CIVIL AERONAUTICS AUTHORITY

Technical Development Report No 7

DEVELOPMENT OF A SAFETY AND PLANNING PROGRAM

By RICHARD C GAZLEY

Chief, Safety and Planning Division

Formerly Report No 7, Safety and Planning Division, Bureau of Air Commerce, Department of Commerce, Reprinted by the Civil Aeronautics Authority

APRIL 1938

UNITED STATES GOVERNMENT PRINTING OFFICE

WASHINGTON 1940

CONTENTS

	Page
SUMMARY	1
INTRODUCTION	1
Details of Safety and Planning Functions	1
Details of Organization	2
PROCEDURE FOLLOWED	2
Routine Projects	2
Special Projects Previously Started	3
New Special Projects	3
RESULTS OF SURVEY	3
DISCUSSION	4
Separation of Routine Projects	4
Classification of Special Projects as to Type	4
Service Projects	4
Planning Projects	4
Classification of Special Projects as to Subject	5
Airways, Airports, and Navigation Facilities	5
Air Traffic Control and Communications	5
Aircraft, Power Plants, and Equipment	5
Airmen	5
Air Carrier Operation	5
Fostering Air Commerce	5
United States Aviation Policy	5
Project Classification vs Administrative Organization	5
Realignment of Charts	6
FINANCES	6
PROJECTS IN PROCESS	6
CONCLUSIONS	6
INDEX TO CHARTS	7
APPENDIX	23

DEVELOPMENT OF A SAFETY AND PLANNING PROGRAM

SUMMARY

Following the organization in the Bureau of Air Commerce of a separate unit for the prosecution of all safety and planning work a survey of all authoritative aviation sources was made to determine in detail the conceived duties of such a unit

The voluminous results of this survey were analyzed with reference to the basic legislation under which the Bureau operates and were classified as to type and objective A summary of the final classification listing all of the detail projects under consideration, is given on Chart No 22

It is concluded that the amount of safety and planning work required to effectively discharge the obligations of the Bureau is so large in comparison with the resources available that appreciable progress can only be expected on some of the items of the most urgent nature

Details of the safety and planning work now in progess have been tabulated and are presented in the appendix to this report

INTRODUCTION

Prior to 1937 the plan of operation of the Bureau of Air Commerce required each Division thereof to assume responsibility, not only for its routine regulatory or maintenance functions, but also for such planning and other special work as was necessary to anticipate future development and to solve the numerous pressing problems which always associate themselves with a rapidly growing industry This system was well adapted to earlier aviation development but continued expansion of the industry has made it unsatisfactory It was difficult, if not impossible, to effect coordination and stability within the Bureau with reference to working toward planned objectives Furthermore the various Divisions were so pressed with a large volume of imperative routine work that it was impossible for them to give full consideration to anything else

To improve this situation there was created in the Bureau on July 1, 1937, a new Division to be known as the Safety and Planning Division The purpose of this Division is to relieve all other Bureau Divisions of all work looking to the future, thereby serving as a coordinating agency devoted to the thoughtful planning and detail work necessary to reach sound and intelligent objectives Such objectives involve all of the policies, procedures, and mechanical development required to reach and retain fully effective administration of the Air Commerce Act

Details of Safety and Planning Functions

Preliminary study and analysis showed that the safety and planning obligations of the Bureau under the Air Commerce Act required attention to the following subjects

1 A national civil airways system,
2 Air carrier operation problems,
3 Safe and efficient—
  (a) aircraft,
  (b) aircraft instruments,
  (c) aircraft power plants,
  (d) aircraft equipment, and
  (e) air navigation facilities,
4 International air navigation arrangements,
5 A national program of aeronautical education,
6 Private flying problems,
7 Other nonschedule flying, and
8 Any other air commerce matters of interest to the Federal Government

Continuing the analysis further there are, as is well known, other Federal agencies which are obligated to interest themselves in portions of some of the foregoing subjects These include the National Advisory Committee for Aeronautics and the National Bureau of Standards, both of which engage in fundamental technical research, the Army Air Corps and the Bureau of Aeronautics, Navy Department, which conduct some technical research and development of interest to civil aeronautics, the Department of State, which supervises international matters, the Bureau of Foreign and Domestic Commerce, the Interstate Commerce Commission, the Post Office Department, and the Department of Labor In addition there exist numerous nongovernmental agencies, such as manufacturers, operators, and universities which have well-equipped laboratories and conduct a great deal of valuable aeronautical research work

A significant factor in this connection, however, is that all of such work which is applicable to civil aviation regulation or promotion must come to the attention of the Bureau of Air Commerce for such application This is fortunate for purposes of Federal coordination and is further fortunate in that it permits the Bureau of Air Commerce to function without a research laboratory and without foreign offices and thus automatically prevents duplication of effort

It is obvious from the foregoing discussion that one of the chief functions of the Bureau of Air Commerce is to maintain familiarity with aeronautical research activities in all agencies to the end that they may be guided and coordinated to fit the needs of civil aviation

An additional function which is equally obvious after some thought arises from the inevitable characteristic of newly evolved theories, formulae, ideas, and mechanisms They must always be subjected to a period of scrutiny, trial, and modification known as study and development before they can be applied to the practical usage of safeguarding lives In this field no agency except the Bureau of Air Commerce has the experience or means to act

Details of Organization

The organization which was planned for effectively discharging these functions consists of eight Sections as follows

1 Aircraft Section
2 Airport Section
3 Air Transport Section
4 Educational Section
5 International Section
6 Power Plant Section
7 Radio Development Section
8 Private Flying Section

None of these Sections is fully manned as yet At the moment of writing there is, in fact, no personnel assigned to the Educational and Private Flying sections Deliberation in completing the staff has been dictated by the following factors

(a) Budgetary limitations
(b) A desire to reach a full understanding of the exact projects which would be required of each Section
(c) An indicated need for finding and appointing outstanding experts in the fields of activity involved

A skeleton staff was organized largely by transferring to the new Division some of the Bureau personnel previously engaged in related work Complete development of the staff complement will probably take several years, dependent upon the funds available

PROCEDURE FOLLOWED

A plan of general activity having been developed the next step was obviously a determination, in detail, of the specific work to be undertaken In this connection several fundamental factors were immediately obvious as will appear from the following discussion

Routine Projects

Analysis of the functions of the Bureau, combined with past experience, showed that there were a number of projects of a continuous or recurring nature which automatically became obligations of the Safety and Planning Division

It is obvious for example that an agency can have no satisfactory knowledge of trends in aviation development, the regulatory or developmental needs of the industry or the possibilities of supplying improved airway equipment, unless it maintains a close liaison with the research laboratories and other agencies throughout the country (or indeed in the entire world) that contribute to aviation advancement and unless it maintains continuous contact with aircraft manufacturers and operators

A further illustration lies in the fact that the Secretary of Commerce is the recipient of a large volume of correspondence and importunities from people claiming to have new ideas or inventions which will contribute to the advancement of aeronautical science or flight safety The subject matter of these submissions may be of a mechanical nature or it may deal with the regulations or organization of the Bureau of Air Commerce Most of these people request Federal funds for the development of their ideas to the point of practical application They must all be considered on the merit of the idea advanced to the end that worthwhile developments may be encouraged When the subject matter falls within the jurisdiction of other agencies it must at least be appropriately referred

Here, therefore, is a group of inescapable projects for incorporation in the Bureau's Safety and Planning program They will be referred to as "Routine Projects" and form the background for the prosecution of safety and planning work

Special Projects Previously Started

A number of special projects of a nonroutine nature were already proceeding in the Bureau or in outside agencies under contract with the Bureau

This was particularly the case with respect to radio air navigation facilities as has been shown in some of the Bureau reports which have been published in the past few months Radio landing system experimentation has covered a period of ten years and radio teletypewriter work a period of seven years Other illustrations existed in the several contracts to which the Bureau was committed in connection with airplane and engine developmental activities, medical studies and the like

Prosecution of these projects therefore became an immediate and indisputable part of the program to be followed They were accordingly assigned to the appropriate Sections for suitable action

New Special Projects.

