USAAVNS PT 6

PROGRAMED TEXT

HELICOPTER TACTICAL LOADING

MAY 1967

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6

DEPARTMENT OF TACTICS

UNITED STATES ARMY AVIATION SCHOOL

FORT RUCKER, ALABAMA

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TITLE: Tactical Loads (RW) FILE NO. 5/69-597-1 & 8-597-3

POI SCOPE: Determining aircraft requirements for a mission, preparation for aerial delivery and techniques, types of cargo loading, center of gravity considerations, and troop briefing utilizing programed techniques of instruction.

INSTRUCTOR REFERENCES: FM 57-35; TM 55-1520-210-10, TM 55-405-9, TM 57-210; Airborne Handbook, USAIS.

MATERIALS ISSUED TO STUDENTS: Program Workbook.

PREPARED BY: Captain J. W. Russell DATE: October 1966

APPROVED BY: Colonel Roy E. Creek, Director

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PREFACE

The methods, techniques and rules of thumb given in this instruction are designed for use under tactical or combat conditions. The sections covering Aircraft Requirements, External and Internal Loading of Helicopters and Cargo Center of Gravity are good guidelines for quick and adequate computations that will insure safe operation of the aircraft if all the rules are correctly applied. But it must be remembered that in many cases the methods given here are not the most accurate but all are safe, quick, and proven.

A good understanding of these aspects of Tactical Loading, plus the classroom instruction in Theory of Lashing, will insure the aviator safe operation of his aircraft under such field or combat situations. After all, the majority of helicopter missions involve the transport of personnel, supplies, or equipment. If we do not know how to apply the techniques of tactical loading or more serious - do not care, our mission may suffer as a result of our lack of knowledge and skill.

OBJECTIVES

Knowledges:

The student will, without the use of notes:

1. Be able to write all four of the planning considerations concerning external loading of helicopters.

2. List in writing each of the four major elements of the briefings received by transported troops prior to helicopterborne operations.

Skills:

The student will, without the use of notes, be able to:

1. Correctly solve a sample problem finding the pressure exerted by a given item of cargo on the cargo floor given all information necessary to solve the problem, and be able to determine if the figure derived is within the floor pressure limits set for the helicopter.

OBJECTIVES (Cont'd)

2. Compute the exact number of aircraft required to transport the cargo for a sample tactical mission using the information derived from the proper steps in the space method.

3. Solve correctly a sample problem using the station method of finding center of gravity of a cargo load given the information necessary to solve the problem.

HELICOPTER TACTICAL LOADING

Frame 1

This booklet is designed to teach you about Helicopter Tactical Loading. It will give you the knowledge needed by you as a rated aviator in some of the important areas of Helicopter Tactical Loading. The program will guide you along the path at your own speed so that you will be sure to grasp and understand the methods and technique used in the field. The instruction given here is the same as you would receive in the classroom. But here you will learn by teaching yourself.

Go on to the next page

Frame

2 In the course of this booklet you will be asked to do several things:

3 A. You may be asked to fill in the _____s. (In such a case the correct answers will be on the flip side of the page.)

4 B. You may be asked to choose between several words to answer a question or complete (choose one) a -

1. Forward pass

2. Sentence (see flip side for answer)

3. Song

blank(s) or space(s)

2. Sentence

Frame

5 Or you may be asked to choose between several alternative answers. When this is the case the answer you choose will direct you on to another page in the booklet.

6 You should then turn to that page to see if the answer you choose is the proper one. If it is not the right answer, the directions on that page will tell you what to do.

7 You should follow these directions carefully. You are only cheating yourself if you skip over material or look ahead to find the answers.

8 You are responsible for the information in this booklet just the same as you would be for classroom instruction. You will be tested on the knowledge and skills you learn.

9 **You may keep this booklet when you finish. It will be a very good review also, so make sure it is complete.**

Frame

10 If at any time you have difficulty or do not understand the directions, ask the monitor for help.

11 Now let's learn something about Tactical _____.

Loading

METHODS FOR DETERMINING AIRCRAFT REQUIREMENTS

Frame

12 When we are given a mission to perform one of the planning stages is to determine how many helicopters we will need for that mission.

