedy return to your usual health and vigor. They are looking forward to your being here with them next May

"W. P. MacCracken."

INSPECTION OF LABORATORY.

The members of the conference then proceeded on a tour of inspection of the laboratory in accordance with the following program:

<table>
<thead>
<tr>
<th>Arrive</th>
<th>Red</th>
<th>White</th>
<th>Blue</th>
<th>Brown</th>
<th>Green</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-Foot High-Speed Tunnel</td>
<td>10:11</td>
<td>9:45</td>
<td>12:30</td>
<td>12:04</td>
<td>11:35</td>
<td>11:06</td>
</tr>
<tr>
<td>N.A.C.A. Tank</td>
<td>11:06</td>
<td>10:40</td>
<td>10:11</td>
<td>9:45</td>
<td>12:30</td>
<td>12:01</td>
</tr>
<tr>
<td>Engine Laboratory</td>
<td>12:04</td>
<td>11:38</td>
<td>11:09</td>
<td>10:43</td>
<td>10:14</td>
<td>9:45</td>
</tr>
</tbody>
</table>
Propeller-Research Tunnel. At the propeller-research tunnel charts were shown of results obtained in the investigation of the effect on control and performance of a two-engine airplane after failure of one engine. The large model equipped with operating propellers, which was used in the investigation, was shown in test position in the tunnel. Results were also presented of the analysis of problems of propeller design, showing the efficiency likely to be obtained under various conditions.

Eight-Foot High-Speed Wind Tunnel. At the new eight-foot high-speed wind tunnel, which was opened for inspection for the first time, the principal design features of the tunnel were briefly described. It was stated that the tunnel proper had a working section eight feet in diameter and a range of air speeds from 85 miles per hour to 500 miles per hour and that the tunnel was operated by a 8000-horsepower electric motor driving an 18-blade propeller 16 feet in diameter. Charts were shown of results obtained in the Committee's smaller high-speed wind tunnel of the pressures on propeller blade sections and the loss in energy corresponding to increased drag at very high speeds.

Free-Spinning Wind Tunnel. At the free-spinning wind tunnel charts were shown of the influence upon spins of the arrangement of tail surfaces; a comparison between spinning characteristics as determined by the spinning balance in the N.A.C.A. vertical wind tunnel as observed in the free-spinning wind tunnel, and as determined in actual flight; and a method of the rapid estimation of lateral-stability characteristics of airplanes. Demonstrations were made in the tunnel of the spinning characteristics of a small pusher-type double-tail airplane with three-wheel landing gear and of a low-wing monoplane of modern type with and without the addition of a small area at various parts of the tail.

N.A.C.A. Tank. In the N.A.C.A. tank a model of a hull equipped with a hydrofoil was towed through the water and on an illuminated chart a curve was developed showing the improved drag characteristics of the model with the hydrofoil as compared with the same model without the hydrofoil, resulting in decreased time and distance of take-off. Charts were exhibited and shown of the effect on take-off of rivet heads on the bottoms of flying-boat hulls, and the effect of ventilating the step to improve take-off characteristics.
N.A.C.A. Hangar. At the N.A.C.A. hangar charts were shown of results obtained in the study of high-lift and lateral-control devices on full-scale airplanes, the investigation of the column strength of stiffeners for stressed-skin construction, and the measurement of accelerations on transport airplanes in gusty air. A demonstration was given of the effectiveness of a swiveling or castering wheel when placed below the airplane forward of the center of gravity in the prevention of ground looping.

Engine Research Laboratory. At the aircraft engine research laboratory charts were shown of results obtained in the investigation of the high-speed aircraft Diesel engine, and a single-cylinder engine of this type, having a displacer form of combustion chamber, was shown in operation. A special glass-cylinder engine for the study of the mixture of injected fuel and air in a fuel-injection engine was exhibited. In this cylinder smoke is used to make the air movement in the cylinder visible during the suction and compression stroke and the air movement and fuel spray distribution are photographed by high-speed motion pictures.

Variable-Density Wind Tunnel. At the variable-density wind tunnel charts were shown indicating the development of a method for the rational selection of wing sections for airplane design according to the requirements of the airplane. A demonstration was given in the smoke-flow tunnel of laminar and turbulent boundary-layer flow and of the effect of rivet heads on the turbulence of the flow.