Having provided for what might be termed the "fixed obligations" of the Bureau as exemplified by routine projects and special projects previously started, it then became necessary to decide upon the new special projects which would be undertaken with any funds and facilities which might remain available

This phase of the work under discussion is at once the most significant and the most complex Even a cursory consideration brings to mind the wide range of diverse subjects involved, the difficulty of attempting to foresee future developments, the length of time required to complete a project once launched and the danger of poor judgment in estimating relative importance when attempting to establish priorities

At this juncture it was decided to appeal to all the authoritative sources available for suggestions and comments It was hoped that this procedure would be helpful in establishing the basis for a sound and constructive program which would be pursued if and as funds therefor became available

Accordingly all persons in executive or authoritative positions in governmental and nongovernmental aviation agencies, including Bureau of Air Commerce personnel, and in all scientific and manufacturing aviation organizations were contacted by letter, telephone, or personal visit If any were missed, such omission was unintentional and they are herewith sincerely requested to forward any suggestions or comments which occur to them The Congressional Record was also consulted for help or instruction in this connection

RESULTS OF SURVEY

The excellent and voluminous response to the Bureau's request for suggestions is indicative

of the genuine need for constructive effort in this field

All of the material received was analyzed and separated in accordance with the functional organization of the Safety and Planning Division All projects, including those of a routine nature, the special ones previously started, and the proposed new ones, were then carefully listed in accordance with these functional groupings Wherever possible the order of listing represents the approximate order in which the projects might logically be undertaken, either by reason of established priority, or importance, or the relative probability of an early solution to the problem involved It must be realized, however, that the accuracy of the order of listing is problematical and that the actual schedule of solutions will be dependent upon future developments

It will also be noted in the case of the Educational and International sections particularly that most of the projects listed are simultaneous and therefore have no priority

The lists, by Sections, are included herein on Charts 1 to 7, which serve as working charts for the further analysis which follows

In reading the charts it will be observed that identical or similar subjects are in some instances, listed for two different Sections Where this is the case it indicates that each Section will work on a different aspect of the project Projects relating to private flying are assigned temporarily to the existing Sections, pending the establishment of a Private Flying Section

DISCUSSION

Examination of the 162 items listed on Charts 1 to 21 shows that the volume of work to be done makes it difficult to obtain a clear understanding of the objectives involved The situation is further confused by the fact that some of the projects are routine and therefore continuous, some will involve such a long period of effort as to be semi-continuous and others are relatively short It seemed wise at this point therefore to attempt to clarify the matter by further classification, taking into consideration the ultimate objectives

Separation of Routine Projects.

As a first step, in order to expedite analysis, it was decided to remove from the charts all routine or background projects Such projects are of an administrative nature and are in a somewhat different category from the rest This leaves for consideration, therefore, only projects which might be expected to be completed and discontinued at some time in the future, length of time being dependent upon the state of a particular art or science These are the items which have been referred to as "Special Projects" in the foregoing

Classification of Special Projects as to Type

Detailed examination of the special projects shows that they fall into two broad categories, dependent upon the circumstances from which they arise and the immediate urgency of completion These categories are as follows

Service Projects—Those special projects which are classified under this heading are the projects directed toward improved safety under existing conditions They are dictated by some immediate need and usually it is necessary that their solutions look to the present rather than the future

Examples of this type of projects are those directed toward reliable functioning of the existing radio ranges and assistance in the inspection and tests of the new ones now being installed As a long-range proposition it is hoped that many of the problems involved will be solved by the use of ultra high frequencies but that, as a complete solution, is some distance in the future and is moreover still problematical, so more immediate measures are desirable if procurable

Projects dealing with the procurement and application of specific new design information for aircraft and those directed to certain immediate airport problems, as well as many others, are in the same category

This type of project will undoubtedly always exist and will usually be of an imperative nature because some part of the Bureau or the industry will be unable to proceed with full knowledge of the facts until such projects are accomplished For this reason they will usually require priority over other projects

Service projects, therefore, are projects arising from existing conditions and which must be undertaken whether or not they direct themselves to long range objectives

Planning Projects—Projects associated with planning are of a long-range nature and are directed

toward planned objectives which it is the duty of the Bureau to reach if possible They may be completely disassociated from existing systems, schemes, or mechanisms if it appears that the objective requires investigation along new lines but will not necessarily be so disassociated

This type of project, which suggests raising one's self above the horizon for the purpose of studying the broader aspects of the civil aeronautics situation, is by far the most important of the two categories It is unfortunate that circumstances dictate priority to the Service Projects instead of these

Classification of Special Projects as to Subject.

It is obvious, and has been stated in the foregoing, that planning projects, by their very nature, require planned objectives The objectives are necessary to give direction to air commerce work on the part of Government

It is, of course, impossible for anyone at any time to delineate in detail the ultimate scheme of any objective and it is difficult, if not impossible, to visualize all the details of an objective, which, when reached, could be pronounced entirely satisfactory It is for that reason, in fact, that planning work devoted to filling in the details is mandatory It is possible however, to specify the subjects with which such objectives will deal Furthermore, the grouping of projects under such subjects tends to focus and correlate all work to the end that the objective may at least be approached as closely as the state of the art permits.

The objectives which appear to be appropriate and adequate for the work under discussion are described in the following paragraphs

Airways, Airports, and Navigation Facilities—The objective thus entitled is the best airways system obtainable, as determined by the state of the art and the needs of both national defense and air commerce, the term "airways system" including all ground facilities

Air Traffic Control and Communications—This objective contemplates the best possible system for the safe and expeditious movement of all air traffic over the airways, including the general plan, the procurement and dispatch of necessary information and the mechanisms involved and based upon the thought that the Federal airways are for the benefit of all citizens

Aircraft, Power Plants, and Equipment—This objective contemplates bringing aircraft and their equipment to a state of perfection which permits their safe use of the airways facilities provided, and maintaining them in such condition.

Airmen—This objective involves the general system used for the inspection and certification of airmen and the details thereof, this type of project also being necessary to indicate the human characteristics which dictate airways and aircraft characteristics

Air Carrier Operation—This objective involves the details essential to adequate and constructive control of air carrier operations, both scheduled and nonscheduled.

Fostering Air Commerce—This subject includes all items tending to promote the sound growth of air commerce through added usefulness of aircraft, increased private flying, methods of reducing costs, added interest and more accurate knowledge on the part of educational institution graduates and accomplishments of a like nature

United States Aviation Policy—This subject involves both foreign and domestic matters and has many subheadings, including the development and application of a coordinated plan of international air commerce relations, an adequate cooperative plan between Federal and State governments, the trend and rigidity of air regulations as they affect air commerce, and all similar matters

It is considered desirable to group Service Projects under the headings used for Planning Projects as this helps to keep the two types of projects coordinated as much as the circumstances will permit As a matter of fact it will be seen from the charts which follow that it has been possible by this means to inject a sufficient element of planning into some of the Service Projects and vice versa so that it is difficult to decide in which category they belong The categorical classification of borderline cases is not particularly important, however

Project Classification vs. Administrative Organization

It will be noted that the project classification described in the foregoing paragraphs is largely unrelated to the functional organization of the Bureau and of the Safety and Planning Division It is apparent, however, that this difference is possible and desirable for the reason that abstract matters can be best analyzed and understood when not subjected to the physical restrictions which shape organizations Such restrictions relate to the general lack of diversity of qualifications which can be ex-

pected in single individuals, the routine best suited to the handling of details and matters of that character, none of which are pertinent to an abstract analysis

Realignment of Charts

The present and proposed projects, except those completed at this date and except Routine Projects, are presented on Chart 22, reclassified in accordance with the objective classifications discussed in the foregoing paragraphs It is to be noted that, while the objectives will remain essentially unchanged until accomplished the detailed projects listed thereunder will be added to and subtracted from as progress is made toward the conceived ultimate The projects on which work is now going forward are those which are followed by a blocked-in circle

FINANCES

A carefully made estimate of the funds required to proceed with all of the projects listed, plus an appropriate reserve for such Service Projects as may arise, results in a total of $1 903,152 for the fiscal year 1938–39 Since it appears likely that only a fraction of that sum will be available the progress which may be expected is not particularly great, especially with reference to Planning Projects

PROJECTS IN PROCESS

The projects, other than Routine Projects, which were being worked on as of March 1, 1938, are described in the appendix attached to this report, and are marked by solid circles on Chart 22

CONCLUSIONS

From the foregoing analysis and discussion the following conclusions are drawn

1 The safety and planning functions of the Bureau of Air Commerce relate to the regulation and fostering of air commerce by
   (a) establishing the objectives of Federal participation,
   (b) coordinating the work of all agencies which contribute to those objectives,
   (c) conducting or sponsoring all necessary developmental work, and
   (d) applying the results

2 A considerable amount of background liaison work, designated as Routine Projects, is necessary in connection with the foregoing obligations

3 Safety and planning work directed to special projects is divided into two broad categories which are best described as Service Projects and Planning Projects

4 All special projects, and particularly all Planning Projects should be directed to an understanding and attainment of the conceived ultimate with reference to the following seven subjects
   (a) Airways, Airports, and Navigation Facilities
   (b) Air Traffic Control and Communications
   (c) Aircraft, Power Plants, and Equipment
   (d) Airmen
   (e) Air Carrier Operation
   (f) Fostering Air Commerce
   (g) United States Aviation Policy

5 Little or nothing can be done on Planning Projects unless the safety and planning appropriation is sufficient to provide therefor over and above the amount required for Routine Projects and Service Projects because those two types are of an urgent nature

6 The projects which are already on the schedule indicate a need for an annual safety and planning appropriation of approximately $2,000,000 which is far more than is at present being made available

INDEX TO CHARTS[1]

PRESENT AND PROPOSED PROJECTS	Page
Chart 1, Aircraft Section	7
Chart 2, Airport Section	11
Chart 3, Air Transport Section	13
Chart 4, Educational Section	15
Chart 5, International Section	16
Chart 6, Power Plant Section	16
Chart 7, Radio Development Section	17
Chart 8, Summary Chart	20

Chart 1—AIRCRAFT SECTION

Present and Proposed Projects

1 EXPERIMENTAL FUNK AIRPLANE.—Supervision of the performance of the existing contract with Funk Aircraft Company for an experimental airplane

2 EXPERIMENTAL TAILLESS AIRPLANE.—Supervision of the performance of the existing contract with Management & Research Incorporated for an experimental tailless airplane

3 DEVELOP METCALF BLIND LANDING INSTRUMENT AND SYSTEM.—Supervision of the performance of the existing contract with Massachusetts Institute of Technology for a blind landing instrument and system

4 AIRPORT ORIENTATOR.—Supervision of the performance of the existing contract with Sperry Gyroscope Company for an Airport Orientator, which is an instrument for the reproduction in the aircraft cockpit of a properly orientated chart of an airport Supervision of the flight testing of the instrument by various airlines

5 AUTOMATIC INSTRUMENT LOG.—Supervision of the performance of the existing contract with Fairchild Aerial Camera Corporation for an Automatic Instrument Log, which is an instrument for recording instrument readings and control settings in the aircraft cockpit continuously and automatically Complete flight testing of the instrument.