13 There are three ways to figure out how many helicopters will be needed to accomplish this mission.

14 They are:

TYPE-LOAD METHOD

WEIGHT METHOD

SPACE METHOD

Frame
15 The three methods for determining the number of helicopters needed for a mission are the:

Type-_____ Method

W _ _ _ _ _ Method

S _ _ _ _ Method

Frame

16 The type-load method is used when a specific type of load is to be transported - for example, a TOE Rifle Company. The exact number of helicopters are computed and loads planned in great detail and these "Loading Plans" are kept on file. So when a TOE Rifle Company is to be moved the plans are on file and the exact number of helicopters needed are known.

17 But this method is very inflexible - what happens when you have a mission for which there is no "Loading _____"?

18 So we can say because of these reasons the type-_____ method is:

VERY QUICK TO USE - but it is also:

VERY INFLEXIBLE

19 The other two methods for determining aircraft requirements are the _____ Method and the _____ Method.

Plan

load

Weight Space

Frame

20 The second method is the W _ _ _ _ _ Method. We say this is the most EXACT method because the exact weights of all cargo, equipment, and personnel are figured in detail - but as you can see this would take a lot of time and would be very complicated.

21 Advantage: most EXACT method

Disadvantage: takes TIME and is COMPLICATED

22 The advantage of the Type-Load method is that it is very q_____. Its disadvantage is that it is very in_____.

23 The remaining method then, is the _____ Method.

(W)eight

(q)uick

(in)flexible

Space

Frame

24 The SPACE Method combines the best features of the T_____-_____ Method and the W_____ Method. As you will see it is easy to use and doesn't take much time.

25 Another important advantage is that the Space Method remains CONSTANT. The same method is used Army-wide and is used in the same way in Europe as it is in CONUS, so we can say that Computations remain Constant.

(T)ype-load (W)eight

Frame

26 Thus the _____ Method gives us two desirable results.

1. Computations remain _____.
2. Overall planning time is shortened.

27 So we can say the Space Method is C_____ and Planning time is _____.

Space

Constant

(C)onstant

shortened

Frame
28 The two desirable results of the Space Method are:

1. Computations remain _____.

2. Overall Planning time is _____.

Constant

Shortened

Frame

29 The foundation of the space method is an <u>average</u> weight which is based on:

<u>One Combat Loaded Soldier</u>

30 We will assume this "average" soldier weight is:

<u>240 pounds</u>

31 And we will say he takes up a given amount of room in the helicopter which we will call a:

<u>SPACE</u>

32 One Combat Loaded _____ = _____lbs = One Space

Soldier	240

Frame
33 This "space" based on 240 pounds is what we use to determine how much a helicopter can carry. It is also used to determine how many "spaces" are <u>in</u> an item of equipment (such as a 1/4 T Trk) for planning purposes.

Frame

34 One Space equals _____ pounds.

35 This is based on the weight of one fully loaded

_____ _____.

240

Combat Soldier

Frame
36 This _____ pounds is made up of two parts:

A. The soldier's individual weight.

B. His share of the supplies and crew served weapons weight.

37 These crew served weapons go up to and include the 81mm mortar. Any item heavier than this (such as the 106 RR or the 4.2 mortar) would have to be figured as a separate item.

240

Frame
38 This is the meat of the space method:

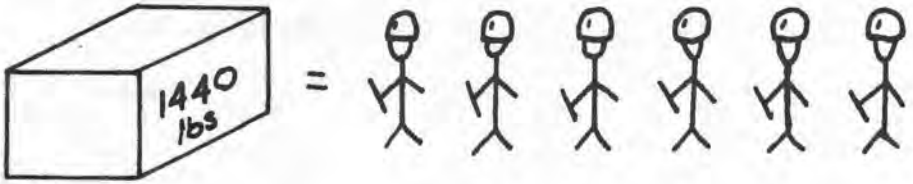
The cargo room in a helicopter is theoretically divided into "spaces" - these are based on the assumption that:

ONE SPACE = ONE SOLDIER = _____ POUNDS

240

Frame
39 You then theoretically divide the cargo you have into "SPACES" (one space = _____ pounds)

40 In other words an item of equipment has, say, SIX 240 pound "spaces" in it.



1440 pounds = 6 spaces (based on a fully loaded c_____ _____.

240

(c)combat soldier

Frame

41 Then you will find out how many h_____ you will need to carry that cargo or how many s_____ in the helicopter that cargo will take up.

42 So now let's get into the mechanics of how to actually use the Space Method.

(h)elicopters

(s)paces

Frame
43 Let's say we have an item of equipment that weighs 2088 pounds.

