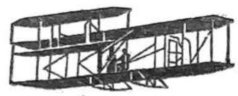
INSTRUCTION BOOK

for the

Hoffman Airplane Calculator



MECHanic
B. J. Sacks

Manufactured by

The Airplane Calculator Co.
Chicago, U. S. A.

THE HOFFMAN AIRPLANE CALCULATOR

A Wonderful Mechanical Aid in All Airplane Calculations, Eliminating the Necessity of Tedious and Tiresome Figuring, Thereby Saving Time, Labor, Trouble and Worry

---

Accurate and Reliable Calculations Made in a Few Minutes by a Simple but Valuable Device Which Is Indispensable for the Airplane Designer, Builder, Mechanic and Student

---

In presenting the Hoffman Airplane Calculator in its latest improved form, with circular slides, the AIRPLANE CALCULATOR COMPANY takes pleasure in guaranteeing its accuracy and reliability, if used according to the plain Instructions given herewith.

This automatic mechanical Calculator is the invention of Mr. R. J. Hoffman, M. E., and is an improvement upon his well-known Triple-Slide Airplane Calculator, which is used by aviators, designers, builders, engineers, and scientists in the United States, Great Britain, France, Italy, Japan, China, and elsewhere, to save time and labor in performing the mathematical calculations required in the design, manufacture, and use of the airplane.

With this Calculator, when you know the Wing

Curve of any airplane or any Laboratory Tested model, you can readily find all its other "characteristics," as they are called, including the Gliding Angle, the Minimum Speed, the Maximum Speed, the Minimum Horse Power, the Reserve Horse Power, the Highest Possible Flying Weight, the Useful Load, the Range of Distance and Fuel Capacity for Distance Flying, the Altitude Record, and all the other characteristics that you need to know, and that could not otherwise be found without intricate and tedious figuring. In short, the Airplane Calculator will be your Consulting Engineer, and will pay for itself in a very short time if you are engaged in any sort of Aviation work. Those who have used it and proved its value would not be without it for many times its cost.

A fair and honest trial will convince you of its value. Simply follow the Instructions given, and you will soon learn to use it readily.

Description of the Hoffman Airplane Calculator

1. The Hoffman Airplane Calculator has a base marked **A**, two slides or turnable disks marked **B, C**, and an Indicator.

Base **A** is the slide which will be used in connection with Horse Power, Climbing, and Altitude calculations.

It has five scales:

1—1 indicates the Weight;
2—2 the indicator Coefficient;
3—3 the Altitude in feet;
4—4 the Weight of the Machine;
5—5 the Climbing Speed in feet per minute.

Slide **B** is known as the Horse Power slide. It contains the following four scales:

6—6 the Area in sq. ft.;
7—7 the required Horse Power;
8—8 the Weight in lbs.;
9—9 the Speed in miles per hour.

Slide **C** is the Speed Slide, bearing the following scales:

10—10 the Area in sq. ft.;
11—11 the Speed Coefficient;
12—12 the Altitude in feet, connected with the Speed.

2. **The Indicator.**—The Indicator is used in connection with the chart in the following manner:

Connect the center point of the Indicator with the number of E of C (Efficiency of Construction, see paragraph 13); turn the tangent line to any point of the curves and read the amount at the intersection of the horizontal line with the indicator; if the Indicator is used in connection with chart No. 1, the Indicator coefficient is used for calculating the Horse Power. In using the indicator on Chart No. 2 the Indicator coefficient shows the Gliding Angle.

Example: If E of C is 40, and the wing curve U. S. A. 1 and an angle of incidence of 6 degrees are used, the Indicator coefficient will be, by using Chart No. 1, 8.3 and by using Chart No. 2, 9.6.

Basis of Airplane Calculations.—All airplane calculations are based on the used Wing Curve. There is no process or system known whereby airplane calculations can be made without knowing the Laboratory Test of the Wing Section.

The Characteristics of the Wing Curve which influence the results of any and all airplane calculations are known as the Lift and Drag Coefficients. The ratio of the Lift to the Drag is known as the Gliding Angle of the Wing.

Every wing or plane moved against the air creates a certain resistance, which is known as the Drag. The Drag is always contrary to the forward motion of the Airplane, and is measured by the Laboratory Test giving the amount of resistance by a wing of one square foot when moved horizontally one mile per hour under a certain angle of incidence. This measurement is known as the Drag Coefficient, as it is multiplied by the number of square feet used in

the wing and the square of the speed in miles per hour attainable by the airplane, to give the entire Drag of the Wing.