Atmospheric Wind Tunnel. A demonstration was given in the atmospheric wind tunnel of a tapered wing designed so that the center section of the wing stalled first instead of the tip section. In this demonstration the stalling characteristics of this wing were shown, as well as the stalling characteristics of an ordinary tapered wing which stalled first at the tip section. White silk tufts fastened at various places over the wing surface were used to indicate the character of the air flow, and the model as tested with both wings was mounted so as to be free to rotate and free to pitch about its center of gravity. It was shown that when the tips stalled first the model had a strong tendency to autorotation and spinning, whereas with the wing without tip stall this tendency was very greatly reduced.
At 1:00 p.m. all groups reassembled for lunch at the full-scale wind tunnel, after which, at 2:10 p.m., the entire party gathered in the test chamber of the full-scale wind tunnel where a group photograph was taken.

Physical Research. Charts were then shown presenting in greater detail the Committee’s investigation of the factors involved in the design of a cowling and the new N.A.C.A. nose-type cowling was shown mounted on the front part of a fuselage.

Full-Scale Wind Tunnel. Charts were exhibited of the results of the Committee’s investigation of the effect of aspect ratio for airship fins and of the forces on an airship in ground handling. Information was presented as to the effect of engine nacelles on the stall of highly tapered wings, on the effect of propeller slipstream upon the span loading of wings, and on the effect of locked and windmilling propellers with nacelles located in the leading edge upon the maximum lift coefficient.

Mr. Reid announced that, as shown on the programs, seven simultaneous conferences would be held for the discussion of seven different subjects. He indicated the place of meetings for each of these seven conferences, as well as an assembling point for those desiring to attend each. The party accordingly separated to attend the following seven simultaneous conferences:

I. Flying and Handling Characteristics
II. Aerodynamic Efficiency and Interference
III. Aerodynamic Consideration of Cowling and Cooling
IV. Power Plant Consideration of Cowling and Cooling
V. Aircraft-Engine Research
VI. Seaplanes
VII. Autogiro

CONFERENCE ON FLYING AND HANDLING CHARACTERISTICS

The conference on flying and handling characteristics was held in Room A of the full-scale wind tunnel building at about 3:00 p.m. Honorable Edward P. Warner, a member of the National Advisory Committee for Aeronautics and Chairman of the Committee on Aerodynamics, presided at this conference.
After a brief introductory statement by Mr. Warner the conference proceeded to the consideration of the subject in accordance with the following outline:

1. Lateral control:
   - New criterions for comparison
   - Differential linkages
   - Special wings with unstalled tips

2. Control forces that can be exerted by pilots

3. Lateral stability

4. Longitudinal stability - Measured stability compared with pilot's feel of stiffness

5. Taxying stability

6. Take-off and landing with high-lift devices:
   - Wind-tunnel data
   - Flight results

7. Quantitative measurement of flying and handling qualities

Charts showing results obtained by the Committee in connection with the various subjects in this outline were presented by Mr. Weick and other members of the Committee's technical staff. During the presentation questions were asked by members of the conference and answered by the laboratory personnel, and suggestions for future work were submitted by guests.

Following the discussion, at about 5:00 p.m., the conference adjourned.

CONFERENCE ON AERODYNAMIC EFFICIENCY AND INTERFERENCE.

The conference on aerodynamic efficiency and interference was held in Room B of the full-scale wind tunnel building at about 3:00 p.m. Dr. H. L. Dryden, of the National Bureau of Standards, a member of the Committee on Aerodynamics, presided at this conference.

Charts were presented and explained by members of the Committee's staff and the data covered by the charts
were discussed. Questions were asked and suggestions for future work were submitted by the guests.

The discussion of the subject in general followed the outline given below:

1. Air-flow fundamentals - Scale effect
   Scale effect for the pressure distribution on an airfoil section.
   The nature of the transition phenomenon and its relation to the drag scale effect.
   Airfoil scale effect.

2. Tapered Wings - Application of section data to design of tapered wings.

3. Compressibility effects - Propellers
   Application of compressibility investigations to propellers
   Fundamental investigation

4. Improvement of airfoil sections and wing-fuselage combinations (interference)
   Airfoil section development
   Wing-fuselage interference.

On conclusion of the discussion, at about 5:00 p.m., the conference adjourned.

CONFERENCE ON AERODYNAMIC CONSIDERATION OF COWLING AND COOLING

The conference on aerodynamic consideration of cowling and cooling was held in Room C of the full-scale wind tunnel building at about 3:00 p.m. Dr. George W. Lewis, Director of Aeronautical Research of the National Advisory Committee for Aeronautics, presided at this conference.