44 To find out how many spaces in that item we:

DIVIDE by 240

$$\frac{2088}{240} = \underline{\qquad\qquad\qquad\qquad} \text{ spaces}$$

8.7

Frame

45 In the Space Method we deal only with whole or half numbers.

46 Your answer should always be stated in this way.

Never use anything but w_____ or h_____ numbers.

(w)hole (h)alf

Frame
47 When determining the number of spaces in a given cargo we

ROUND UP

48 This gives us an added safety factor - so always R_____ U_____ when finding the number of spaces in c_____.

(R)ound (U)p

(c)argo

Frame 49

An item of equipment weighs 744 pounds.

How many spaces would be needed to carry this item?

a. 3.0 spaces (turn to page 45)

b. 3.5 spaces (turn to page 46)

c. 4.0 spaces (turn to page 47)

d. 2.5 spaces (turn to page 48)

(Cont'd from page 43)

Frame
50 You probably worked the problem right but you probably rounded off the wrong way.

Turn back to pages 39 - 41, Frames 45 - 48 and study them.

Then turn back to page 43 and re-work the problem.

(Cont'd from page 43)

Frame

51 Correct Always remember that safety factor - and round off in the direction that will give you the safety factor.

Go on to page 49.

(Cont'd from page 43)

Frame
52 You either rounded up to the next whole number or worked the problem incorrectly.

Go back to pages 39 - 41, Frames 45 - 48 and study them.

Then turn to page 43 and re-work the problem.

(Cont'd) from page 43)

Frame
53 You must have dropped a number somewhere. Go back to pages 37 - 39, Frames 43 - 46 and study that section again.

Then go back to page 43 and re-work the problem and select the right answer.

Frame
54 Now here is an important point that is easy to miss.

If you have two or more of the same item of equipment:

1. Figure the spaces in one item first.
2. Then Round UP to the nearest whole or half number.
3. Multiply your answer by the number of items you have to transport.

55 Example:

One item [ITEM] = 4 SPACES

Three items [ITEM] + [ITEM] + [ITEM] = _____ SPACES

50

12

Frame

56 Here is a sample problem:

You have three items of equipment that weigh 2450 pounds each.

57 How many spaces do you need for all three items?

a. 30.0 spaces (turn to page **53**)

b. 30.5 spaces (turn to page **54**)

c. 31.0 spaces (turn to page **55**)

d. 31.5 spaces (turn to page **56**)

(Cont'd from page 51)

Frame
58 You must have dropped a number somewhere. Go back to pages 37, 39, 41, and 49, Frames 43 - 55 and review the material.

Then re-work the problem on page 51.

(Cont'd from page 51)

Frame

59 Go back and check your work. If you still get the same answer, go back to pages 37 - 41, and page 49, Frames 43 - 55, and study them. Then re-work the problem on page 51 and select the right answer.

(Cont'd from page 51)

Frame 60

Remember we said to find the spaces in one item, then multiply by the number of items. Also remember to Round UP the spaces after you find out the spaces in one item - then multiply.

Go back and study pages 37, 39, 41, and 49, Frames 43 - 55. Then re-work the problem on page 51.

56

(Cont'd from page 51)

Frame

61 Right! Go on to page 57.

Frame
62 For bulk items of cargo (such as rations, ammo, etc.) divide the total weight by _____ pounds.

63 Example:

How many total spaces needed to load 63,744 pounds of rations?

_____ spaces

64 How many spaces would be needed for 43 combat loaded troops? _____ spaces

240

266

43

Frame

65 Hope you weren't caught napping on that last one! Remember the whole space method is based on the fact that one fully loaded _____ _____ is equal to _____ lbs.

66 O.K. - Now we need to find how many helicopters we will need to carry these "spaces".

67 Do you remember what two weights are NOT included in the helicopter's Operating Weight?

_____weight and _____weight

combat soldier

240

fuel cargo

Frame

68 OPERATING WEIGHT is the total weight of the helicopter except for FUEL and CARGO.

69 Max Gross Weight is the total weight the helicopter is able to lift and transport.

70 So to find how much cargo the helicopter will transport we use the following formula:

MAX _____ WEIGHT - (O _____ WEIGHT + FUEL) =

ALLOWABLE CARGO LOAD (or how much cargo we can transport)

GROSS (O)PERATING

Frame

71 Let's say we can haul 3167 pounds of cargo (which is the _____ _____ load).

72 We then divide this by _____ pounds and get the number of spaces that particular helicopter can carry.

73 How many spaces would we have in a helicopter that has an allowable cargo load of 3167 pounds?

_____ spaces

allowable cargo

240

13.0

Frame

74 13.19 is what you should have arrived at - but

here again we deal only with w_____ or _____

numbers.