6 NEW DEVELOPMENTS.—Obtaining all available information concerning new developments pertaining to, or having a possible application to aircraft, aircraft instruments, and aircraft equipment This includes the reading of all technical publications, the obtaining of information from the agencies carrying out the developments, and the inspection of new aircraft, instruments, and devices This is a routine project

7 INVENTIONS AND IDEAS.—A thorough study of all inventions and ideas submitted to the Bureau with a view to encouraging inventors to further perfect their devices or to including promising inventions or ideas in the Bureau's development program This is a routine project

8 ICE FORMATION ON AIRCRAFT.—Assistance in the development of suitable means for the prevention of ice formation on aircraft control surfaces, windshields, and instrument pitot heads Recommendations as to airworthiness regulations having to do with the elimination of the ice hazard Assistance in the possible further development of wing de-icers and propeller de-icers Study, in cooperation with the National Advisory

[1] For status of Private Flying Section, see page 4

Committee for Aeronautics of the fundamental factors concerning ice formation on aircraft

9 VIBRATION AND FLUTTER.—Thorough study of the entire subject of vibration as it affects the aircraft structure, power plant, instruments, accessories, and equipment Assistance in the development of equipment properly to detect, measure, and analyze vibration Development of technique for the detection, measurement, and analysis of vibrations by testing aircraft and analyzing the test results Assistance in the formulation of methods for the elimination of undesirable vibrations in aircraft Recommendations as to airworthiness regulations having to do with vibrations in aircraft This project probably will continue for two more years

10 ULTRA-HIGH-FREQUENCY WAVE GENERATOR AND DETECTOR.—Development of an ultra-high-frequency wave generation and detection device for use in several instrument projects

11 LIGHTNING.—Study in cooperation with the National Advisory Committee for Aeronautics, of the subject of lightning strikes on aircraft and their effect Development of suitable means for the prevention of accidents or serious damage due to lightning strikes Recommendations as to airworthiness regulations having to do with lightning strikes Part of this project probably will continue for two more years

12 GLIDER CONSTRUCTION MANUAL.—Enter into and supervise the performance of a contract with the Soaring Society of America for the compilation of a "Glider Construction Manual" to be published by the Bureau for use in conjunction with its airworthiness regulations having to do with gliders

13 PATENT LAWS AND REGULATIONS.—A survey of patent laws and regulations as affecting Bureau development contracts and inventions and ideas submitted to the Bureau, and the formulation of appropriate Bureau action and policy

14 TRICYCLE LANDING GEAR.—Study of all available data and the determination, by means of a test program, of the loads on the tricycle type landing gear, handling qualities and desirable shock-absorption characteristics and design features of this type of gear Recommendations as to airworthiness regulations having to do with the tricycle type landing gear

15 MONOCOQUE DESIGN.—Compilation of all available data on monocoque design, in cooperation with A-N-C Committee and National Advisory Committe for Aeronautics Development of a general monocoque theory such that reasonably accurate analysis of any such structure can be made Recommendations as to airworthiness regulations having to do with monocoque structures This is a long project

16 AIRFOIL SPAN AND CHORD LOAD DISTRIBUTION.—Cooperation with the National Advisory Committee for Aeronautics in the development of simple methods, checked by flight tests, to predict span and chord distribution on airfoils such as can be easily used in investigating strength and flight characteristics for the purpose of design Cooperation with the National Advisory Committee for Aeronautics in the correlation of wind-tunnel and flight test data on airfoils Recommendations as to airworthiness regulations having to do with span and chord load distribution

17 ABSOLUTE ALTIMETER AND OBJECT DETECTOR.—Development of an absolute altimeter, independent of barometric pressure The instrument developed to be such that it can be used also as an object detector or a collision prevention device

18 SIMPLE RECORDING ACCELEROMETER.—Cooperation with the National Advisory Committee for Aeronautics in the development of a simple recording accelerometer for use by Bureau inspectors in routine testing and for use in obtaining aircraft landing reactions

19 AIRCRAFT LANDING REACTIONS.—In cooperation with the National Advisory Committee for Aeronautics the installation of recording accelerometers in various aircraft to collect data to enable the establishment of the en-

velope of the landing reaction for both land and water aircraft Recommendations as to pertinent airworthiness regulations and as to suitable airport paving

20 Hull Pressure Distributions —In cooperation with the National Advisory Committee for Aeronautics, the installation of pressure recorders in the hulls of various aircraft to collect data for statistically determining design pressure distributions Recommendations as to pertinent airworthiness regulations

21 Sea-wing Loading —Investigation, in cooperation with the National Advisory Committee for Aeronautics, of loads imposed upon sea-wings Investigation of their effect upon the aircraft characteristics involved in its airworthiness Recommendations as to pertinent airworthiness regulations

22 Aircraft Take-off and Landing Measurements —Development, in cooperation with Airport Section and Certificate and Inspection Division, of instruments and necessary technique to measure aircraft take-off and landing for the use of Bureau Inspectors

23 Aircraft Landing Lights —Development, in cooperation with National Bureau of Standards, of suitable landing lights for aircraft Recommendations as to pertinent airworthiness regulations

24 Certification of Mechanics.—Thorough study of the subject of certification of airplane and engine mechanics Recommendations as to the procedure the Bureau should follow in this matter

25 High Altitude Flight —Investigation of the effects of high altitude flying upon those functions of the airplane involved in its airworthiness Recommendations as to pertinent airworthiness regulations if necessary Cooperate with Air Transport Section in study of high altitude flying as affecting pilot fatigue and passenger comfort Recommendations as to pertinent airworthiness regulations if necessary

26 Lighter-than-air Aircraft —Thorough study of the entire lighter-than-air situation to guide the Bureau in a Lighter-Than-Air Policy

27 Perfect Metcalf Blind Landing Instrument and System —Construction of the Metcalf blind landing system developed under Project No 3 for actual use by aircraft Complete flight testing of the system and instrument

28 Aircraft Launching Devices —Thorough study to determine the necessity for a launching device for transport aircraft Thorough study to determine the best type of device for this use This project probably will lead to another such as "Assistance, in cooperation with other agencies, in the development of an aircraft launching device '

29 Mechanical Interruptions to Flight —Thorough study and analysis of mechanical interruptions to flight and accidents caused by mechanical failures Recommendations as to any necessary changes in airworthiness regulations as a result of this study

30 Parachutes —Thorough study of all parachute problems Recommendations as to any necessary regulations pertaining to riggers, jumpers, jumps, and possibly parachutes themselves

31 Windshields —Development of means to safeguard pilots and prevent damage to windshields when struck by birds in flight Recommendations as to pertinent airworthiness regulations Cooperation with the National Advisory Committee for Aeronautics and National Bureau of Standards in developing a flexible substitute for glass

32 Aircraft Wheels —Development of improved wheel brakes, with special emphasis on those for larger aircraft Investigation of the possibilities of an electric brake Investigation to determine the necessity for anti-corrosion treatment for magnesium wheels Recommendations as to pertinent airworthiness regulations Investigation and development of shock-absorbing wheels

33 Aircraft Position Lights —Study, in cooperation with National Bureau of Standards, of aircraft position light developments

Recommendations as to pertinent airworthiness regulations when considered necessary

34 Aircraft Instrument Lights—Study, in cooperation with National Bureau of Standards, of aircraft instrument lighting developments Recommendations as to pertinent airworthiness regulations when considered necessary

35 Aviation Colors—Determination, in cooperation with the National Bureau of Standards of the optimum specifications for aviation colors Recommendations as to pertinent regulations

36 Glider Operations Manual—Enter into and supervise the performance of a contract with the Soaring Society of America for the compilation of a "Glider Operations Manual" to be published by the Bureau for use in conjunction with its airworthiness regulations having to do with gliders

37 Three component Accelerometer—Development, in cooperation with the National Advisory Committee for Aeronautics, of an instrument, or instruments, to obtain and record all three components of linear and angular accelerations of an aircraft, both in flight and in landing

38 Ground Speed Indicator—Study of the possibilities of obtaining a true ground speed indicator and the development thereof

39 Two control Aircraft—Investigation of "two-control" operation as it affects the aircraft's airworthiness Recommendations as to pertinent airworthiness regulations if necessary

40 Effects of Age and Use upon Aircraft—Investigation of the effects of age and use upon the strength of typical aircraft structures Recommendations as to pertinent airworthiness regulations if necessary