Charts were exhibited showing results obtained by the Committee in its study of the aerodynamics of cowling design. Dr. Theodorsen referred to these charts and invited questions as to the information presented therein. A number of questions were asked, to which replies were made by Dr. Theodorsen or others present.
The information presented at this conference included the following subjects:

1. Cowling nose design - Frontal opening
2. Skirt design - Regulation of air flow for cooling
3. Cooling as affected by cowling
4. Effect of propeller on cowling design
5. Effect of baffling of engine - Conductivity
6. Effect and use of spinners
7. Effect of inner cowl - Design of exit opening
8. Effect of size of nacelle or afterbody
9. "Pump efficiency"
10. Factors affecting cooling on the ground
11. Skirt flaps, large hub sections, fans, and blowers
12. Differences in efficiencies of propellers
13. New N.A.C.A. nose-type cowling

At the close of the discussion, at about 5:00 p.m., the conference adjourned.

CONFERENCE ON POWER PLANT CONSIDERATION OF COWLING AND COOLING.

The conference on power plant consideration of cowling and cooling was held in Room D of the full-scale wind tunnel building. Mr. Henry J. E. Reid, Engineer-in-Charge of the Langley Memorial Aeronautical Laboratory, presided.

The results obtained by the Committee in its investigation of cowling and cooling, particularly from the viewpoint of engine cooling, were presented by Mr. Kemper and other members of the Committee's staff. Charts were exhibited and questions and suggestions presented by the guests.
The discussion at the conference included the following subjects:

1. Correction factor for variation in cooling air temperature
2. Investigation of the cooling of the Wasp S1H1-G engine
3. Aerodynamics of investigation of N.A.C.A. cowling
4. Investigation of cowling and cooling of in-line air-cooled engine
5. Finned-cylinder investigation
6. Correlation of cooling obtained in flight and in tests with single-cylinder engine
7. Blower cooling

Following the discussion, at a little after 5:00 p.m., the conference adjourned.

The conference on aircraft engine research was held in the Engine Research Laboratory at about 3:00 p.m. Dr. H. C. Dickinson, of the National Bureau of Standards, a member of the Committee on Power Plants for Aircraft, presided at this conference.

Charts were exhibited and explained by members of the Committee's staff giving results obtained in the investigation of aircraft engines, particularly of the compression-ignition type. The data presented included information as to the new N.A.C.A. fuel flowmeter developed by the laboratory in connection with its investigation of the reduction of fuel consumption of aircraft engines. The subjects discussed at this conference were as follows:

1. Reduction in fuel consumption - N.A.C.A. fuel flowmeter
2. Fuel-injection spark-ignition engines
3. Research on performance obtained with high octane number fuels
4. Distribution and exhaust gas analysis
5. Compression-ignition engine research
6. Investigation of ignition and combustion of Diesel fuels
7. Rate of fuel injection

CONFERENCE ON SEAPLANES.

The conference on seaplanes was held at the N.A.C.A. Tank at about 3:00 p.m. Mr. Starr Truscott, Chief of the Hydrodynamics Division of the Committee's laboratory, presided at this conference.

Charts were exhibited and explained by members of the staff of the N.A.C.A. Tank on the following subjects:

1. Effect of rivets on water drag of seaplane hulls
2. SVA type floats and hydrofoils
3. Ventilation of step of flying-boat hull
4. Wing-tip floats - Hydrodynamic characteristics
5. Wing-tip floats - Aerodynamic characteristics
6. Comparison of stub wings and floats
7. Comparison of single-hull and double-hull designs
8. Comparison of characteristics of improved designs of large seaplanes, both European and American

There was general discussion of the charts and of the problems of seaplane design. In addition to the subjects covered by the charts the following problems were discussed:

Controllability and maneuverability of seaplanes on the water
Form of presentation of results from N.A.C.A. Tank

Minimum time and distance of seaplane take-off - Development of special instruments

Questions and suggestions for future research were submitted by members of the conference and replies made by representatives of the Committee.

Following the discussion, at about 5:00 p.m., the conference adjourned.

CONFERENCE ON THE AUTOGIRO.

The conference on the autogiro was held in the N.A.C.A. hangar at about 3:05 p.m. Mr. John W. Crowley, Jr., head of the Flight Research Section of the Committee's laboratory, presided.