75 If we round up here - to 13.5 spaces in the helicopter - this is MORE than the aircraft can carry according to the Space Method! So when finding the number of Spaces in helicopters we:

ROUND D_____

This gives us an added safety factor.

(w)hole half

(D)OWN

Frame
76 So we have TWO built in safety f_____s.

One when we Round _____ when finding the Spaces in CARGO.

One when we Round _____ when finding the Spaces in HELICOPTERS.

77 Properly round off the following numbers - which are the number of spaces in Helicopters:

a. 33.6 c. 36.9

b. 116.1 d. 48.5

(f)actor(s)

up

down

a. 33.5

b. 116.0

c. 36.5

d. 48.5

Frame
78 So now that we can find the spaces in a given cargo and the spaces in our helicopter, we can now apply our figures and work a problem.

79 The formula is:

$$\frac{\text{NUMBER OF SPACES OF CARGO}}{\text{NUMBER OF SPACES IN AIRCRAFT}} = \text{NUMBER OF AIRCRAFT NEEDED}$$

80 Example:

We have 370 spaces of cargo, and our helicopter has 12 spaces.

Number of helicopters needed _____

31

Frame

81 Rounding off is simple in this case. You would ask for 31 helicopters - not 30.8.

82 So you round _____ to the next WHOLE helicopter.

83 Don't cheat yourself - even if your figures come out 30.02 request 31. It's better to have a little bit more than not enough and not be able to accomplish the mission.

up

Frame

84 Our two safety factors are:

1. Round _____ when figuring spaces of CARGO.

2. Round _____ when figuring spaces in helicopter

85 The formula for finding the number of helicopters needed using the space method:

$$\frac{\text{Number of } \_\_\_\_ \text{ of } \_\_\_\_}{\text{Number of } \_\_\_\_ \text{ in h } \_\_\_\_} = \text{No. of h needed } \_\_\_\_$$

up

down

Spaces Cargo (h)elicopters

Spaces (h)elicopter

Frame
86 Now let's work a sample problem:

Your helicopter has an operating weight of 5160 pounds. The Max Gross weight is 8750 pounds. Your fuel load is 160 gal. of JP-4 (6.5 lbs per gal).

You have the following cargo to be transported:

1. 32,000 pounds of rations and ammo.
2. Four 1/4 T Trks (2273 pounds each).
3. 35 combat equipped troops.

How many helicopters will be needed to accomplish this mission?

a. 19 a/c (turn to page 78)
b. 20 a/c (turn to page 79)
c. 21 a/c (turn to page 78)
d. 22 a/c (turn to page 80)

(Cont'd from page 75)

Frame
87 Go on to page 79.

78

(Cont'd from page 75)

Frame

88 Here is the solution for the problem on page 75. Go through it and see where you made your error. You will see page numbers (opposite the part of the problem) to refer to if that is the part you missed.

1040 lbs - fuel weight
5160 lbs - operating weight
6200 lbs (see pages 59-61, Frames 66-70)

8750-6200 = 2550 lbs
2550 lbs = allowable cargo load

$\frac{2550}{240}$ = 10.62 or 10.5 spaces in a/c (pages 63-65, Frames 71-75)

32000 lbs cargo = 133.3 or 133.5 spaces (page 57, Frames 62-63)

35 troops = 35.0 spaces (page 57, Frame 64)
4 Trks (9.5 spaces ea) 38.0 spaces (page 49, Frames 54-55)
TOTAL 206.5 spaces

$\frac{206.5}{10.5}$ = 19.7 or 20 a/c needed (pages 69-73, Frames 78-85)

After you find your error and understand what you missed, go to page 81 and work another sample problem.

(Cont'd from page 75)

Frame
89 Good! If you are sure you understand all parts of the Space Method, go on to page 87.

Note: The proper steps for the problem on page 75 are found on page 78 if you would like to look it over. It will be useful for review in the future.