41 Generator Failure Warning Light—Development of a warning light in the cockpit of an aircraft to indicate failure of the electric generator

42 Simple Strain Gauge—Development of a simple strain gauge for use by Bureau inspectors in routine testing

43 New Materials for Aircraft—Cooperation with the National Advisory Committee for Aeronautics and National Bureau of Standards to determine the properties and characteristics of new materials suitable for aircraft use This is a recurring project

44 Airworthiness and Design Practice—Correlation of number of accidents for a given type of airplane to determine whether present regulations and practices are producing the safest airplane compatible with reasonable design practice with special emphasis on aircraft used for miscellaneous flying purposes Thorough study of the aircraft airworthiness requirements with a view to ascertaining that the minimum design requirements are on the basis of "safety" rather than on "reliability"

45 Reconciliation of the Differing Stress-Analysis Requirements—Cooperation with A–N–C Committee in the reconciliation of the differing stress-analysis requirements of the Army, Navy, and Department of Commerce Study of these requirements with a view to modification to bring precision and consequent complexity of methods more in line with the assumptions and basic data available concerning loads and load distribution

46 Aircraft Weight and Performance Statistics—Tabulation and analysis of the large amount of data concerning airplane weight and performance now in the Bureau files Publication of these data in the most comprehensive manner, probably graphically The first step in this project to be the publication of data concerning the take-off characteristics of both land and water aircraft

47 Patented Fastenings—Investigation to determine the tests necessary to prove various patented fastenings, such as "Chicago" and "Parker-Kalon," satisfactory for use in the primary structures of aircraft Recommendations as to pertinent airworthiness regulations

48 Wing Rib Testing Machine—Development of a universal rib testing machine by means of which ribs may be tested by the

application of load rationally distributed chordwise

49 COMMON AIRCRAFT MATERIALS—Correlation and publication of all available data concerning allowable fiber stresses for the common aircraft materials

50 JONES METHOD OF BOUNDARY LAYER CONTROL—Thorough study of the Jones method of boundary layer control Assistance in the development of this method of boundary layer control if merited

51 SENSITIVE ALTIMETERS—Study of existing types of sensitive altimeters with a view to providing closer limits of accuracy

52 GROUP INSTRUMENTS—Assistance in the development of group instruments

53 WING BEAMS—Development of a satisfactory method of analyzing box-type wing beams subjected to combined bending and torsion

54 STRESS ANALYSIS OF LOW-WING MONOPLANES—Development of an alternative special method of stress analysis for low-wing monoplanes which form such a large part of current production

55 SIMPLIFICATION OF AIRCRAFT OPERATION—Study, development, and application of methods and mechanisms for making the handling of large aircraft less complex

56 AIRPORT DIMENSIONS—In cooperation with the Airport Section to determine the proper relation between aircraft performance and airport dimensions

57 FUEL DUMPING—To determine a safe means for the rapid discharge of fuel from aircraft in flight

58 FEDERAL PARTICIPATION IN CIVIL AVIATION TECHNICAL DEVELOPMENT—Analyze the extent to which the Federal Government now participates and the distribution of types of work and finances for the purpose of effecting the closest possible coordination

Chart 2—AIRPORT SECTION

Present and Proposed Projects

1 FINANCIAL AND PHYSICAL SURVEYS—A nation-wide survey is in progress and should continue during the next fiscal year to determine existing facilities on all airports in the United States, together with the capital investment of each airport, annual maintenance cost, operating expenditures, annual income, etc In connection with the above surveys, vertical photographs of all airports and seaplane bases to scale are being obtained and these are to be checked by actual measurements against data submitted Completion of these surveys will require several months and will necessitate further attention to keep the information current A survey is being made affecting the reliability of electrical power supply to major airports with the view of determining where stand-by power plants will be needed These surveys will enable the Airport Section intelligently to plan future airport development and construction, based on actual data which will be tabulated from the above surveys

2 LONG-RANGE PROGRAM OF AIRPORT AND AIRWAY DEVELOPMENT—The Airport Section consults with states, municipalities, aircraft manufacturers and others interested in greater safety and convenience in aeronautical operation at airports in the United States to the end that development of a coordinated civil airway system and the improvement of airports may keep pace with other aeronautical developments Planning is conducted in connection with other government departments such as the Army, Navy, National Advisory Committee for Aeronautics, Post Office, National Park Service and the aviation industry as a whole for the purpose of coordinating all ideas, studies and information in the formulation of a comprehensive long-range program of airport and airway construction and development Long-range planning, particularly where Federal expenditures are involved, is essential for future development in order that costly errors may be avoided

3 TESTS TO DETERMINE TAKE-OFF AND LANDING CHARACTERISTICS OF AIRCRAFT—Further development and tests of the four electrically synchronized range-finding cameras which are being used at present to secure information at key airports throughout the

United States The accumulation of this information should be continued It will be utilized to determine the exact take-off and landing distances required by different type airplanes in different atmospheric conditions and at different altitudes, together with rate of climb immediately after take-off

4 AIRPORT RATING REGULATIONS—Rapid advancement in the aircraft industry has necessitated a revision in the airport rating regulations of the Bureau of Air Commerce The Airport Section has been concerned with the preparation of new airport rating regulations which were discontinued in 1933 It is anticipated that these regulations will be completed and placed into effect during the next year This project includes the drafting and publication of the new regulations, the field inspection and the office routine in connection with rating of airports (Air Commerce Act of 1926)

5 TESTS OF PAVING AND OTHER AIRPORT FACILITIES—Conducting studies on soils, paving, drainage, lighting, including studies of hangar design and runway construction Joint studies are being initiated through other Federal agencies and universities, together with the Asphalt Institute, on soil characteristics and paving materials, including special studies of airport drainage Tests of existing and new lighting equipment for the purpose of standardizing airport lighting Studies in connection with runway layouts, hangar design, administration building, fire control methods, snow control and traffic control

6 REVISION OF OBSOLETE AIRPORT BULLETINS—The present Bureau of Air Commerce airport bulletins are obsolete Revision of all airport bulletins to bring them up to date and into conformity with the projected regulations and with present-day requirements is necessary

7 SEAPLANE TERMINAL FACILITIES—A survey of existing seaplane terminal facilities and a study to determine future requirements as to location equipment, and size, considering local and international air traffic both present and future

8 FACILITIES FOR PROTECTION OF AIRLINE PASSENGERS ENTERING AND LEAVING AIRCRAFT—Conduct a study necessary to determine the facilities and equipment necessary for the protection and convenience of airline passengers embarking and disembarking from airplanes

9 AIRMARKING—Continuation of the present airmarking program Survey to determine actual conditions of present air markers as to location, type condition, and other pertinent information and to determine what additional air markers should be developed Preparation of the necessary records to keep all data in connection with this survey and program current The development of a national plan for use in connection with present and future federal and state air marking programs Preparation of a bulletin on air marking construction to replace obsolete bulletins which are out of publication

10 AIRPORT ZONING—Includes

(a) Determination of airport approaches necessary now and in the future, considering airplane performance and airport construction

(b) Study of legal problems arising in connection with airport zoning, based on court decisions and available literature

(c) Preparation of bibliography on subjects of approaches and zoning

(d) Procurement and analysis of all existing airport zoning legislation of states, counties, and municipalities

(e) Assistance to political subdivisions and airport operators with zoning phases of airport planning and with other zoning problems, both by correspondence and by conferences

(f) Preparation of bulletin to take place of the Report of the Committee on Airport Zoning and Eminent Domain, published by the Bureau under date of December 18, 1930, and now out of date in several important particulars

(g) Preparation of suggested airport zoning ordinance

(h) Preparation of material on approaches and zoning for all publications of the Bu-

reau regarding airport construction or layout (such as proposed Handbook), and for the rating regulations

(i) Recommendations to the Certificate and Inspection Division concerning changes in regulations governing the maneuvering of airline aircraft in landing and taking off

(j) The handling of all other matters of airport approaches and zoning as they arise

11 Development and Test of Fog-Piercing Light—Test and installation of a fog landing light system It is proposed to make the first installation at Sacramento, where fog is frequent and regular Installations at other locations should also be made for experimental purposes

12 Test of Airport Beacons—Purchase and flight test of newly developed oscillating type beacon It is proposed to purchase one beacon of this type, and have it installed at Washington Airport The flight checking could be incidental to the normal use of the airport Other tests should be made to determine the desirability of placing this type beacon in regular use

13 Installation and Test of Runway Reflector Units—Runway reflector units provide a relatively inexpensive method of marking runway edges These units reflect the landing lights of a plane, and show the pilot where the edges of the runway are It is proposed to conduct tests on this unit in several locations to determine its usefulness

14 Develop and Test Suitable Airport Runway Illuminators—This is the development of an idea for floodlighting a runway from small units distributed along the runway edges It is proposed to install units for test purposes at old Bolling Field

15 Directory of Airport Officials—Compile a directory of the managers and officials of the airports of the United States

16 Snow Handling on Airports—Study methods in use and prepare recommendations for universal practice

17 Airport Floodlighting—Study and recommendations

18 Power Supply at Airports—Survey the power conditions at major airports to determine suitable specifications and particularly the necessity for a stand-by source.