The Lift is the power of the wing to overcome gravity, and is always vertical to the forward motion of the airplane. The Lift is measured by the Laboratory test giving the number of pounds a wing of one square foot can lift when moved horizontally one mile per hour under a certain angle of incidence. This measurement is known as the Lift coefficient, as it is multiplied by the number of square feet used in the wing and the square of the speed in miles per hour attainable by the airplane, to give the entire Lift of the wing.

The Charts.—We attach four charts to this Instruction Book, which give the Lift and Drag Coefficients of 10 square feet, moved 100 miles per hour, and to convert the coefficients given in the lbs., one sq. ft., and one mile per hour system (which we call the U. S. A. System), to the system used in connection with our Calculator, you have only to multiply the given figures by 100,000.

Thus, if in the U. S. A. System, a coefficient would be .001, in our chart it would be 100,000 times .001, which is equal to 100. As we see, this system has the advantage of simplicity and is easy to memorize.

Chart No. 1 and Chart No. 2 are plotted on so-called polar graphs, where the Drag Units are horizontally and the Lift Units vertically laid out. The angles of incident are marked from 2 to 2 degrees. The bottom line is elongated to the left and has marked on the upper hand the E of C, and on the lower hand the equivalent Drag Coefficient.

So if the E of C is 40, the Drag Unit would be 8.

The other space is filled out with the design of the wing cross section, giving the dimensions for the chord of the unit. To find the design for a given chord, you have only to multiply the given figures with the length of the chord. Chart No. 1 is used in Horse Power Calculation.

Chart No. 2 has the same Wing Curve plotted as Chart No. 1, but it will be used only in Gliding Angle calculations; on the left side the Centers of Pressure are given for the given Wing Curve, with the exception of R. A. F. 6, which is practically identical with the U. S. A. 1 wing section.

There is one plain chart No. 1 and No. 2 attached for using to plot in your own wing curve without our help, which will be of big help in investigating new designs or your own wing curve, or that of a whole Laboratory Tested Model.

3. **Airplane Terms and Symbols.**—The **main factors** of an airplane are:

(A) the Wing Area (figured in Sq. Ft.).

(W) the Flying Weight (figured in Pounds).

(DA) the Dead Area (figured as a Vertical Plane in Sq. Ft.).

(d) the Density of the Air (figured in Altitude-feet).

(HP) the Power Plant (figured in Horse Power).

The Principal Aerodynamical Elements of an Airplane are as Follows:

4. **Area of the Wing** (A).—The Area of the Wing is the wing surface area of the machine, or the Wing Area, and is measured in square feet.

5. **Flying Weight** (W).—(a) the Construction Weight is the Empty Weight of the built-up machine and comprises everything that is built into the machine as a part of it. (b) the Flying Weight is the Total Weight supported in the air, including the Empty Weight and the Useful Load, which consists of the pilot with passenger and observer, instruments not necessary for actual flight, bombs, guns, ammunition, etc. This weight naturally varies with the services required of the machine, such as military, commercial, and supporting purposes.

6. **Dead Area** (DA).—The Dead Area is the

area of a flat plate with a resistance equal to the nonlifting parts of the machine exposed to the air in the direction of its flight; such as wires, struts, stabilizer, landing gear, radiator, etc. The absolute amount of the Dead Area is very seldom known, as it requires the building of an exact scale model of the airplane, which then has to undergo a Laboratory Test. The approximate Dead Area is commonly based on the result of numerous Laboratory Tests on Standard Parts.

In the following we will give the Dead Area of the different types of construction, assuming standard design:

		Wing Area	Dead Area
Speed Scout, Pursuit Machine	A	200-300 sq. ft.	5- 6 sq. ft.
Reconnaissance Machine	"	300-400 "	7-10 "
Bombing Machine	"	400-600 "	10-13 "
Twin Motored Machine	"	500-700 "	12-16 "
Flying Boat		300-500 "	12-14 "

7. **Brake Horse Power** (BHP).—The real Horse Power of the motor at its different revolutions found by testing the motor on a brake. This Horse Power must be taken into consideration in designing the propeller.

8. **Propeller Horse Power** (HP).—The real Horse Power that is developed from the Propeller by the Motor. Owing to the Efficiency of the Propeller, this Horse Power is never above 85% of the Brake Horse Power, and in poorly designed propellers, it is as low as 50%. The common average is 75% of the Brake Horse Power, for high speed, and 65% when the machine is climbing, which is used when the real Efficiency of the Propeller is unknown. The Propeller Horse Power is the Horse Power that has to be used for calculations, as it is the real Horse Power of the Airplane.

9. **Maximum Horse Power** (Max. HP).—The greatest amount of the Horse Power developed from the Propeller by the motor, creating the Maximum Speed in horizontal flight and commonly known as the Horse Power of the Airplane.

10. **Minimum Horse Power** (Min. HP).—The least required Horse Power developed from the Propeller by the Motor to sustain the airplane in horizontal flight, creating the Economical Speed.