(Cont'd from page 75)

Frame

90 Go to page 78.

Frame
91 Here is another problem:

The type helicopter you will be using has an Operating weight of 4900 pounds. Its Max gross weight is 8500 lbs. Your fuel load on each helicopter will be 150 gal of JP-4 (6.5 lbs per gal).

You have the following cargo to transport:

1. 29,500 pounds of rations and ammo.
2. Four Army "mules" fully loaded - 2050 lbs each.
3. 60 combat troops.

How many helicopters will you need to transport this cargo?

a. 19 a/c (turn to page 86)
b. 21 a/c (turn to page 83)
c. 20 a/c (turn to page 85)
d. 22 a/c (turn to page 84)

(h)elicopters

time

(Cont'd from page 81)

Frame
92 Correct! Now you shouldn't have any trouble with the space method.

Go on to page 87.

Note: The solution to the problem you just worked is found on page 86 if you would like to check it over.

(Cont'd from page 81)

Frame
93 Go to page 86.

(Cont'd from page 81)

Frame
94 Go to page 86

86 (Cont'd from page 81)

Frame
95 Go over the problem step by step as outlined below. When you find your error, go to the page indicated and study that section. Then re-work the part you missed.

975 lbs - fuel weight 8500-5875 = 2625 lbs
4900 lbs - operating wt. (allowable cargo load)
5875 lbs (see pages 59 - 61, Frames 66 - 70)

$\frac{2625}{240}$ = 10.9 or 10.5 spaces in the a/c (page 63-65, Frames 71-75)

29,500 lbs cargo	= 122.9 =	123.0	spaces	(page 57, Frames 62-63)
60 combat troops	=	60.0	spaces	(page 57, Frame 64)
4 preloaded "mules" (2050 lbs ea)	=	36.0	spaces	(page 49, Frames 54-55)
	TOTAL	219.0		

$\frac{219.0}{10.5}$ = 20.9 or 21 helicopters needed (pages 69-73, Frames 78-85)

After re-working the part you missed and when you understand where you made your error, go on to page 87.

Frame

96 You round DOWN when finding spaces in _____.

97 You round UP when finding spaces in _____.

helicopters

cargo

Frame
98 EXTERNAL LOADING OF HELICOPTERS

Frame
99 External loading of helicopters is accomplished by the use of a cargo hook mounted at or near the center of gravity of the helicopter. External loading greatly expedites loading and unloading of helicopters, and eliminates the need of center of gravity computations. Bulky items of equipment can be transported, and the load can be jettisoned in an emergency situation.

Frame
100 External loading has disadvantages which must be considered: It normally requires slower airspeeds, and increased pilot technique.

Frame

101 Before we undertake to haul a cargo using ex_____ loading, there are certain things that must be **PLANNED**.

102 There are four important elements that must be considered before l_____ can be accomplished.

1. **Packing the cargo**
2. **Weighing the cargo**
3. Vehicle preparation (for sling loads)
4. Cargo arrangement in the Loading Zone

(ex)ternal

(l)oading

Frame
103 The four items or areas that must be considered before external loading operations are:

1. P_____ the cargo.
2. W_____ the cargo.
3. V_____ preparation.
4. Cargo a_____ in the Loading Zone.

104 These are the four steps of **PLANNING**.

(p)acking

(w)eighing

(v)ehicle

(a)rrangement

Frame
105 The four steps of Pl_____ of external loading of helicopters are:

1. _____ _____ _____.
2. _____ _____ _____.
3. _____ p_____.
4. Cargo _____ in the _____ _____.

(pl)anning

packing of cargo

weighing of cargo

vehicle (p)reparation

arrangement loading zone

Frame
106 The first Pl_____ consideration, which is the

_____ of cargo, takes into account the

following:

1. You must pack the cargo in containers if the cargo cannot stand the crushing effect of the cargo net.

2. Loose cargo or equipment must be tied or restrained to prevent loss or damage.

3. Stack boxes or flat items to give maximum self-imposed structural strength.

(pl)anning

packing

Frame
107 The second P_____ consideration which is the _____ of cargo, does one very important thing:

Weighing prevents attempting to lift loads OVER the capacity of the sling or aircraft.