Charts of results obtained by the Committee in its investigation of autogiros were presented and discussed. The following subjects were considered:

1. Stability of the autogiro rotor
2. Rotor vibration
3. Rotor efficiency

Following the discussion, at about 4:30 p.m., the conference adjourned.

* * * * * * * * * *

At the close of the seven afternoon conferences, at about 5:00 p.m., the party, accompanied by members of the Committee's staff at Langley Field, proceeded by automobiles to the Chamberlin Hotel. At 7:00 p.m. the party left Old Point Comfort by steamer and arrived at Washington at 7:00 a.m., Thursday, May 21, 1936.
The following were present at the conference:

Members and Officers of the National Advisory Committee for Aeronautics:

Dr. Charles G. Abbot, Smithsonian Institution,
Dr. Lyman J. Briggs, National Bureau of Standards,
Honorable Willis Ray Gregg, United States Weather Bureau,
Honorable Harry F. Guggenheim,
Rear Admiral Ernest J. King, U.S.N.,
Honorable William P. MacCracken, Jr.,
Brigadier General A. W. Robins, Air Corps, U.S.A.,
Honorable Eugene L. Vidal, Bureau of Air Commerce,
Department of Commerce,
Honorable Edward P. Warner,
Major General Oscar Westover, Air Corps, U.S.A.,
Commander Ralph D. Weyerbacher (C.C.), U.S.N.,
Dr. Orville Wright,

Dr. George W. Lewis, Director of Aeronautical Research,
Mr. John F. Victory, Secretary,
Mr. E. H. Chamberlin, Assistant Secretary,
Mr. H. J. E. Reid, Engineer-in-Charge, L.M.A.L.

Members of Committee on Aerodynamics:

1Honorable Edward P. Warner, Chairman,
2Dr. George W. Lewis, Vice Chairman,
1Dr. Lyman J. Briggs, National Bureau of Standards,
Mr. Theophile dePorte, Materiel Division, Army Air Corps, Wright Field,
Lieutenant Commander W. S. Diehl (C.C.), U.S.N.,
Dr. H. L. Dryden, National Bureau of Standards,
Mr. Richard C. Gazley, Bureau of Air Commerce,
Department of Commerce,
1Honorable Willis Ray Gregg, United States Weather Bureau,
Mr. Lawrence V. Kerber, Bureau of Air Commerce,
Department of Commerce,
Lieutenant Commander R. D. MacCart (C.C.), U.S.N.,
Lieutenant Commander A. C. Miles (C.C.), U.S.N.,
Mr. Elton W. Miller, Langley Memorial Aeronautical Laboratory,
Major James G. Taylor, Air Corps, U.S.A.,
Dr. A. F. Zahm, Division of Aeronautics, Library of Congress.

1Also member of the N.A.C.A.
2Also officer of the N.A.C.A.
Members of Committee on Power Plants for Aircraft:

1Honorable William P. MacCracken, Jr., Chairman,
2Dr. George W. Lewis, Vice Chairman,
Dr. H. C. Dickinson, National Bureau of Standards,
Mr. John H. Geisse, Bureau of Air Commerce,
Department of Commerce,
Mr. Carlton Kemper, Langley Memorial Aeronautical Laboratory,
Lieutenant Commander T. C. Lonnquest, U.S.N.,
Mr. Gaylord W. Newton, Bureau of Air Commerce,
Department of Commerce,
Major E. R. Page, Air Corps, U.S.A.,
Professor C. Fayette Taylor, Massachusetts Institute of Technology.

Representatives of Manufacturers and Operators:

Aeronautical Corporation of America, Cincinnati, Ohio:
Mr. R. E. Schlemmer,

Air-Tec, Incorporated, New York City:
Mr. James B. Taylor, Jr.,

Allison Engineering Company, Indianapolis, Indiana:
3Mr. N. H. Gilman,

American Airlines, Incorporated, Chicago, Illinois:
Mr. Otto E. Kirchner,

Analyses, Incorporated, Philadelphia, Pennsylvania:
Mr. Thomas Carroll,
Mr. T. H. Huff,

Autogiro Company of America, Willow Grove, Pennsylvania:
Mr. A. E. Larsen
Mr. Paul H. Stanley,

Aviation Manufacturing Corporation, Lycoming Division,
Williamsport, Pennsylvania:
Mr. George J. Brew,
Mr. Val Cronstedt,
Mr. M. W. Manchester,

