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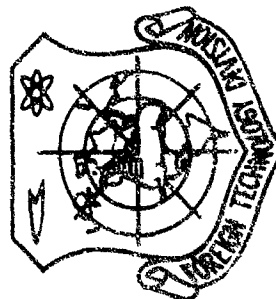
FOREIGN TECHNOLOGY DIVISION



DESIGN HANDBOOKS FOR THE SOVIET MINISTRY OF AVIATION INDUSTRY

by

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EDITED TRANSLATION

DESIGN HANDBOOKS FOR THE SOVIET
MINISTRY OF AVIATION INDUSTRY

By: A. S. Yakovlev

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(50 Years of Soviet Aircraft Design),
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DESIGN HANDBOOKS FOR THE SOVIET MINISTRY OF AVIATION INDUSTRY

A. S. Yakovlev

A great role in the practical use of scientific investigations and their technical realization was played by the development of the "Manual for Designers" (MD), which unified the method of design, construction and testing of modern aircraft.

The necessity for such a "manual" arose because the design bureaus did not have a single method, each worked in his own way, and, one must say, not always successfully. The single law, compulsory for all, was the standards of endurance for aircraft. All were subordinated to this law. Other methodological questions were not worked out, and even the testing of aircraft in wind tunnels was treated by each designer in his own way. The process of design, construction and testing of aircraft was not regulated, and the work often was conducted haphazardly, and this, in the final analysis, brought about large and not always justifiable outlays of materials and labor.

As long as there were only two or three design bureaus in the country, such qualified ones as the Tupolev and Polikarpov Design Bureaus, it was possible to dispense with the regulations, although, even for them a single manual was useful. But, when the design bureaus became many, it was already senseless to work without a single orderly "code." All of this was especially well understood after, as a result of haphazard work and the disorganization in work, in 1940

and 1941, several new aircraft suffered catastrophies during test flights.

The first edition of the MD was prepared in 1940, and was published at the beginning of 1941. A significantly revised and supplemented second edition of more than 150 printer's sheets was released during the Great Patriotic War. It reflected the experiences of the designing, mass production, and battle application of the new generation of Soviet aircraft which appeared before and during the war - Yak, La, and MiG fighters; Il-2 attack planes; and Il-4, Pe-2, and Tu-2 bombers.

The first edition consisted of five parts, while in the second, three-volume, edition there were eleven parts:

1. Aerodynamics;
2. Hydromechanics;
3. Endurance;
4. Flight tests of an aircraft and its equipment;
5. Engine equipment;
6. Aircraft equipment;
7. Aircraft armament;
8. Landing gear and mechanisms;
9. Standard systems;
10. Materials;
11. Semifinished products.

Prominent scientists, designers, and test pilots took part in the preparation of the first edition of the MD. The scientific editors of the parts and divisions were I. V. Ostoslavskiy (aerodynamics), L. I. Sedov (hydromechanics), S. N. Shishkin (endurance), A. I. Makarenskiy (division of endurance specifications), M. V. Keldysh (divisions of dynamic and vibration testing and calculations on flutter), A. V. Chesalov (flight tests, landing gear and mechanisms), V. I. Polikovskiy (engine equipment), G. V. Akimov and S. T. Kishkin (Materials), N. I. Petrov (aircraft equipment), P. Ya. Zaleskiy (armament), and A. T. Tumanov (materials). Also, M. A. Tayts, N. S. Stroyev, V. V. Kostochkin, G. P. Svishchev, A. A. Dorodnitsyn, V. V. Struminskiy, and many others took part in the writing of the MD.

The MD contains a description of wind tunnels and experiments in them, requirements for wind-tunnel models of wings and aircraft and mock-ups, data on wing aerodynamics, detailed recommendations on the selection of specific loading, profiles, etc., on the design of tail units, rudders, and flaps, on the composition of power plants, basic characteristics and recommendations on the selection of propellers and the calculation of their thrust, information on unitized propellers, data on the determination of the stability and controllability of an aircraft according to model tests, longitudinal and side stability of an aircraft, matching of horizontal and vertical tail units.

The section of the MD devoted to hydromechanics was of valuable assistance to seaplane designers. Here the test basin of the Central Aero-Hydrodynamic Institute (TsAGI) and the experiments in it were described, hydrostatic calculations were given, including the calculation of the unsinkability and hydrodynamic calculations of seaplanes.

Questions of endurance were characterized in special detail. Besides the "Endurance Standards," the volume and order of carrying out static and dynamic tests, determination of vibration characteristics, and calculations for flutter were regulated in the MD. The account was distinguished in its detailedness and "instructiveness."

A separate part of the MD was associated with flight testing of aircraft and their equipment. Here, programs and documentation of

aircraft testing were given; tests for stability, controllability, maneuverability and spins; testing of power plants, equipment, gun and bombing armament, landing gear mechanisms, control and landing devices, and the apparatus for flight testing was characterized.

A group of divisions of the MD was connected with engine equipment and contained the requirements, design examples and testing methods for such systems as fuel, oil, liquid cooling, intake, exhaust, for radiators and housings, and for control of the power plants. The section "Radiators and Housings" is distinguished by the greatest detailedness. It explains the importance of optimal planning for these devices to lower the aircraft resistance.

The part of the MD "Aircraft equipment" encompasses pilot-navigation instruments, bombing and mine-torpedo armament, rockets, and armor-plating of aircraft.

The section connected with rockets is interesting, and presents the brief account "Short manual on the use of rockets on an aircraft." Soviet aviation was the first in the world to receive rocket armament and to successfully test it in battles at Khalkhin-Gol. After this, it "dropped to the ground," becoming the menacing guards mortar "Katyusha." Here also, general directions are given for armor-plating of aircraft, along with information on aviation armor and its characteristics. At the end are basic technical recommendations for designing armor parts and for aircraft construction. In particular, it explains that armor-plating of basic military aircraft, namely: fighters, bombers, attack planes, and reconnaissance planes, is necessary. Armor protects certain sectors which are the most dangerous for the crew.

The MD pays a great deal of attention to the development of landing apparatus.

The question of cabin standardization in various types of aircraft, placement of instrumentation in the cabins of bombers, fighters, and attack planes is examined separately.

Two parts of the MD contain a description of the physicomachanical properties of basic aviation materials.

This whole encyclopedia for aviation designers, rich in content, was created in brief periods. It played a great positive role in making clear the work of the Experimental Design Office and it served as the vitally important connecting link between science and practical work.

The People's Commissariat of the Aviation industry paid great attention to the activity of the design bureaus and the scientific research institutes. The problems of the scientific research institutes were cleared away and freed of non-current subjects, the work of scientists was aimed at solving the most important questions of both present and long-range character. Construction was speeded up on new wind tunnels with high-speed streams, and also on gigantic laboratories for static and dynamic experiments, where on a highly scientific basis, designers could check the endurance of aircraft.

Everything was done so that aviation designers could work on a base of the newest scientific investigations.

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ABSTRACT (UNCL, 0) EXTRACT OF REPORT. The article describes the three volume "Manual for Designers" containing eleven parts: Aerodynamics, Hydromechanics, Endurance, Flight tests of an aircraft and its equipment, Engine equipment, Aircraft equipment, Aircraft armament, Landing gear, and Mechanisms, Standard systems, Materials, Semi finished products. A brief description of what is contained in each part is given. The Manual served to standardize and organize the work of design bureaus and it gave aviation designers a base of the newest scientific investigations to work on. Contributors to the Manual included: M. V. Keldysh, A. I. Makarenskiy, V. I. Polikovskiy, and others.				