108 If you know in advance how much an item weighs, you will know if you will safely be able to sling load that item.

planning

weighing

Frame
109 The third P_____consideration, which is

_____ _____ has several points

to consider:

1. Security of the vehicle with its equipment.

2. Utilize the proper lifting devices.

3. Front end of the vehicle elevated to keep it from rotating. This "streamlines" the vehicle in flight.

4. Proper amount of fuel in tank - usually covered in ground unit's SOP.

5. Each major item of equipment, such as a vehicle or artillery piece, should be secured according to the applicable TB or TM covering the external loading of that equipment.

planning.

vehicle preparation

Frame
110 The fourth P_____ consideration, which is

_____ _____ in the l_____

z_____, includes the following:

1. A system of marking or identifying the cargo in the loading zone known to both ground personnel and the pilot of the helicopter.

2. Coordination with ground personnel as to general location in the loading zone of the sling load.

111 Note: A system may be anything that is common to both air and ground personnel, i.e., numbered panels, colored panels, panels with distinctive marks, etc.

planning

cargo arrangement (1)oading (z)one

Frame
112 The four P_____ considerations for external loading are:

1. _____.
2. _____.
3. _____.
4. _____.

planning

packing the cargo

weighing the cargo

Vehicle preparation

Cargo arrangement in the load zone

Note: If you were unable to remember these, it would be advisable to study them until you know them.

Frame
113 INTERNAL LOADING OF HELICOPTERS

Frame
114 Internal loading is normally used to transport troops and equipment when the helicopter can land and be unloaded. Troops, casualties, and fragile items of equipment must be transported internally. Higher airspeeds can be maintained with internal loads than with external loads.

Frame
115 Disadvantages that must be considered when transporting internal loads are:

1. The cargo must be properly restrained.
2. Center of gravity limits must be considered.
3. Bulky items may not fit through the cargo doors.
4. Time is consumed loading and unloading equipment.
5. In normal operations, a landing zone must be available and secured prior to discharging cargo.

Frame
116 There are eight general considerations in **Planning**

internal loads:

1. Cargo must be loaded without damage to the helicopter f_____.
2. Cargo should be arranged to permit rapid and secure tiedown of all items of c_____.
3. Bulk items of cargo must be stacked properly to avoid da_____ to fragile items.
4. Cargo should be handled in accordance with the instructions marked on them.

(other four on next page)

(f)loor

(c)argo

(da)mage

Frame
117 (Cont'd) The other four p_____ considerations for internal loading are:

5. Cargo should be arranged to permit free a - - - to emergency exits and equipment.

6. Cargo must be loaded to remain within c_____ of g_____ limitations.

7. The pressure of the cargo on the c_____ floor must not exceed the maximum capacity of the floor.

8. Cargo must be checked for size so that all items of cargo can f__ through the cargo compartment door.

planning

(a)ccess

(c)enter (g)ravity

(c)argo

(f)it

Frame
118 Speaking of pressure on the **helicopter floor**, you must be able to compute this pressure so as to prevent exceeding the recommended floor strength.

The formula is:

$$\frac{\text{WEIGHT OF THE OBJECT (in lbs)}}{\text{AREA OF THE BASE (in sq feet)}} = \text{FLOOR PRESSURE}$$

119 Possible damage to the **cargo compartment f**_____ could result if you did not compute its pressure before loading.

(f)loor

Frame
120 In other words we must know:

1. How much the item w_____.
2. How much of it is actually touching the cargo

_____.

121 The formula for finding the _____ pressure is:

_____ OF THE OBJECT (in lbs)

_____ = _____ PRESSURE

AREA OF THE _____ (in sq _____)

(w)eighs

floor

floor $\frac{\text{weight}}{\text{Base} \qquad \text{feet}}$ = Floor

Frame
122 As you can see, we must know the base of the item in Square Feet - here is how it's done:

If the item of cargo is rectangular:

LENGTH X WIDTH = AREA (in square feet)

If the item is circular:

Diameter^2 X 0.8 = AREA (in square feet)

123 What is the Area of the base of a box 6 feet by 2 feet?

_____ sq feet


12

Frame
124 What is the area of the base of a 50 gallon drum that has a diameter of 3 feet?

_____ sq feet.

125 The formula for finding Floor Pressure is:

$$\frac{(\qquad)}{(\qquad)} = \qquad$$

7.2

$$\frac{\text{Weight of the Object (in pounds)}}{\text{Area of the Base (in square ft)}} = \text{Floor Pressure}$$

Frame
126 Here is a sample problem:

Your helicopter has a floor pressure limit of 150 pounds per square foot (found in the -10).