1Also member of the N.A.C.A.
2Also officer of the N.A.C.A.
3Also representing General Motors Corporation
Barkley-Grow Aircraft Corporation, Detroit, Michigan:
Mr. A. S. Barkley,
Mr. D. C. Maier,

Bell Aircraft Corporation, Buffalo, New York:
Mr. Harlan Poyer,

Bell Telephone Laboratories, Incorporated, New York City:
Mr. H. D. Wilson, Jr.,

Bellanca Aircraft Corporation, New Castle, Delaware:
Mr. G. M. Bellanca,
Mr. Andrew F. Haiduck,
Mr. R. D. Morgan,
Mr. N. F. Vanderlipp,

Bendix Products Corporation, South Bend, Indiana:
Mr. John R. Cautley,
Mr. C. V. Johnson,
Mr. J. M. Miller,
Mr. F. C. Mock (East Orange, New Jersey),
Mr. George W. Schairer,

Boeing Aircraft Company, Seattle, Washington:
Mr. Wellwood E. Beall,
Mr. Ralph L. Cram,
Mr. James P. Murray (Washington, D. C.),

Brewster Aeronautical Corporation, Long Island City, New York:
Mr. Vance Breese,

Burnelli Aircraft, Limited, Keyport, New Jersey:
Mr. Fred Barker,
Mr. V. J. Burnelli,
Mr. Stanley Cohen,
Mr. M. E. Grevemberg,
Mr. Dave Weingart,

Central Airlines, Incorporated, Pittsburgh, Pennsylvania:
Mr. J. B. Franklin,
Mr. Luther Harris (Detroit, Michigan),
Mr. J. F. Martin,

Cleveland Pneumatic Tool Company, Cleveland, Ohio:
Mr. E. W. Cleveland,
Mr. L. W. Greve,
Colvin Laboratories, Morristown, New Jersey:
Mr. Charles H. Colvin,

Consolidated Aircraft Corporation, San Diego, California:
Mr. E. N. Gott,
Mr. H. E. Weihmiller (Washington, D. C.),

Continental Motors Corporation, Detroit, Michigan:
Mr. F. T. Gould,
Mr. A. J. Meyer,
Mr. Norman Tilley,
Mr. E. T. Vincent,

Curtiss Aeroplane and Motor Company, Incorporated,
Buffalo, New York:
Mr. Don Berlin,
Mr. R. C. Blaylock,
Mr. Burdette S. Wright,

Curtiss-Wright Airplane Company, Robertson, Missouri:
Mr. G. J. Brandeweide,
Mr. George Page,

Curtiss-Wright Corporation, New York City:
Mr. Robert L. Earle (Washington, D. C.),
Mr. Bruce G. Leighton,
Mr. A. I. Lodwick,
Mr. G. W. Vaughan,
Mr. T. P. Wright,

The Douglas Aircraft Company, Santa Monica, California:
Mr. Frank N. Fleming,
Dr. A. L. Klein,
Mr. John M. Rogers,

E. I. du Pont de Nemours and Company, Incorporated,
Wilmington, Delaware:
Mr. A. Felix du Pont, Jr.,
Mr. Emile du Pont,
Mr. H. B. du Pont,
Mr. R. P. Genereaux,
Mr. Don Smith,

Eastern Air Lines, New York City:
Mr. Charles Froesch,
Mr. S. L. Shannon,

Also representing the Northrop Corporation.
Eclipse Aviation Corporation, East Orange, New Jersey:
  Mr. D. J. Deschamps,
  Mr. C. H. Havill,
  Mr. R. P. Lansing,
  Mr. A. E. Raabe,
  Mr. Z. Soucek,

Engineering and Research Corporation, Washington, D. C.:
  Mr. Henry Berliner,

Fairchild Aircraft Corporation, Hagerstown, Maryland:
  Mr. L. E. Reisner,
  Mr. W. H. Schwebel,
  Mr. Herbert V. Thaden,

Fairchild Aviation Corporation, New York City:
  Mr. Duncan Cox,
  Mr. Richard Depew,
  Mr. Sherman M. Fairchild,
  Mr. Beckwith Havens,
  Colonel J. H. Jouett,
  Mr. J. S. Ogsbury,
  Mr. Hugh Pasmore,

Fleetwings, Incorporated, Bristol, Pennsylvania:
  Mr. Carl de Ganahl,
  Mr. Charles F. de Ganahl,
  Mr. Frank de Ganahl,
  Mr. Wilson L. Sutton,
  Mr. Kenneth B. Walton,