11. **Reserve Horse Power** (RHP).—The difference between the Max. HP developed and the Min. HP required is the Reserve Horse Power, which creates climbing ability.

12. **Density of the Air.**—As higher altitudes are reached the density of the air becomes lighter. This action of the air affects both the motor and the airplane. The performances of an airplane in the higher altitudes are quite different from the performances obtained in the lower altitudes. The density of the

air causes all machines to have a certain altitude record called the "ceiling."

13. **Efficiency of Construction** (E of C).—The number of times the Area of Surface is greater than the Dead Area, or A/DA. For example; if the Wing Area is 400 sq. ft. and the Dead Area is 10 sq. ft., the Efficiency of Construction is then 400/10 or 40.

14. **Angle of Incidence.**—The inclination of the chord of the wing to its forward motion is the Angle of Incidence, which is determined by the characteristics of an airplane.

There is no one Angle of Incidence that will give the best results for every important characteristic of an airplane.

There is one angle for the Maximum Speed, and one Angle for the Minimum Speed. To secure the best all-around Angle of Incidence you have to compromise between the angle for the Maximum Speed and the angle for the Minimum Speed. The Angle of Incidence regulates the Speed; and vice versa the Speed regulates the Angle of Incidence. It is only possible to get one Speed from one Angle in horizontal flight.

15. **Gliding Angle.**—Whenever the motor stops or is stopped, the airplane is forced to come down. The flier prevents it from falling by means of the

control surfaces, making it dive or gliding through the air. The ratio of the distance it will glide before touching the ground to the Altitude, or the height it was at when starting to glide, is known as the Gliding Angle.

For example: The Airplane is 1,000 feet high and can glide over a distance of 8,000 feet before touching the ground which makes the Gliding Angle of the airplane 1 to 8. The Gliding Angle of an airplane is regulated by the Dead Area and the Wing Area. The Weight and the Altitude will only influence the Speed.

16. **Range of Distance.**—The farthest distance the airplane can fly and still be able to return to its starting point without landing for supplies. The Range of Distance is regulated by the fuel and oil that can be carried, the speed, and the weather conditions.

17. **Center of Pressure.**—When all Pressures of the Wing Curve are included in one main pressure and definitely located according to the Angle of Incidence on the Chord of the Wing, this point is the Center of Pressure of the Wing Curve. The Center of pressure is used in balancing the airplane.

18. **Speed** (V).—The velocity in miles per hour required to support the airplane in horizontal flight.

19. **Landing Speed** (Vl).—The lowest speed possible for landing.

20. **Economical Speed** (Ve).—The speed derived from the minimum HP of the airplane in horizontal flight.

21. **Minimum Speed** (Min. V).—The lowest sustaining speed for horizontal flight with motor running; mostly the same as the Economical Speed.

22. **Maximum Speed** (Max. V).—The greatest Speed and commonly called the Speed of the Airplane.

23. **Gliding Speed** (Vgl).—The speed attained at the best Gliding Angle.

24. **Altitude Speed** (Va).—The speed obtained at the different altitudes.

25. **Climbing Speed** (Vcl).—The ability to climb in feet per minute, in accordance with the Reserve Horsepower.

26. **Nose-dive Speed** (Vnd).—Whenever the motor stops and the flier dives vertically down to the ground, we obtain a speed which is called the Nose-dive Speed.

INSTRUCTIONS

How to Operate the Hoffman Airplane Calculator

27. To calculate the Speed of any Angle of Incidence for horizontal flight when you know the Weight (W) and Wing Area (A):

Connect the scale 8 (W) with scale 10 (A), then find speed coefficient for the particular angle of incidence from chart No. 1 or No. 2, or the life coefficient in the USA units multiplied by 100,000. Looking on scale No. 11, you find the speed coefficient connected with a certain V on scale No. 9, which is the speed required for the stipulated angle of incidence.

Example: W = 2000 lbs., total flying weight.
A = 200 sq. ft., USA 4 wing curve, 12 degrees.
Speed coefficient = 330.

On slide C scale 10 connect 200 with the 2000 on scale No. 8 and find 330 on scale No. 11 connected with the speed of 55 miles per hour on scale No. 9.

28. To calculate the Landing Speed when you know the Weight (W) and the Wing Area (A).

Connect W on scale No. 8 with A on scale No. 10, then find the maximum speed coefficient from the chart No. 1 or No. 2; looking on scale No. 10 you find the speed coefficient connected with the speed in miles per hour on scale No. 9, which is the Landing Speed to be found.

Example: W = 2000 pounds flying weight.
A = 400 square feet.
U. S. A. 1 wing curve.