19 Regulations for Restricted Water Areas—Study of regulations applicable to seaplane terminals and development of means to prevent collision between surface craft and aircraft

Chart 3—AIR TRANSPORT SECTION

Present and Proposed Projects

1 Pilot Medical Study—Study of pilot fatigue for the purpose of making of recommendations as to medical requirements for pilots. Study of oxygen requirements as related to altitude

2 Accident Survey—Detailed study of airline accidents since 1934 and those in miscellaneous flying since 1933 Report and recommendations as to trend of future development to avoid repetitions

3 Spacing Air Lines Schedules—Study of air traffic along the airways and at important terminals and recommendations for proper spacing of schedules

4 Alternate Adjacent Airports—Study of the selection of alternate airports when conditions prohibit landing at normal terminal

5 Coordination of Pilots' Duties.—Study and making of recommendations regarding logical and efficient division of duties of airplane crews

6 Dead Reckoning Avigation—Investigation of this method of aerial navigation and establishment of regulatory limitations

7 Time Synchronizing Along Airways—Investigation and study looking to a method for keeping all clocks and watches at ground dispatching stations and in operating aircraft synchronized and for accurately logging all radio communications

8 Improved Weather Reporting—Study of method for better dissemination of weather information, including observations of pilots in flight Study contemplates investigation of actual requirements and making of recommendations.

9 Instrument Landing Training—Establishment of program for the training of flying personnel in use of blind landing equipment Suitable equipment for this program could be set up at several advantageous and accessible locations throughout the country

10 Additional Airways—Economic studies with reference to air commerce in connection with the establishment of additional airways

11 Pilot Retirement Plan—Study of a possible scientific retirement plan for pilots Pilot ineffectiveness in many cases believed due to worries over possible loss of job and future activities after being retired as active pilot

12 Proper Fuel Storage at Airports—Development of means for the prevention of accidents due to water in gasoline

13 Bone Conduction Hearing Device—Investigation of apparatus designed to accomplish better reception of radio range and voice signals under static conditions, prevent diminution of hearing under conditions of rapid descent and prolong the usefulness of a pilot's career by preventing deafness

14 Meteorological Radiographs—Cooperation with other agencies in investigating this method of exploring weather aloft

15 Ground Personnel Medical Study—Study of medical requirements for ground personnel in view of the increasing amount of exacting work demanded of such personnel This study allied with Project No 1

16 Airway Beacon Survey—This project contemplates study of existing light beacons and recommendations as to additions or changes

17 Instrument Arrangement—Study and recommendations to manufacturers with reference to arrangement of aircraft instruments and controls with the view of minimizing the presently existing complexities of the cockpit In cooperation with Aircraft Section and allied to Pilot Medical Study

18 Safety Requirements at Airports—Study of means for providing greater safety in the conduct of passengers before and after leaving aircraft at airports, together with study of extent of jurisdiction of the Bureau of Air Commerce along these lines In cooperation with Airport Section

19 Polarized Light—Investigation of method of application of certain lenses now available, to the end that reflected light (glare) from parts of aircraft and instrument panel may not cause pilot eye strain, which it is believed contributes to pilot fatigue Allied to Pilot Medical Study and in cooperation with Aircraft Section

20 Passenger Medical Study—Study of requirements necessary to the safety, health, and comfort of scheduled airline passengers Study includes such problems as ventilation, temperature control, lavatory facilities, determination of altitudes to which average passengers may safely ascend and effects of rapid ascents and descents In cooperation with Aircraft Section

21 Oxygen Inhaling Apparatuses—Coordination of manufacturers efforts to provide practicable means of administering oxygen to crew and passengers during high altitude flights This project is aside from work in field of supercharged cabins Allied to Pilot Medical Study Program

22 Quarantine Restrictions—Study of problem of flare-ups of various infectious and contagious diseases believed to result from long flights at high altitudes This project will include the making of recommendations for protective measures and supplying findings to Public Health Service

23 Cabin Supercharging—Study of this problem with a view to determining the limiting factors with reference to passengers' health and comfort

24 Program of State Cooperation—Many of the Bureau's objectives can be aided in a large measure through the help of the several States' aeronautical commissions A logical project is that of presenting many of the Bureau's problems to these bodies and securing help in enforcement and other ways

25 State Licensing of Private Flying—Study of proposal for placing private flying in the hands of the States and the certification of private airplanes by State Boards,

Federal Bureau would still specify minimum requirements as to airworthiness of planes, instruction qualifications for pilots' certificates, and approval of aircraft as to type

26 First Aid Kits—Study and drafting of specifications for improvement and modernization of first aid kits Recommendations as to measures for perpetuating usefulness of kits after installation

27 Emergency Supplies Aboard Aircraft—Study of the desirability of amending the requirements for the carrying of emergency supplies for use in the event of an accident or forced landing in a remote location

28 Additional Uses for Aircraft—Study and investigation of the development of types for purposes not presently used

29 Airline Cost Studies—Economic study of air-line costs as affecting safety activities, even though indirectly

30 Transportation Between Airports and Cities—Study with reference to improving conditions to the end that less time is lost between commercial airports and metropolitan centers

31 Land Planes vs Sea Planes for Trans-Oceanic Flying—Study and recommendations

32 Relieving Congestion at Airports—Development of a means for expediting the arrival and departure of aircraft at crowded terminals This is allied to Item 3

33 Pilot Seniority Plan—Development of a plan for the establishment of orderly and uniform privileges and restrictions for pilots as related to length of service with the thought that it might be adopted by everyone concerned The Bureau would be interested only from the standpoint of the effect of existing practices on the safe performance of a pilot

Chart 4—EDUCATIONAL SECTION

Present and Proposed Projects

1 Cooperation With Educational Agencies—Generally, should work in close cooperation with Federal Educational agencies and with State and Municipal bodies with reference to matters of aviation education

2 Maintenance of Educational Record—Compile and keep currently accurate a list of schools giving aviation courses, academic or trade, such list to classify type of instruction and degrees or certificates given

3 Determine Educational Needs—Determine the type and number of school-trained employees needed in the aviation industry

4 Coordinate Educational Needs and Student Output—Compile and disseminate results of studies looking to coordinating the number of students and the types of instruction with the needs of the industry

5 Secure and Disseminate Teaching Material—Determine the needs of the schools as to accurate aviation teaching material and take steps to secure such material for them

6 Interest Studies and Faculty in Specific Investigations—Interest undergraduates or post graduate students or instructors in special aviation studies needed in connection with the work of the Bureau and make arrangements therefor

7 Stabilization of the Educational Qualifications of Personnel—Stabilization of the qualifications of personnel and the passing back to the education institutions, educational specifications for careers in aviation as being fundamental for regulation and flight promotion

8 Harmonize Curriculi—Work toward similar types of instruction for comparable degrees or certificates in the various schools

9 Study Foreign Aviation Educational Methods—Obtain information relative to aviation educational systems and methods used in other countries and determine if the U S may profitably use similar procedures

10 Assist Schools in Obtaining Teaching Personnel—Assist the faculties of aviation schools in obtaining competent teaching personnel

11 Federal and State Participation on Aviation Education—Analyze the extent to which Federal and State governments now participate with the objectives of drafting a

national plan and effecting the closest possible coordination

Chart 5—INTERNATIONAL SECTION

Present and Proposed Projects

1 DEVELOP A PLAN OF INTERNATIONAL AIR RELATIONS—This involves further work along lines already set up

2 COMPARATIVE STUDY OF FOREIGN AND DOMESTIC CIVIL AVIATION—Comparative information is difficult to procure and has never been fully analyzed The results of this project should reveal much information of value for future planning

3 The program includes following Routine Projects with reference to the foreign and international aspects

(a) Generally, study and compilation of information concerning every phase of civil aeronautics, the extent thereof, the rate of growth, and the probable expansion, with particular reference to plans for the future in connection with national and international expansion that may possibly affect the United States from the standpoint of air transportation as well as from the standpoint of expansion of commerce

(b) Compile information concerning all foreign and other international air transportation systems

(c) Compile information concerning the method and degree of Government subsidy of various European and South American airlines

(d) Compile information concerning the types of aircraft, accessories, and general equipment used

(e) Compile information concerning the total of personnel employed, by classifications

(f) Compile information concerning flight time limitations for pilots and other crew personnel

(g) Compile information concerning maintenance methods, procedures, and equipment used, and details of government regulations governing operation

(h) Compile information concerning the extent and type of navigation facilities supplied by the Government and by the individual operators, including all information on meteorological facilities and methods used

(i) Study of foreign technique of operation, training, and control of personnel, etc

(j) Compilation and study of foreign physical standards required, frequency of physical and professional qualification examinations etc

(k) Compilation and study of information for use in establishing or revising reciprocal agreements between the United States and other nations in matters pertaining to Civil Aeronautics

(l) Compilation of available technical information as to new developments in aircraft, engines, and propellers, and all aircraft accessories, including radio

(m) Maintain a close contact and cooperate with the foreign aeronautical offices of the various Departments of the United States Government

(n) Cooperate with all United States foreign representatives with reference to the expansion of foreign markets for American civil aircraft and accessories

(o) Represent the Director of the Bureau in conferences held abroad, relating to civil aeronautics

(p) Represent the Director of the Bureau with foreign purchasers of American aircraft in matters relating to questions that arise from time to time, particularly with such large purchasers of American aircraft as the K L M of Holland