General Electric Company, Schenectady, New York:
  Mr. E. M. Kinney,
  Mr. Ray Stearns,

General Motors Corporation, Detroit, Michigan:
  Mr. N. H. Gilman,

General Tire and Rubber Company, Akron, Ohio:
  Mr. A. G. Maranville,

The B. F. Goodrich Rubber Company, Akron, Ohio:
  Mr. Henry F. Schippel,
  Mr. M. S. Taylor,
  Mr. Harry E. Waner,

1 Also representing Allison Engineering Company.
Granville, Miller, and de Lackner, Springfield, Massachusetts:
Mr. Lee Gehlbach,

Grumman Aircraft Engineering Corporation, Farmingdale, Long Island, New York:
Mr. B. A. Gillies,
Mr. LeRoy R. Grumman,
Mr. W. T. Schwendler,
Mr. Charles Tilgner, Jr.

Gulf Refining Company, Pittsburgh, Pennsylvania:
Mr. Richard E. Fell,
Mr. W. J. Griffith, Jr.,

Gwinn Aircar Company, Incorporated, Buffalo, New York:
Mr. J. M. Gwinn, Jr.,

Hall-Aluminum Aircraft Corporation, Bristol, Pennsylvania:
Mr. Charles Ward Hall,
Mr. G. Sumner Ireland,
Mr. S. D. Weaver,

Hamilton Standard Propellers, East Hartford, Connecticut:
Mr. Erle Martin,
Mr. Carl F. Schory,

Hayes Industries, Incorporated, Jackson, Michigan:
Mr. Charles Hollerith,

Jacobs Aircraft Engine Company, Pottstown, Pennsylvania:
Mr. A. R. Jacobs,
Mr. Henry M. McFadgen,

Kellett Autogiro Corporation, Philadelphia, Pennsylvania:
Mr. Walter R. Jones,
Mr. R. G. Kellett,
Mr. W. W. Kellett,
Mr. C. C. Miller, Jr.,
Mr. R. H. Prewitt,

Lambert Aircraft Corporation, Robertson, Missouri:
Mr. P. R. L. Brooks,
Mr. C. W. Bunch,
Lockheed Aircraft Corporation, Burbank, California:
Mr. Courtlandt S. Gross (New York City),

The Glenn L. Martin Company, Baltimore, Maryland:
Mr. B. C. Boulton,
Mr. Ivan H. Driggs,
Mr. Harlan D. Fowler,
Mr. J. T. Hartson,
Mr. J. S. McDonnell,
Mr. W. W. Symington,

Menasco Manufacturing Company, Los Angeles, California:
Mr. John Harding, Jr.,

National Aviation Corporation, New York City:
Mr. Frank F. Russell,

The Northrop Corporation, Inglewood, California:
Mr. John M. Rogers (Washington, D. C.),

Packard Motor Car Company, Detroit, Michigan:
Colonel J. G. Vincent,

Pan American Airways, New York City:
Mr. H. Franchimont,
Mr. A. A. Priester,

Pennsylvania Aircraft Syndicate, Limited, Philadelphia, Pennsylvania:
Mr. Elliot Daland,
Mr. Ralph McClarren,
Mr. George Spratt,
Mr. E. Burke Wilford,

Pioneer Instrument Company, Brooklyn, New York:
Mr. M. N. Fairbank,
Mr. R. H. Isaacs,

Pitcairn Autogiro Company, Willow Grove, Pennsylvania:
Mr. Paul E. Hovgard,
Mr. Lester D. Seymour,

Pratt and Whitney Aircraft, East Hartford, Connecticut:
Mr. W. A. Parkins,
Mr. T. E. Tillinghast,
Mr. A. V. D. Willgoos,

Also representing the Douglas Aircraft Company.
Ranger Engineering Corporation, Farmingdale, Long Island, New York:
Mr. Walter F. Davis,
Mr. Alfred T. Gregory,

Scintilla Magneto Company, Sidney, New York:
Mr. T. Z. Fagan,

Seversky Aircraft Corporation, Farmingdale, Long Island, New York:
Mr. Roland C. Bergh,
Mr. Alexander Kartveli,

Shell Petroleum Corporation, St. Louis, Missouri:
Major J. H. Doolittle,
Mr. M. Hamon,

Sikorsky Aircraft, Bridgeport, Connecticut:
Mr. M. E. Gluhareff,
Mr. S. E. Gluhareff,
Mr. Y. Jeurosnv,
Mr. I. I. Sikorsky,