Connect 2000 on scale No. 8 with 400 on scale No. 10. On chart No. 2 we find the maximum speed coefficient for U. S. A. 1 to be 318. Looking on scale 11 you find 316 connected with the speed of 39.5 miles per hour on scale No. 9.

29. You will notice that the highest point of the wing characteristic curve has a certain Angle of Incidence. This angle we call the Landing Angle, as it is the greatest Angle that you can throw your airplane into when landing, without stalling or tail sliding. This Angle is imperative in designing and laying-out of the landing gears.

30. To calculate the Horse Power required for any Angle of Incidence, when you know the Weight (W), the Wing Area (A), the Dead Area (DA).

Calculate E of C (see paragraph 13), connect the center of the Indicator on chart No. 1 with the E of C, turn the Line of Tangent to the Angle of Incidence on the selected Wing Curve, and read the Indicator coefficient. Then connect W on scale No. 1 with A on scale No. 6. Looking on scale No. 2 we find the Indicator Coefficient connected with the required Horsepower on scale No. 7.

Example: W = 2000 pounds total weight.
A = 400 square feet. Wing curve, U. S. A. 4 — 10 degrees.
DA = 10 square feet.

So E of C equals 400/10 or 40, and the reading on indicator shows 9.8. You will find the required Horse Power by connecting 2000 on scale No. 1 with 400 on scale No. 6. Looking on scale No. 2 we find 9.8 connected with 24.5, which is the required Horse Power for horizontal flight.

31. To calculate the Minimum Horse Power when you know the Weight (W), the Area (A), the Dead Area (DA), and the wing curve is selected. Calculate E (see definition), connect the center of the Indicator on chart No. 1 with E of C, turn the "Tangent Line" until it is tangent to the Lift-Drag line of the selected wing curve, and read the Indi coefficient on the horizontal line. Then connect W on scale No. 1 with A on scale No. 6. Looking on scale No. 2 we find the Indicator coefficient connected with the required Horse Power, which is the minimum necessary to fly.

Example: W = 2000 pounds weight.
A = 400 square feet.
DA = 10 square feet.
U. S. A. 1 Wing Curve.

E = 400/10 = 40. On chart No. 1 connect center line of the Indicator with 40, then turn it till it will be tangent to the Lift-Drag Line of the U. S. A. 1 wing curve, and then read the Indicator coefficient, being 9.4. Then connect 2000 on scale No. 1 with 400 on scale No. 6; looking on scale No. 2 you find 9.4 connected with 25.5 on scale No. 7, which is the Minimum Horsepower.

32. To calculate the Reserve Horse Power if you have the HP min, and the Brake Horse Power (BHP). Multiply the BHP with the efficiency of the propeller and subtract the Minimum Horse Power; you will have the Reserve Horsepower (RHP).

Example: If BHP = 100, HP min = 40. the propeller efficiency for climbing is 65%, the RHP equals 100 times 65 minus 40, equals 25, so the RHP = 25HP.

33. To calculate the Climbing Speed when you know the Weight (W), the Wing Area (A), the Dead Area (DA), and the Brake Horse Power (BHP).

Find the Propeller Horse Power from the BHP. Calculate the Minimum Horse Power. (See instruction No. 31.) Then find the Reserve Horse Power according instruction No. 32, then connect the RHP on scale No. 7 with W on scale No. 4, and read at the point of the arrow the climbing speed in the first minute on the scale No. 5.

Example: BHP = 215 HP.
Propeller Efficiency 65%.
W = 2000 pounds.
HP min. = 40 HP.

Taking the propeller efficiency, 65%, we get 65 times 215, equals 140, so 140 would be the Propeller Horse Power; subtract from it the HP min, and you will have 100 HP as RHP. Then connect 100 on scale No. 7 with 2000 on scale No. 4 and read at the arrow the climbing speed of 1650 feet in the first minute on scale No. 5.

34. To calculate the "Ceiling" of a machine when you know the Propeller Horse Power and the HP min. (see calculation of HP min. No. 31). Connect on scale No. 3 the O altitude with HP min. and read at the HP max. or Propeller HP the Altitude to be reached, or the "Ceiling" of the machine, in feet.

Example: HP min. = 35 HP.
BHP = 100 HP.
Propeller Efficiency = 65%.

The real Horse Power of the machine would be 100 times 65, equals 65 HP. Connect 35 on scale No. 7 with zero altitude on scale No. 3, then look at 65 on the scale No. 7. You will find it is connected with 10,000 feet on scale No. 3, which is the "Ceiling" of the machine.

35. To calculate the Economical Speed or the Minimum Speed when you know the Weight (W), Wing Area (A), and Dead Area (DA).

