



INSTRUCTIONS

FOR THE USE OF THE

LOAD ADJUSTER

This publication supplements the Handbook of Weight and Balance Data, T.O. 1-1B-40, and shall be inserted in the same binder.

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IN ORDER TO SIMPLIFY the job of the pilot and Weight and Balance personnel, the Load Adjuster is used as the Balance Computer of the Air Force-Navy Weight and Balance System. It will be found in a leather carrying case, fastened with a metal clip in the pilot's compartment of the airplane. Proficiency in its operation will save the time and effort of solving the center of gravity problem by means of mathematical calculations. Its use with the charts and forms in the Handbook of Weight and Balance Data—T.O.1-1B-40—insures a safe loading and provides a means of checking in advance exactly how the balance position will be affected by each item of load added or expended.

THE COLORED TOP STRIP of the Load Adjuster is the guide to a safe loading. Its red sections show the limits of the loading range. A sloping line defines a limit according to the gross weight of the loaded airplane, a vertical line indicates a limit that is constant at all gross weights. The note to "check landing condition" is a very important part of this top strip. The use of fuel and other expendable load causes a change in the balance position and unless the loading is arranged to allow for this movement of the c.g. it is possible that the allowable limits will be exceeded as expendable load is consumed.

The movement of the transparent **INDICATOR** translates the change in balance position as load is added or expended in terms of the **INDEX SCALE** which appears on the bottom of the rule. This Index Scale is merely a simple reference that is mathematically related to the Center of Gravity Grid, or balance diagram, which appears on the inner recess of the Load Adjuster.

THE CENTER OF GRAVITY GRID is the basis of the Load Adjuster's design. The forward and aft red sections show the c. g. limits in terms of percent of the Mean Aerodynamic Chord and it is from these limits that the top strip of the Load Adjuster is derived. The c.g. position in terms of percent MAC and inches from the reference datum may be read directly from this grid. The crosswise lines represent the weight and the diagonal lines represent the percent. To convert an index reading to percent MAC, note the point at which the indicator hairline and the gross weight line intersect, the percent MAC is estimated at that intersection. The marks across the top of the grid are inches, (or feet as the case may be) from the reference datum. The c.g. position in inches or feet, depending upon which measurement is indicated on the grid itself, is read in the same manner as the percent MAC since, had the lines been extended downward, they would follow the trend of the percent lines.

THE FUSELAGE DIAGRAM on the back of the Load Adjuster will be of great assistance in deciding where to place load items since it provides information concerning station locations. The loading scales on the front of the Load Adjuster are lettered to correspond with the compartment letters on the diagram.

THE BASIC WEIGHT AND MOMENT SCALES on the inner side of the Load Adjuster slide determine the basic index which is the starting point of all loading calculations. These scales are based on the index formula shown in the recess on the inside of the rule. To arrive at a basic index (1) set the indicator hairline at "O" on the index scale. (2) Move the slide until the basic weight is under the hairline. (3) Slide the indicator to the Basic Moment and read the basic index under the hairline on the index scale.

If the Basic Moment should happen to be on a scale other than that containing the basic weight, set the basic weight as above; (2) move the indicator to the final Moment mark at the end of the scale containing the basic weight; (3) move the slide again until the same Moment value at the beginning of the next scale below is under the hairline; (4) Move the indicator to the applicable Moment figure and read the index under the hairline.

OPERATION OF THE LOAD ADJUSTER

All loading calculations start with the hairline of the indicator over the basic index. From there on it requires two operations to load each of the totals shown on the Form F.

1. Move the slide until the "O" vertical starting line of the scale to be used is under the hairline.
2. Move the indicator until the hairline is over the weight to be added. The new index is then read under the hairline on the index scale at the bottom of the rule.

These two operations are repeated for each loading total that appears on the Form F. The computations are made in the order that the items appear on the Form and the resulting index reading is progressively entered in the index column.

When moving the slide, make sure that the indicator is not moved. Moving the indicator to add the totals, see that the slide remains in position.

The effect of the removal or redistribution of load is determined by following the same two steps above only the hairline is set not over the "O" line of any given scale but rather over the total weight to be removed and the last recorded index reading. The indicator is then moved to the "O" line of the scale or to an intermediate weight and the new index is read under the hairline on the index scale.

SAMPLE PROBLEM FOR THE USE OF THE U-1A LOAD ADJUSTER (E-1101)

Suppose the Charts in the Handbook in your airplane show a basic weight of 4,623 pounds and a basic index of 71.7. FORM F is filled out as in the following example. Index readings for each of the load items have been shown so that you can check your answers if you want to work out the problem on the basis of the foregoing general instructions.