Sperry Gyroscope Company, Incorporated, Brooklyn, New York:
Mr. P. R. Bassett,
Mr. C. D. Jobson,
Mr. Cleeman Withers,
Mr. S. J. Zand,

Standard Oil Development Company, New York City:
Major E. E. Aldrin,
Mr. Robert E. Ellis,
Mr. Fred MacPhaul,

The Stearman Aircraft Company, Wichita, Kansas:
Mr. Deed Levy,
Mr. Earl Schaefer,

Summerill Tubing Company, Bridgeport, Pennsylvania:
Mr. J. P. Boore,
Mr. J. P. Dods,

Taylor Aircraft Company, Bradford, Pennsylvania:
Mr. Edward R. Burn,
Mr. Walter C. Jamouneau,
Mr. George B. Thorp,

Taylorcraft, Butler, Pennsylvania:
Mr. C. G. Taylor,
TWA, Incorporated, Kansas City, Missouri:
   Mr. W. A. Hamilton,

United Aircraft Corporation, East Hartford, Connecticut:
   Mr. Charles H. Chatfield,
   Mr. C. W. Deeds,
   Mr. Thomas B. Rhines,
   Mr. George S. Wheat,
   Mr. B. L. Whelan,

United Air Lines Transport Corporation, Chicago, Illinois:
   Mr. William A. M. Burden (New York City),
   Mr. D. B. Colyer,
   Mr. E. P. Lott,
   Mr. Sumner Sewall (Bath, Maine),
   Mr. C. C. Thompson (Washington, D. C.),
   Mr. H. O. West,

The Viking Flying Boat Company, New Haven, Connecticut:
   Mr. F. T. Kurt,

Chance Vought Aircraft, East Hartford, Connecticut:
   Mr. P. S. Baker,
   Mr. R. B. Beisel,
   Mr. C. J. McCarthy,
   Mr. E. E. Wilson,

The Waco Aircraft Company, Troy, Ohio:
   Mr. A. Francis Arcier,

Western Electric Company, Incorporated, New York City:
   Mr. F. C. McMullen,

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania:
   Dr. Frank Conrad,

Wright Aeronautical Corporation, Paterson, New Jersey:
   Mr. Burnham Adams,
   Mr. Kenneth Browne,
   Mr. George Chapline,
   Mr. Rudolph Daub,
   Mr. M. B. Gordon,
   Mr. Henry Hill,
   Mr. Arthur Leak,
   Mr. Arthur Nutt,
   Mr. Raymond Young,

Zap Products Corporation, Baltimore, Maryland:
   Mr. Temple N. Joyce.
Representatives of Aeronautical Industrial Societies:

Aeronautical Chamber of Commerce, Washington, D.C.:
Mr. W. C. Clayton,
Mr. Louis R. Inwood,

Institute of the Aeronautical Sciences, Incorporated, New York City:
Mr. Lester D. Gardner,

Manufacturers Aircraft Association, New York City:
Mr. James M. Clark,
Mr. John A. Sanborn.

Representatives of Aeronautical Journals:

AERO DIGEST, New York City:
Dr. Michael Watter,

AVIATION, New York City:
Mr. S. Paul Johnston,
Mr. Leslie E. Neville,
Mr. George Newbold,

NATIONAL AERONAUTIC MAGAZINE, Washington, D.C.:
Mr. W. R. Enyart,
Mr. Wayne W. Parrish,

SCIENCE SERVICE, Washington, D.C.:
Mr. Robert D. Potter,

SCIENTIFIC AMERICAN, New York City:
Professor Alexander Klemin,

TIME, New York City:
Mr. Thomas McAvoy (Washington, D.C.),

U. S. AIR SERVICES, Washington, D.C.:
Mr. Earl N. Findley.

Representatives of the Press:

Associated Press:
Mr. Stephen McDonough,

Hampton DAILY PRESS:
Mr. J. R. Long,
New York SUN:
  Captain Sherman Altick (Washington, D. C.),

New York TIMES:
  Mr. R. M. Cleveland,

Washington POST:
  Mr. Sam Lubell,

Washington STAR:
  Mr. Joseph S. Edgerton,

Press Photographer (Harris and Ewing):
  Mr. James Rothrock.