Calculate the E of C. Connect the center of the Indicator on chart No. 1 with the found E of C, then

turn the Indicator around this point till it is tangent
to the Lift-Drag Line of the selected Wing Curve,
and then read the Speed Coefficient where the Indi-
cator tangent line touches the Lift-Drag Line. With
the found Speed Coefficient, you proceed in calcu-
lating as described in No. 27.

36. To calculate the Maximum Weight to be
carried, when you know the Wing Area (A), Dead
Area (DA), and Brake Horse Power (BHP). Calcu-
late E and find the Indicator Coefficient as described
in No. 35; then find the Propeller Horse Power, con-
nect the HP on scale No. 7 with the Indicator Coeffi-
cient on scale No. 2, then look at the scale **No. 6.**
You find A connected with W max., on scale **No. 1.**

Example: A = 400 square feet.
DA = 10 sq. ft.
Eiffel 32, Wing Curve.
BHP = 160 HP.

Thus the Indicator Coefficient will be 8.5. Taking
75% as the efficiency of the propeller we have 120
HP. Connect 8.5 on scale No. 2 with 120 on scale
No. 7, we find on scale No. 6, 400 connected with 5300
lbs. on scale No. 1, which is the highest POSSIBLE
WEIGHT you can impose upon the airplane. In
using this weight you have no climbing or bank-
ing ability, as the entire 120 HP is devoted to car-
rying the extreme weight. By using only 80% of

the HP available you climb up to 3300 feet of alti-
tude and it gives you a certain amount of power
for banking successfully. Thus the maximum
weight to be carried would be only 4600 lbs. The
Useful Load is the difference between the highest
weight used and the Empty Weight of the Airplane.

37. To calculate the Gliding Angle when you
know the Wing Area (A) and the Dead Area (DA).
Calculate E (see definition 13), then connect the
center of the Indicator on Chart No. 2 with E and
turn the Indicator till it is tangent to the Lift-Drag
Line of the selected Wing Curve, and read the Glid-
ing Angle on the Indicator.

Example: A = 400 square feet.
Reconnaissance machine = 10 sq. ft. DA.
U. S. A. 4 Wing Curve.

E = A/DA = 40. Connect center of Indicator with
E on Chart No. 2; turn indicator till it gets tang-
ent to the U. S. A. 4 Lift-Drag Curve. Then read the
Gliding Angle at the horizontal Line, which is one in
9.7.

38. To calculate Gliding Speed when you know
the Weight Area (A), Dead Area (DA), and the
Wing Curve.

Calculate E, and proceed like No. 37, taking the
Speed Coefficient at the point where the Indicator

touches the Curve. With the help of the Indicator Coefficient and the WA, we can find according to No. 27 the Speed, which will be the Gliding Speed. The actual speed will be less than so found, but the difference is so small at a gliding angle of 1 in 4, it will be only 1½% less than the found speed, so it could be neglected.

Example: Take example from No. 37 with a weight of 2000 lbs.

The indicator touches or is tangent at the angle of 7 degrees, which has a Lift coefficient of 235. Connect W 2000 on scale No. 8 with A 400 on scale No. 10, and you find on scale No. 11 Lc 235 connected with the Gliding Speed of 46 miles per hour on the scale No. 9.

39. The Speed for Minimum Thrust is identical with the Gliding Speed.

40. To calculate the Altitude Speed at the top level, or "Ceiling," when you know the Weight (W), Area (A), Dead Area (DA), and the Brake Horse Power (BHP). Calculate the MinHP (see No. 31), then the Economical Speed (see No. 35), then find the ceiling feet, then connect on scale No. 9 the Ve with the zero altitude of the scale No. 12, and you will find the ceiling connected with the Altitude eed on scale No. 9.

Example: Min. HP = 75 HP.
Prop. HP = 75 HP.
Ve = 45 MPH.

Connect 40 on scale No. 7 with zero on scale No. 3 and read at 75 the altitude of 10,000 feet, which is the Ceiling of this machine. Then connect V45 on scale No. 10 with zero on scale No. 12, and read at 10,000 the Altitude Speed of 53.3 miles per hour.

41. To calculate the Nose-Dive Speed if you know the Weight (W), Area (A), Dead Area (DA), and the Wing Curve. Find on charts No. 1 and 2, the Drag Coefficient for "no lift," calculate the E of C, and find the equivalent Drag Coefficient on the horizontal line of the chart. The addition of the Drag Coefficient of the Wing Curve and the E of C gives you the Total Drag Coefficient. Then connect W on scale No. 8 with A on scale No. 10, and you find the Total Drag Coefficient on Scale No. 11 connected with the Nose-Drive Speed on scale No. 9.

Example: W = 2000 lbs.
A = 40 sq. ft.
DA = 10 sq. ft. U. S. A. 4 Wing Curve.