(q) Compile information concerning the amount of capital invested in each operation and division of ownership of various European and South American airlines

Chart 6—POWER PLANT SECTION

Present and Proposed Projects

1 ASSISTANCE IN DEVELOPMENT OF POWER PLANT INVENTION—This project involves contracts for the development of promising

inventions in aviation power plants, including engines, accessories, and propellers

2 DEVELOPMENT OF OIL ENGINES.—This project contemplates encouragement of the development of oil engines

3 DEVELOPMENT OF TWO STROKE CYCLE ENGINES.—This project contemplates contracts to encourage the development of the two stroke cycle engine

4 DEVELOPMENT OF BARREL TYPE TWO STROKE CYCLE OIL ENGINE.—It is proposed to continue the development of the barrel type engine, a development already started under contract

5 TESTS FOR AIRWORTHINESS SECTION.—This involves the conduct of tests to assist in the proper determination of airworthiness requirements

6 REDUCTION OF FIRE HAZARDS.—This project for miscellaneous tests looking toward a reduction in fire hazards

7 ACCESSORY COST STUDY.—Investigation and tests relative to application of the products of other industries to aviation use with a view toward reducing the cost of power plant accessories

8 TWIN ENGINES GEARED TO SINGLE PROPELLER.—Study of relative safety of a new development wherein two engines are geared to a single propeller

9 LIQUID CHEMICAL ENGINE COOLING.—Study of the possibilities with reference to cooling aircraft engines with liquids not now used for that purpose

Chart 7—RADIO DEVELOPMENT SECTION

Present and Proposed Projects

1 ULTRA-HIGH FREQUENCY RADIO RANGE.—Development work on the use of ultra-high frequencies for radio ranges, for purposes of obtaining greater stability of courses, elimination of atmospheric static and considerable saving in cost per station. Some work accomplished and preliminary report prepared

2 RTCA INSTRUMENT LANDING SYSTEM.—Continued development of an instrument landing system along the lines collectively viewed as desirable by the Radio Technical Committee for Aeronautics with a view toward making installations on a national scale. Coordination of the work being done in industry and refinement of service equipment is needed

3 TESTS ON NEW SIMULTANEOUS RANGES.—Inspection and tests of first simultaneous range station, in Bureau's new construction program, to be located at Hartford, Connecticut. Due to novelty of new equipment to be used, design must be given rigid inspection

4 ULTRA-HIGH-FREQUENCY AIR TRAFFIC CONTROL.—Development of 125 Mc ground station transmitters and antennas and aircraft receivers to provide suitable air traffic control facilities eliminating atmospheric static and interference now present on 278 kc. Some work accomplished

5 ULTRA-HIGH-FREQUENCY RADIO RANGE RECEIVER.—Development of aircraft receiver, and complete specifications therefor, to be used for entire ultra-high-frequency radio range spectrum. One experimental receiver has been constructed and now being tested. Report being prepared

6 ACCEPTANCE TESTS ON FAN MARKER EQUIPMENT.—Complete factory testing of transmitters to be used for fan markers, and flight tests on first installation at New Brunswick.

7 ULTRA-HIGH-FREQUENCY RADIO RECEIVERS.—Development and test of "Z" type and fan type radio marker receivers. Project includes sponsorship of further development by radio manufacturers looking to commercial availability of this type of receiver

8 IMPROVEMENT IN FAN MARKERS.—Improvement and refinement of ultra-high-frequency fan markers which provide definite "fixes" to pilots approaching radio range stations and provide obstruction warnings. Preliminary report written. Flight tests to be conducted

9 ULTRA-HIGH-FREQUENCY "Z" MARKER BEACON.—Further development work on the ultra-high frequency "Z" marker transmitter and antenna system. Equipment developed and ready for installation at range

stations on airways Further development necessary to keep abreast of continued progress in this field

10 Ultra-high-Frequency Ground and Ground to Aircraft Communications System —Development of and preparation of specifications for equipment to provide complete ultra-high-frequency airway communications system This will provide a broadcast and teletype channel for ground to aircraft and two or more 60-word-per-minute ground teletype channels for weather and air traffic control communications Some work already accomplished and report written

11 Experimental Radio Range Station —Construction of an experimental radio range station where problems of radio range operation may be investigated without interruption of range service on existing airways

12 Impedance Boxes —Development of a more satisfactory impedance measuring device Involves investigation of present equipment which is used in tuning radio range stations with a view toward improving equipment for accuracy and sensitivity

13 Improvement in the Existing Navigation Facilities —Development work looking to improvement and refinement of existing airway radio facilities This project will keep the Bureau abreast with the latest technical and scientific advances of the radio industry

14 Precipitation Static —Sponsoring and directing further work on the elimination of precipitation static Some progress made by airlines Bureau requested to lend aid in further development

15 Marker Identification —Study for determining most suitable means for positively identifying radio marker beacons which are to be located on radio range courses

16 Simultaneous Ultra-high-Frequency Radio Range—Further development of the ultra-high-frequency radio range to incorporate simultaneous voice broadcast and radio range service similar to that now provided by low frequencies

17 Field Intensity Measurements —Conduct field intensity survey on all existing radio range and broadcast stations operated by Bureau, and measurements as required on foreign interfering stations Survey necessary to accomplish economical assignment of extremely limited number of radio frequencies available

18 Insulator Ice.—Thorough field study to determine the effectiveness of insulating or heating base insulators on towers for prevention of ice formation on insulators Formation of ice on insulators may cause changes in course orientation with serious consequences

19 Ultra-high-Frequency Radio Compass —Development of ultra-high-frequency radio compass for use aboard aircraft Such a compass capable of operating at ultra-high frequencies would probably be free from static interference

20 Monitoring Fan Type Marker Beacons —Study to determine the most suitable means for remote monitoring of fan type marker beacons

21 Development Contracts —Investigate all new patents in aviation radio field and conduct study of equipment developed thereunder This project includes the purchase of sample units for test prior to service application Routine project

22 Positive Altimeter —Investigation of possibilities of developing a positive altimeter for aircraft, the accuracy of which shall be essentially independent of barometric pressure, temperature, and humidity Instrument would provide reading of altitude above ground rather than above sea level In cooperation with Aircraft Section

23 Collision Warning Device —Study problem of collision warning for aircraft and conduct study of various possible methods Allied with aircraft instrument development and work on positive altimeter

24 Ground Radio Direction Finder —Investigate systems of radio direction finding and study problem of developing equipment suitable for installation at Bureau ground sta-

tions to provide facilities for taking directional bearings on aircraft in flight Allied to study of radio compass

25 Radio Receiver Development.—Develop methods of automatically tuning radio receivers in Bureau ground stations for positive reception of calls from aircraft and apply certain circuit refinements for suppression of extraneous interfering noises

26 Radio Range Quadrant Identification.—Investigation of possible methods of providing individual code identification of range quadrants as an aid to solution of blind flying orientation problems Determine by experimentation advisability and practicability of application to all range stations

27 Monitoring Systems for Radio Navigation Aids.—Investigate methods and conduct experimental development of a system for a positive indication of irregularities in operation of important radio aids to air navigation Includes checking of radio range course deviations, normal functioning of cone of silence and traffic control markers, and possibility of recording of voice broadcast of weather information and radio phone communication with aircraft System will be useful also in training of personnel in standard operating methods and procedure

28 Visual Radio Range Demonstrator.—Construction of radio range demonstrator operated by light sources and capable of illustrating multiple courses, fades, and other idiosyncrasies of radio range transmission This development would make available a device for improving a pilot's understanding of the phenomena involved when encountering peculiarities in radio range transmission

29 Foreseeing Frequency Needs.—Anticipate future developments in radio air navigation facilities and work with Federal Communications Commission in determining appropriate frequency assignments

Chart 8—SUMMARY

BUREAU OF AIR COMMERCE

Safety and Planning Program

MARCH 1, 1938

Type of Project	Subject						
	Airways, airports, and navigation facilities	Air traffic control and communications	Aircraft power plants, and equipment	Airmen	Air carrier operation	Fostering air commerce	U S aviation policy
SERVICE PROJECTS	1 Aircraft take-off and landing characteristics ● 2 Directory of airport officials ● 3 Fuel storage at airports ○ 4 Airport rating regulations ● 5 Airport paving ● 6 Revision of obsolete airport bulletins 7 Tests on new simultaneous ranges ● 8 Tests on new fan markers ● 9 Improve impedance boxes ● 10 Radio range insulator fee ○ 11 Monitoring fan marker beacons ○	1 Dead reckoning aviation ○ 2 Elimination of precipitation static ● 3 Snow handling on airports ○	1 Glider construction manual ● 2 Monocoque design ○ 3 Airfoil span and chord load distribution ○ 4 Simple recording accelerometer ○ 5 Aircraft landing regulations ○ 6 Hull pressure distribution ○ 7 Seaw ng pressure distribution ○ 8 Two-control aircraft ○ 9 Simple strain gauge ○ 10 Reconciliation of differing stress analysis require ments ○ 11 Patented fastenings ○ 12 Wing rib testing machine ○ 13 Characteristics of common aircraft materials ○ 14 Analysis of wing beams ○ 15 Stress analysis of low wing monoplanes ○ 16 Power plant tests for airworthiness section ○ 17 Tricycle landing gear ● 18 Twin engines geared to single propeller ● 19 Ice formation ● 20 Vibration and flutter ● 21 Effect of lightning ● 22 Mechanical interruptions to flight ● 23 Windshields ● 24 Sensitive altimeters ○ 25 Oxygen inhaling apparatuses ● 26 Reduction of fire hazards ○ 27 Improve aircraft wheels ○	1 Classification of mechanics certificates ○	1 Fuel dumping ● 2 Protection of passengers at terminals ○	1 Glider operations manual ○	1 Patent laws and regulations ●