Special Guests:

Captain E. E. Adler, U.S.A.,
Major General Frank M. Andrews, U.S.A., Langley Field,
Lieutenant A. D. Ayrault, U.S.N.,
Mr. Emmon Bach, New York City,
Mr. Ismar Baruch, Civil Service Commission,
Colonel Turner W. Battle, Department of Labor,
Mr. R. S. Boutelle, Bureau of Air Commerce, Department of Commerce,
Mr. C. A. Burner, Bureau of Air Commerce, Department of Commerce,
Captain L. T. Chalker, U. S. Coast Guard,
Colonel V. E. Clark, New York City,
Mr. W. D. Clark, Bureau of Aeronautics, Navy Department,
Rear Admiral H. I. Cone, U.S.N. (Retired), Washington, D. C.,
Captain A. B. Cook, U.S.N.,
Mr. M. P. Crews, Bureau of Air Commerce, Department of Commerce,
Lieutenant Commander J. G. Crommelin, U.S.N.,
Mr. H. K. Cummings, National Bureau of Standards,
Mr. Luis de Florez, New York City,
Colonel F. G. Diffin, New York City,
Captain H. C. Downey, U.S.A.,
Lieutenant Colonel R. C. Dunn, U.S.A.,
Mr. James C. Edgerton, Bureau of Air Commerce, Department of Commerce,
Mr. John Easton, Bureau of Air Commerce, Department of Commerce,
Major General B. D. Foulois, U.S.A. (Retired), Atlantic City, New Jersey,
Mr. W. Z. Frisbie, Bureau of Aeronautics, Navy Department,
Mr. Corrington Gill, Works Progress Administration,
Mr. J. T. Gray, Bureau of Air Commerce, Department of Commerce,
Mr. Norman B. Haley, Interstate Commerce Commission,
Captain S. C. Hooper, U.S.N.,
Major C. W. Howard, U.S.A.,
Mr. R. S. Huested, Bureau of Air Commerce, Department of Commerce,
Dr. J. C. Hunsaker, Massachusetts Institute of Technology,
Rear Admiral A. W. Johnson, U.S.N.,
Mr. C. S. Jones, Casey Jones School of Aeronautics,
Mr. H. Kampf, New York City,
Commander S. M. Kraus, U.S.N.,
Mr. E. K. Lasswell, Materiel Division, Army Air Corps,
Wright Field, Dayton, Ohio,
Mr. Jerome Lederer, Aero Insurance Underwriters,
Mr. Robert E. Lees, Works Progress Administration,
Mr. D. M. Little, U.S. Weather Bureau,
Mr. F. A. Louden, Bureau of Aeronautics, Navy Department,
Captain R. V. Laughlin, U.S.A.,
Colonel Leslie MacDill, U.S.A.,
Mr. Rex Martin, Bureau of Air Commerce, Department of Commerce,
Mr. Frederick R. Neely, Bureau of Air Commerce, Department of Commerce,
Colonel R. Olds, U.S.A.,
Major W. B. Persons, U.S.A.,
Brigadier General H. C. Pratt, U.S.A.,
Colonel E. J. W. Proffitt, New York City,
Rear Admiral W. S. Pye, U.S.N.,
Mr. Raymond B. Quick, Bureau of Air Commerce, Department of Commerce,
Mr. James C. Reddig, New Haven, Connecticut,
Captain H. C. Richardson (C.C.), U.S.N.,
Mr. James D. Redding, Bureau of Air Commerce, Department of Commerce,
Mr. Fred E. Schnepf, Public Works Administration,
Mr. F. R. Shanley, Bureau of Air Commerce, Department of Commerce,
Colonel W. Sumpter Smith, Works Progress Administration,
Admiral W. H. Standley, U.S.N.,
Captain J. L. Stromme, Air Corps, U.S.A.,
Rear Admiral Robert Stocker (C.C.), U.S.N. (Retired),
Mr. Cammy Vinet, Chief of Aeronautics, Harrisburg, Pennsylvania,
Mr. J. Vitol, Bureau of Air Commerce, Department of Commerce,
Mr. A. A. Vollmecke, Bureau of Air Commerce, Department of Commerce,
Mr. J. F. Warlick, Bureau of Air Commerce, Department of Commerce,
Dr. Alexander Wetmore, Smithsonian Institution,
Mr. Edgar W. Woolard, U. S. Weather Bureau,
Mr. John S. Wynne, Bureau of Air Commerce, Department of Commerce,
Commander S. J. Zeigler (C. C.), U. S. N.