Chart No. 1 shows the Drag Coefficient for "no lift" = 15. Thus E of C = 400/ 10 = 40, and for 40 find X equals to 8; the addition, 15 plus 8 being the Total Drag coefficient = 23. Connect W 2000 on scale No. 8 with A 400 on scale No. 10, we find on scale No. 11, 23 connected with the Nose-dive Speed, 149.75 miles per hour.

The above calculation was done without taking into consideration the resistance of the propeller driving the motor, which will be equal to 4-5 square feet Dead Area; thus the total Dead Area equals 10 plus 4, equals 14, and then E of C = 400/14 = 28.5, and the Drag Coefficient 11.2. The total drag coefficient 11.2 + 15 = 26.2 instead of 23, and the Nose-dive Speed 140 miles per hour.

42. To calculate the Total Head Resistance created by a certain Speed, when you know the Wing Area (A), Dead Area (DA), Drag Coefficient (Dc) for a certain Angle of Incidence, and the corresponding Speed (V).

Find the E of C and then the equivalent Drag Coefficient; add to this the Drag Coefficient of the Wing Area (see chart No. 2), which will give you the Total Drag Coefficient. Then connect the Speed on scale No. 9 with the Drag Coefficient on scale No. 11. You will find on scale No. 10 A connected with the Resistance on scale No. 8.

Example: A = 400 sq. ft.
DA = 10 sq. ft.
V = 80 sq. ft.
Dc = 6.

then E of C is 40, thus equivalent to 8 and the total Drag Coefficient 6 + 8 = 14; then connect V80 on scale No. 9 with 14 on scale No. 11; you will find on scale No. 10 A400 connected with the Total Head-On Resistance of 355 pounds.

43. To find the Range of Distance.

Calculate the Speed (using 165 pounds for pilot and 165 for each passenger), according to No. 27; calculate the Maximum Weight according to No. 36 and the corresponding Speed. The average of these two Speeds will be the Average Speed required for flight. Then calculate the gasoline consumption per hour and see how many times it will divide into the amount of the fuel capacity; then multiply the amount so found by the Average Speed and divide by 2. You will have the distance the airplane can fly and return to its base, eliminating the disadvantage of the wind.