<u>ITEM</u>	<u>WEIGHT</u>	<u>INDEX</u>
Basic Airplane	4,623	71.7
Oil (10.8 gallons)	81	67.8
Crew (2)	400	47.7
OPERATING WEIGHT	5,104	47.7
Take-off Fuel - Center	360	49.7
TOTAL AIRPLANE AND FUEL WEIGHT	5,464	49.7
Baggage - Compartment D	173	72.4
Passengers - Row 1	400	67.8
- Row 2	400	74.5
- Row 3	400	93.2
- Row 4	200	107.2
- Row 5	400	147.8
TAKEOFF CONDITION	7,437	147.8
TAKEOFF C. G. IN % MAC	35.6%	

The foregoing computation is worked out in detailed steps in the following instructions. Set the indicator hairline over the given basic index of 71.7 and we can begin.

1. Move the **SLIDE** until the "0" vertical starting line of the **OIL SCALE** is under the hairline.
2. Move the **INDICATOR** until the hairline is over the 10.8 gallon mark. This adds the moment of the loaded oil and produces a new index of 67.8.
3. With the **HAIRLINE** over the new index of 67.8, move the slide until the "0" starting line of the **CREW SCALE** is under the hairline.
4. Move the **INDICATOR** to the 200 pound mark on the Copilot's Scale. Doing so adds the moment of the two crew members and produces the **OPERATING WEIGHT INDEX** of 47.7.

ADDITION OF FUEL AND CARGO

The foregoing computation produces the balance position for the operating weight of the airplane. To this must be added the weight of the fuel, baggage and passengers.

1. Set the "0" mark of the **CENTER FUEL SCALE** under the hairline at the operating weight index of 47.7.
2. Moving the **INDICATOR** until the hairline is over the 60 gallon position on the **CENTER FUEL SCALE** will change the index to 49.7.

3. To add the **BAGGAGE**, move the **SLIDE** until the "0" mark of the **CARGO SCALES** is under the hairline at the 49.7 index position.
4. Move the **INDICATOR** until the hairline is over the 173 pound position on **SCALE D** the index will now be 72.4.
5. Using the **PASSENGER SCALE** in the same manner will quickly determine the effect of loading all the passengers in one movement of the indicator. Move the **SLIDE** until the "0" starting line of the **PASSENGER SCALE (Row 1)** is under the hairline at the 72.4 index.
6. Move the **INDICATOR** until the hairline is over the 400 pound position on the **ROW 5** portion of this scale and produce an index of 147.8. This is the final or **TAKEOFF INDEX**.

DETERMINATION OF SAFE FLIGHT AND LANDING C. G.

It is very important to determine that the c. g. will remain within safe limits during the entire flight and for landing. This computation is accomplished by the reverse use of the Load Adjuster scales and the **CHANGE SCALE**. As an example, let us assume that all but 100 pounds of fuel has been consumed at landing.

1. Set the **INDICATOR** hairline at the takeoff index of 147.8.
2. Move the **SLIDE** until the 60 gallon position on the **CENTER FUEL SCALE** is under the hairline.
3. Move the **INDICATOR** to 17 gallon position. The new index will be 146.3. Even though the change in the index reading is very small as fuel is consumed, the decrease in the gross weight could produce a critical condition if the airplane happened to be loaded near the extremes of the loading range area.
4. If, for some reason, a more forward c. g. position were desirable, the effect of moving a passenger from Row 5 to a position in Row 1 could be determined through the use of the **CHANGE SCALE**. Move the **SLIDE** until the Row 5 tick mark on the **Change Scale** is under the hairline at the 146.3 index.
5. Move the **INDICATOR** until the hairline is over the Row 1 tick mark. The resulting index of 123.7 indicates the balance position of the airplane after the passenger has moved to the new position.

READING C. G. POSITION FROM GRID

Just to give you an opportunity to check on reading percent MAC and inches from the center of gravity grid, we are going to help you to convert your loaded index. Set the hairline of the indicator at the **TAKEOFF INDEX** of 147.8 and move the slide so that the gross weight figures on its left-hand side will be conveniently close to the indicator hairline. As these figures duplicate the position of the gross weight lines on the c. g. grid, they serve to simplify locating the gross weight position

when reading the intersection of the weight line and the indicator hairline to determine % MAC and inches from the reference datum. The intersection of the hairline and the position representing the TAKEOFF GROSS WEIGHT of 7437 pounds occurs between the 35% and 36% lines. Therefore, the percent MAC is estimated at 35.6%. The position in inches is read at 148".

SERVICE RECOMMENDATIONS FOR LOAD ADJUSTERS

INDICATOR - When cleaning the transparent lucite indicator, do not wipe with a dry cloth. Wash with a grit-free soft cloth, chamois or sponge, using soap and water, kerosene or naphtha. DO NOT use acetone, benzine, lacquer thinners, kitchen cleansers, etc., as they contain certain solvents and abrasives that will damage the surfaces. Automobile or furniture wax will cover minor scratches and will help to prevent further scratching.

SLIDE AND BASE - To clean the faces (vinylite) of the slide and base, use a caustic-free soap with water and wipe dry with a soft cloth or tissue paper.