Type of Project	Subject						
	Airways airports and navigation facilities	Air traffic control and communications	Aircraft, power plants, and equipment	Airmen	Air carrier operation	Fostering air commerce	U S aviation policy
PLANNING PROJECTS	1 Develop Metcalf blind landing instrument and system. ●	1 Spacing airlines schedules. ○	1 Experimental Funk airplane ●	1 Plan for certification of mechanics ○	1 Transportation between airports and cities ○	1 Develop additional uses for aircraft. ○	1 Study lighter-than-air aircraft possibilities ○
	2 Aircraft launching devices ○	2 Alternate adjacent airports ○	2. Experimental tailless airplane ●	2 Instrument landing training ○	2 Automatic instrument log ●	2. Maintenance of educational record ○	2 Program of state cooperation ○
	3 Financial and physical surveys of airports ●	3 Meteorological radiographs ●	3 Sperry airport orientator ●	3 Visual radio range demonstrator ○	3 Landplanes vs seaplanes over water ○	3 Determine educational needs ○	3 Study desirability state certification of private flying ○
	4 Seaplane terminal facilities ●	4. Time synchronizing along airways ●	4. Ultra high frequency wave generator and detector ●	4 Establish clinical test station ●	4 Compulsory parachute equipment ○	4. Coordinate educational needs and student output ○	4. Study of non schedule accidents ●
	5 Airmarking ●	5 Improved weather reporting ●	5 Absolute altimeter ○	5 Anoxemia study at Harvard university ●	5 Study of airline accidents ●	5 Secure and disseminate teaching material ○	5 Develop plan of international air relations ●
	6 Airport zoning. ○	6 Relieving congestion at airports ●	6 Aircraft landing lights ●	6 Contracts for studies of fatigue factors ●	6 Coordination of flight crew duties ○	6 Interest students and faculty in specific investigations ○	6 Comparative study of foreign and domestic aviation. ●
	7 Development and test of fog piercing light ●	7 Regulations for restricted water areas ●	7 Design specifications for high altitude flight ○	7 Contracts for development of medical equipment ●	7 Pilot retirement plan ○	7 Stabilization of the educational qualifications of personnel ○	7 Federal participation in civil aviation technical development ○
	8 Airport beacons ●	8 Ultra-high-frequency ground & ground to aircraft communications system. ●	8 Aircraft position lights ●	8 Medical requirements for ground personnel ○	8 Pilot seniority plan ○	8 Harmonize curricull ○	8 Federal and state participation on aviation education ○
	9 Runway reflector units ●	9 Ultra high-frequency radio units for traffic control ○	9 Aircraft instrument lights ●		9 Passenger medical study ○	9 Study foreign aviation educational methods ○	
	10 Airport runway flluminators. ●		10 Aviation colors ●		10 Quarantine restrictions ○	10 Assist schools in obtaining teaching personnel ○	
	11 Determine additional airways needs ○		11 Three-component accelerometer ○		11 Emergency supplies ○	11 Accessory cost study ○	
	12 Airway beacon study ●		12 Ground speed indicator ○		12 Airline costs ○	12 Analyze and disseminate aircraft weight and performance statistics ○	
	13 Ultra high-frequency radio range ●		13 Jones method of boundary layer control. ○		13 Additional air ways ○		
	14 Improvements in fan markers ●		14 Group instruments ○				
	15 Ultra-high-frequency "Z" marker beacon. ●		15 Bone conduction hearing device ●				
	16 Marker identification signals ●		16 Development of oil engines ○				
	17 Simultaneous ultra-high frequency radio range ○		17 Development of two stroke cycle engines ○				
	18 Field intensity measurements ○		18 Development of barrel type two stroke cycle oil engine ●				
	19 Ground radio direction finder ○		19 Ultra high-frequency radio compass ●				
	20 Radio range quadrant identification ○		20 Ultra high-frequency radio receiver development ●				
	21 Monitoring systems for radio navigation aids ○		21 Collision warning device ○				
	22. Develop national plan of airport specifications ●		22 Liquid chemical engine cooling ●				
	23 Develop RTCA instrument landing system ●		23 Parachute design and inspection. ○				
	24. Airport floodlighting. ●		24 New materials for aircraft ○				
	25 Power supply at airports ●		25 Effects of age and use upon aircraft ○				
	26 Determine future radio frequency needs. ●		26 Generator failure warning light ○				
			27 Airworthiness and design practice ○				
			28 Application of light polarization ○				
			29 First-aid kits ○				

APPENDIX

Department of Commerce
Bureau of Air Commerce
Safety and Planning Division

SUMMARY OF SPECIAL PROJECTS IN PROCESS

March 1, 1938

FOREWORD

There follows herewith an itemization, by Sections, of the special projects assigned to personnel of the Safety and Planning Division. It is to be noted that these lists do not include projects which are considered as Routine Projects. The items herein given are only those which are expected to be completed and discontinued in a reasonable length of time inasmuch as they represent specific stages of advance in some of the broad general functions of the Bureau.

The basic functions and general objectives of the personnel engaged in this work are detailed elsewhere.

Summary of Special Projects in Process

EXECUTIVE PROJECTS

Project No	Description	To whom assigned	Remarks
6-1	Circularize industry and all other authoritative sources to obtain comprehensive understanding of work to be done, chart and analyze results, and draft program therefrom	All personnel	Report being prepared. Estimated completion date April 1, 1938.

AIRCRAFT SECTION

Under supervision of J. Easton, Section Chief

61-5	Supervision of the performance of the existing contract with Funk Aircraft Company for an experimental airplane	A L Morse	Estimate completion May 1 1938.
61-6	Supervision of the performance of the existing contract with Management & Research, Inc., for an experimental tailless airplane.	A L Morse	Estimate completion May 1, 1938.
61-7	Supervision of the performance of the existing contract with M I T for a blind landing instrument and system	I R Metcalf	Estimate completion October 1, 1938.
61-8	Supervision of the performance of the existing contract with Sperry Gyroscope Co for an Airport Orientator, which is an instrument for the reproduction in the aircraft cockpit of a properly orientated chart of an airport.	I R Metcalf	Contract completed and instrument delivered Dec 8, 1937 Now being flight tested by P C A Estimate completion May 1 1938.
61-9	Supervision of the performance of the existing contract with Fairchild Aerial Camera Corp for an Automatic Instrument Log, which is an instrument for recording instrument readings and control settings in the aircraft cockpit continuously and automatically	I R Metcalf	Estimate completion of contract and instrument ready for flight tests in immediate future. Estimate completion May 1, 1938.
61-10	Assistance in the development of suitable means for the prevention of ice formation on aircraft control surfaces, windshields, and instrument pitot heads Recommendations as to airworthiness regulations having to do with the elimination of ice formation Assistance in the possible further development of wing deicers Study, in cooperation with the N A C A of the fundamental factors concerning ice formation on aircraft	I R Metcalf	Report on aileron ice to be completed in immediate future. Other reports will follow in due course
61-11	Study of the entire subject of vibration as it affects the aircraft structure, power plant, instruments accessories and equipment Assistance in the development of equipment to properly detect, measure, and analyze vibrations Development of technique for the detection measurement and analysis of vibrations by testing aircraft and analyzing the test results Assistance in the formulation of methods for the elimination of undesirable vibrations in aircraft Recommendations as to airworthiness regulations having to do with vibrations in aircraft.	I R Metcalf	Estimate completion of first part of project Sept 1, 1938.
61-12	Development of an ultra high frequency wave generation and detection device for use in several instrument projects.	I R Metcalf	Estimate completion of first part of project Oct 1, 1938.
61-13	Cooperation with the N A C A, in a study of lightning strikes on on aircraft and their effect. Development of suitable means for the prevention of accidents or serious damage due to lightning strikes Recommendations as to airworthiness regulations having to do with lightning strikes	J Easton I R Metcalf	Latter part of project dependent upon N A C A findings on first part.
61-14	Enter into and supervise the performance of a contract with the Soaring Society of America for the compilation of a "Glider Construction Manual" to be published by the Bureau for use in conjunction with its airworthiness regulations having to do with gliders.	J Easton	Estimate completion in immediate future.
61-15	A survey of patent laws and regulations as affecting Bureau development contracts and inventions and ideas submitted to the Bureau, and the formulation of appropriate Bureau action and policy	W C Peck	Estimate completion Apr 15, 1938.
61-16	Development of an absolute altimeter, independent of barometric pressure. The instrument developed to be such that it can be used also as an object detector or a collision prevention device.	I R Metcalf	Some preliminary work accomplished Completion date impossible to estimate due to state of art
61-17	Thorough study of the subject of certifying airplane and engine mechanics. Recommendations as to the procedure the Bureau should follow in this matter	J Easton	Some preliminary work accomplished Crowded schedule prevents estimate of completion.