CHART No.1.
HORSEPOWER CALCULATION

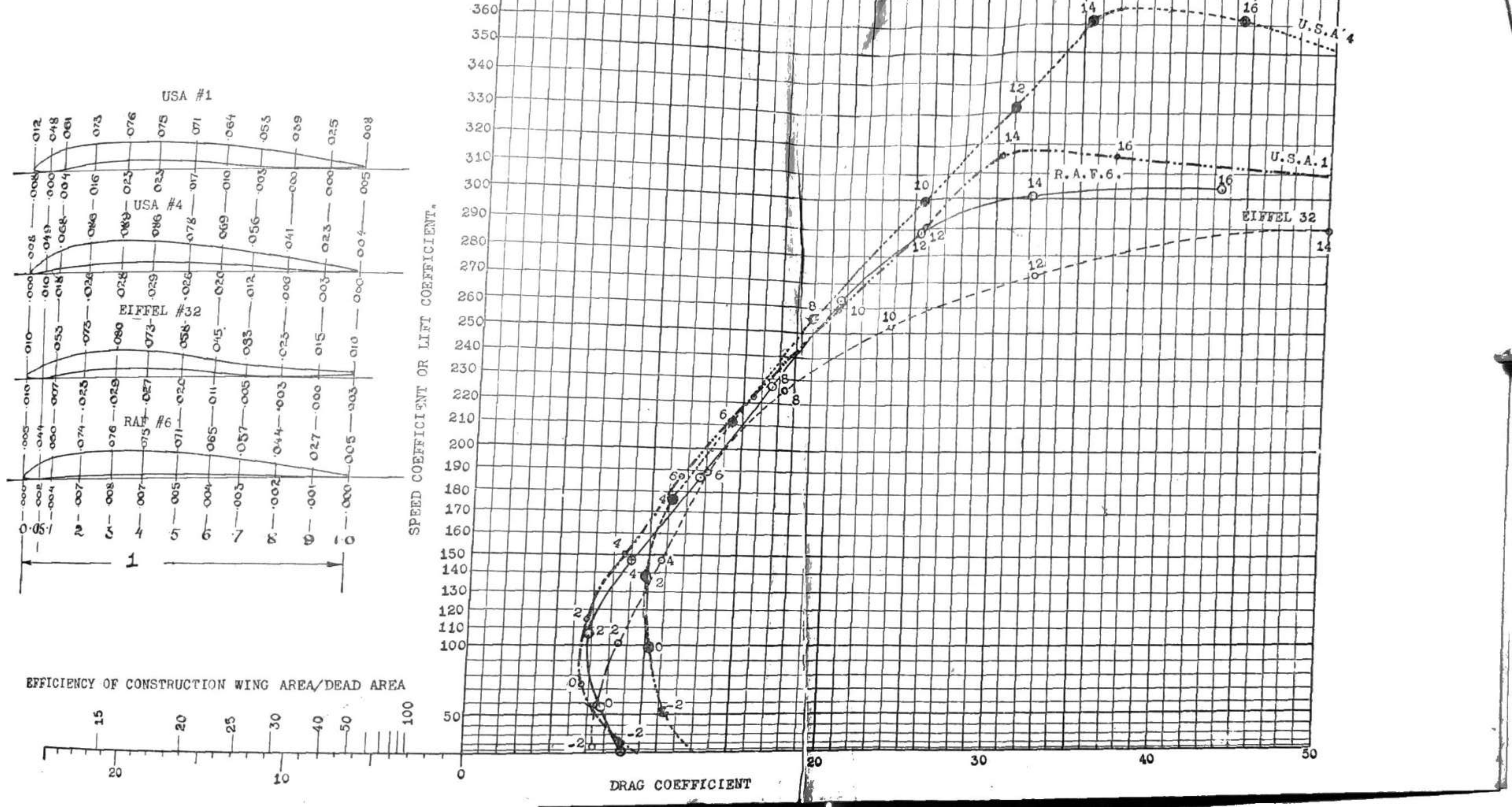


CHART No. 1
HORSEPOWER CALCULATION

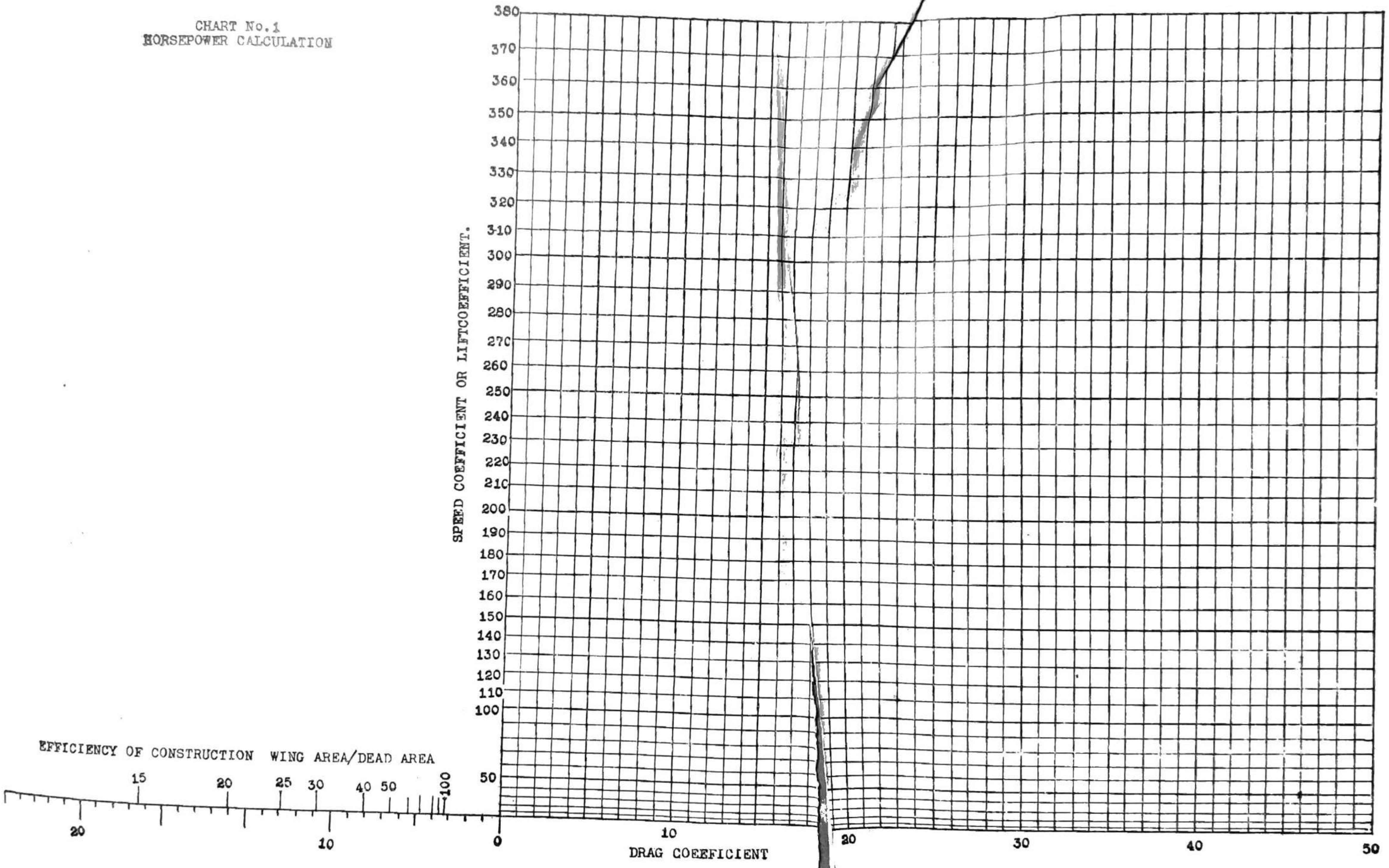


Chart No.2
GLIDING ANGLE CALCULATION

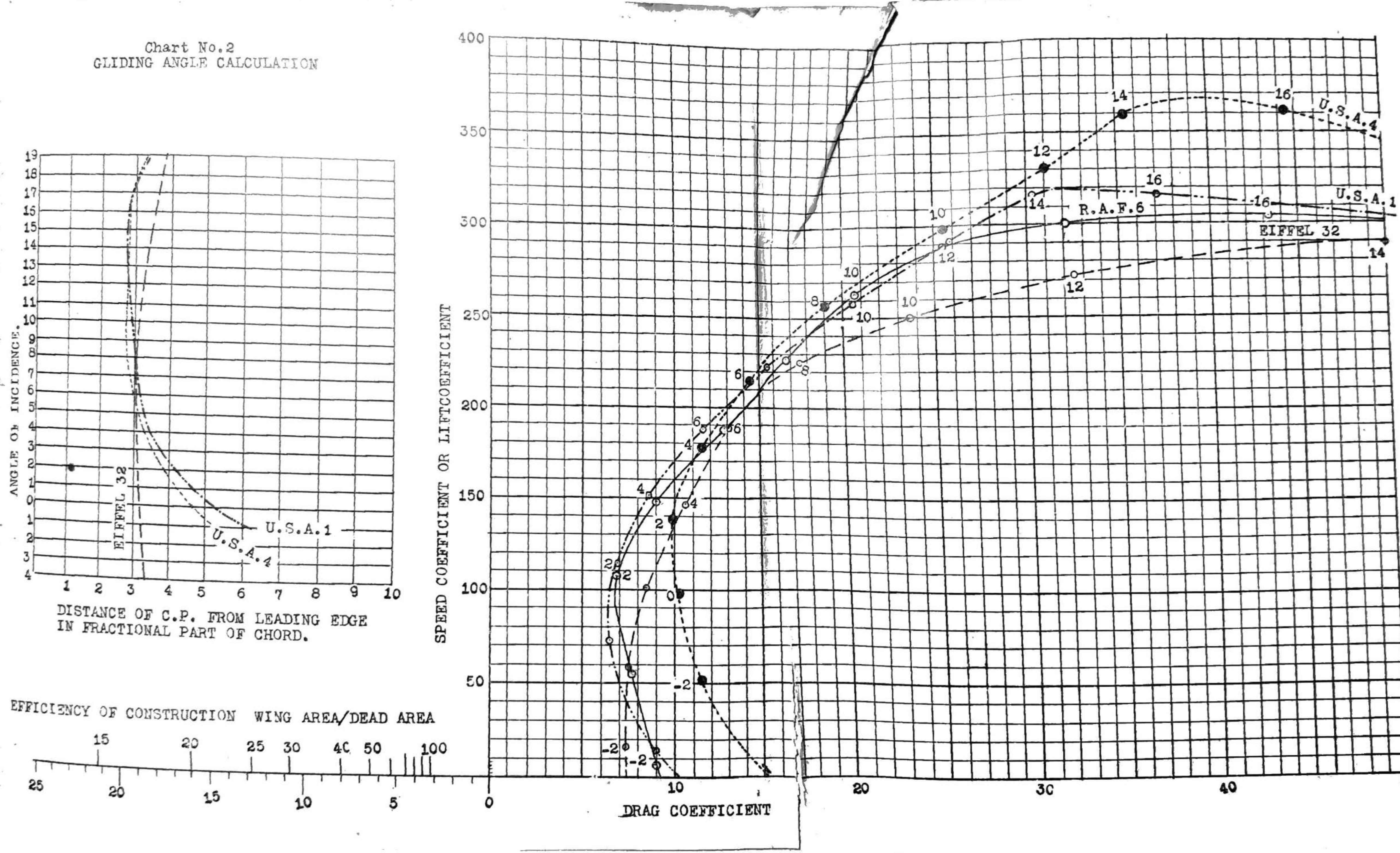


CHART No. 2
GLIDING ANGLE CALCULATION