AIRCRAFT SECTION—Continued

Under supervision of J Easton Section Chief

Project No	Description	To whom assigned	Remarks
61-18	Development of means to safeguard the pilots and prevent damage to windshields when struck by birds in flight Recommendations as to pertinent airworthiness regulations Cooperation with the N A C A and National Bureau of Standards in developing a flexible substitute for glass	J Easton A W Dallas	Work on last item being done under control of N A C A
61-19	Cooperation with Airport Section in its Project No 62 2 to correlate aircraft take-off and landing characteristics with airport size	A L Morse	Estimate completion July 1, 1938
61-20	Thorough study of the subject of dumping fuel from aircraft in flight determination of the hazards involved and of methods for the elimination of dangerous conditions Recommendations as to airworthiness regulations having to do with the dumping of fuel from aircraft	A W Dallas	Estimate completion June 1, 1938
61-21	Study of all available data and the determination, by means of a test program of the loads on the tricycle type landing gear the handling qualities of this type of gear, and the desirable shock absorption characteristics and design features of this type of gear Recommendations as to airworthiness regulations having to do with the tricycle type landing gear	A W Dallas	Completion dependent upon N A C A program

AIRPORT SECTION

Under supervision of A B McMullen Section Chief

Project No	Description	To whom assigned	Remarks
62-1	Determination of requisites for a transoceanic seaplane terminal	R L Campbell	Estimated completion date May 15, 1938
62-2	Develop and test a camera and means for its use to measure airplane performance near the ground and correlate airport size thereto	W M Aldous	Report on camera development being prepared See 61-21 for estimate on latter part of project
62-3	Compile a photographic record of all United States airports	J B Bayard	Estimated completion date July 15, 1938
62-4	Conduct a national survey of airport facilities and tabulate and chart results.	J B Bayard	Estimated completion date July 15, 1938
62-5	Preparation of Airport Rating Regulations	A B McMullen F H Grieme J M Hunter R L Campbell H J C Pearson	Completion or report date July 1, 1938
62-6	A Manual relating to all phases of airport planning, design and construction is being prepared	W M Aldous C R Wilsky C B Donaldson R L Campbell H J C Pearson	Completion or report date June 1 1938
62-7	Preparation of plans for a National Airport and Airway System	A B McMullen J B Bayard S A Kemp	Completion or report date Jan 1 1939
62-8	Compilation of Directory of the managers and administrative officials of the airports of the United States	J B Bayard	Estimated completion date April 1, 1938
62-9	Survey of existing and proposed seaplane terminals and bases to formulate coordinated plan of seaplane airport development	R L Campbell C R Wilsky	Estimated completion date July 1, 1938
62-10	Survey and study of requisites for restricted water areas or "seaplane airports" as applied to enforcement of International rules of the road and requirements of marine authorities	R L Campbell	Estimated completion date Sept 1, 1938.
62-11	Preparation of revised air marking Bulletin	R L Campbell	Estimated completion date June 1, 1938
62-13	Study of city, county, and state zoning laws pertaining to airports and their approaches	J M Hunter	Estimated completion date Sept 1, 1938 (Preliminary to other desirable zoning projects)
62-14	Study coordinated with the Department of Agriculture to determine the usability of cotton fabrics in runway construction	C R Wilsky C B Donaldson	Completion or report date Dec 31, 1938
62-15	Investigation of reflector type runway markers	H J C Pearson	Estimated completion date May 31, 1938
62-16	Comparison of various methods of floodlighting	H J C Pearson	Estimated completion date June 30, 1938
62-17	Accumulation of experience on snow handling on airports	H J C Pearson C R Wilsky	Report date July 1 1938
62-18	Survey of power conditions at major airports, to determine necessity of standby power	H J C Pearson	Estimated completion date June 30, 1938

AIR TRANSPORT SECTION

Under supervision of R Humphreys, Section Chief

Project No	Description	To whom assigned	Remarks
63-2	Analyze the situation with respect to aviation medicine and develop plan for Bureau action	W H Miller	Report being written Estimate completion in immediate future
63-3	Represent the Government's interests in connection with an existing contract with Columbia University for research work dealing with the effect of altitude on pilots	W H Miller	Completion dependent upon receipt of contractor's report.
63-4	Detailed study of air line accidents since 1934 and those in miscellaneous flying since 1933 Report and recommendations as to future development to avoid repetitions	J C Edgerton R W Knight R R DeVore	Report being written on first part Estimate completion date second part July 1, 1938
63-5	Study of air traffic at important terminals and recommendations for relieving congestion	R R DeVore	Estimated completion date of first report May 15 1938.
63-6	Development of means for the prevention of accidents due to water in gasoline storage systems	J C Edgerton	Estimate completion May 15, 1938.
63-7	Investigation, with help of Radio Development Section, of apparatus designed to accomplish better reception of radio range and voice signals under static conditions, prevent diminution of hearing under conditions of rapid descent and prolong the usefulness of a pilot's career by preventing deafness	R Humphreys	Estimate completion May 15, 1938.
63-8	Assist Harvard University in its investigation of the radiograph method of exploring weather aloft.	R W Knight	Estimate completion Apr 15, 1938.
63-9	Study of requirements necessary to the safety, health and comfort of scheduled air line passengers Study includes such problems as ventilation, temperature control, lavatory facilities, determination of altitudes to which average passengers may safely ascend and effects of rapid ascents and descents	W H Miller	Estimate partial report July 1, 1938.

EDUCATIONAL SECTION

This section is nonexistent at present due to need of using available funds on other work

INTERNATIONAL SECTION

Project No	Description	To whom assigned	Remarks
65-1	Study and report upon the state of civil aviation in the United States as compared to other countries	W T Miller	Estimate completion June 1, 1938.

POWER PLANT SECTION

Under supervision of J H Geisse, Section Chief

Project No	Description	To whom assigned	Remarks
66-1	Represent Government's interests in existing contract with Aircraft & Engine Development, Inc., for a barrel type engine	J H Geisse	Completion dependent on contractor
66-2	Endurance test of Funk Engine	J H Geisse	Completion dependent on contractor
66-4	Study of relative hazards of multiengine, multipropeller airplane and multiengine single propeller airplane	K S Cullom	Estimate completion April 1, 1938.
66-6	Determine from available records the specific causes of power plant failures and formulate recommendations looking to the ultimate elimination of such causes.	J H Geisse K S Cullom	Estimate completion May 1, 1938.

RADIO DEVELOPMENT SECTION

Under supervision of W E Jackson, Section Chief

Project No	Description	To whom assigned	Remarks
67–2	Develop and test radio teletype communications system	J C Hromada P D McKeel R A Cunard	First report completed Additional development contemplated on aircraft to ground teletype link Considerable work to be done on specifications for purchase of a complete system
67–5	Develop and test Z type and fan type radio marker receivers	P D McKeel J C Hromada H I Metz H M Lee	Report due April 1, 1938
67–6	Develop and test Z type radio marker	H I Metz C H Jackson	Final report due April 1 1938
67–7	Develop and test receiver for ultra high frequency radio range	P D McKeel J C Hromada R A Cunard	Report due May 1, 1938
67–8	Develop and test ultra high frequency radio range	J M Lee C H Jackson R A Cunard J C Hromada S F Taggart	Preliminary report completed Final report due July 1 1938
67–9	Develop and coordinate installation of radio instrument approach system	W E Jackson J C Hromada F S Donovan C H Jackson D M Stuart A E Harrison S E Taggart R A Cunard	Preliminary report completed Final report due Nov 1, 1938
67–10	Acceptance test of new simultaneous radio range	W E Jackson D M Stuart A E Harrison	Completion of test contingent upon manufacturer s delivery of equipment
67–11	Acceptance test of fan marker equipment	J C Hromada J M Lee	Date of completion contingent upon manufacturer s delivery
67–12	Portable impedance measuring device	H I Metz	Developmental specification will be completed in immediate future
67–13	Investigation of precipitation static in aircraft and means for providing satisfactory radio reception in the presence of such interference	W E Jackson D M Stuart	Laboratory investigation of phenomena under simulated conditions to be sponsored by Bureau Report due September 1, 1938

PRIVATE FLYING SECTION

This Section is nonexistent at present See pages 2 and 4

NATIONAL BUREAU OF STANDARDS

Special work on lights being done for Bureau of Air Commerce under supervision of F C Breckenridge

Project No	Description	To whom assigned	Remarks
68–1	Develop and test a flush type aircraft position light conforming with the requirements of the new Civil Air Regulations for an air line position light	M K Laufer	Estimate completion June 1 1938
68–2	Study available aircraft landing lights and formulate recommendations as to regulations pertaining thereto	M K Laufer	Report prepared Being studied by B A C
68–3	Develop and test suitable airport runway illuminators	E O Seaquist	Preliminary report July 1, 1938
68–4	Study the optical qualities of rotating airways beacons with reference to the speed of rotation and the light intensity	G K Neeland	Progress report prepared Being edited by B A C
68–5	Determine the optimum specifications for aviation colors	W R Schaub	Estimate completion July 1 1938

○