You have been asked to carry an item of cargo in a rectangular container that weighs 2000 pounds. Its dimensions are 6 feet by 2 feet by 1 1/2 feet.

Can you safely carry this item? What is its floor pressure on the cargo floor?

a. No - 222 lbs per sq ft (turn to page 128)

b. Yes - 167 lbs per sq ft (turn to page 130)

c. Yes - 143 lbs per sq ft (turn to page 127)

d. No - 167 lbs per sq ft (turn to page 129)

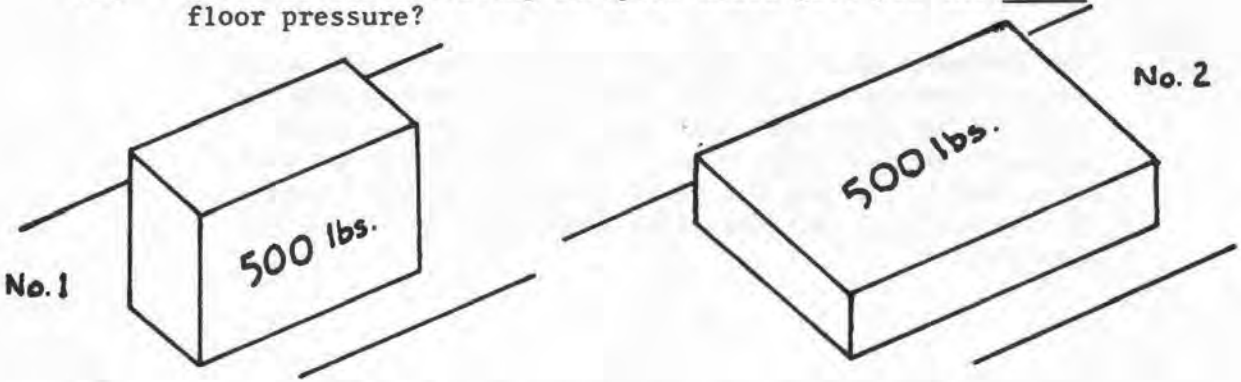
(Cont'd from page 125)

Frame
127 You probably made the mistake of multiplying the wrong sides together to find the base. You would choose the side of the container that would give you the least pressure on the cargo floor. The side of the largest area would give you the least pressure on the floor. Do not multiply all the sides together - remember the formula!

Turn to page 131 and work another sample problem.

(Cont'd from page 125)

Frame
128 Which of the following examples would give you the least floor pressure?



Number 2 of course. So always multiply by the longest sides of a rectangular container. This will give you the most area touching the floor.

Go to page 131 and work another sample problem.

(Cont'd from page 125)

Frame

129 Correct! - Now go on to page 137.

(Cont'd from page 125)

Frame
130 You worked the problem right but overlooked another point. Remember the limits of the cargo floor were 150 lbs per square feet.

Now 167 lbs per sq ft is 17 lbs over, so this object would not be safe to carry.

Go on to page 137.

Frame
131 Here is another sample problem:

Your helicopter has a floor pressure limit of 150 pounds per square foot.

The item of equipment to be loaded is in a box 8 feet by 3 feet by 2 1/2 feet. The box weighs 2475 pounds.

Can you safely carry this item? What is its pressure on the cargo floor?

a. Yes - 124 lbs per sq ft (turn to page 133)

b. No - 157 lbs per sq ft (turn to page 134)

c. Yes - 103 lbs per sq ft (turn to page 136)

d. No - 124 lbs per sq ft (turn to page 135)

(Cont'd from page 131)

Frame

132 Go back to page 128 - you probably made the same mistake explained on that page. When you understand your mistake, go back to page 131 and select the proper answer.

(Cont'd from page 131)

Frame
133 Check your work. If you get the same answer go back to page 117 and study the section on page 123

Then re-work the problem on page 131 and select the proper answer.

(Cont'd from page 131)

Frame
134 Go back to page 128 - you probably made the same mistake that is explained there.

When you find your mistake, go back to page 131 and select the right answer.

(Cont'd from page 131)

Frame
135 Correct! Now go on to page 137..

Frame
136 Now let's work a problem using a circular object:

Your helicopter has a floor pressure limit of 150 pounds per square foot.

You have been asked to transport a roll of 1/2 inch steel cable mounted on a 4 foot diameter drum. The item weighs 1985 pounds.

Would this cargo be safe to transport? What is its pressure on the cargo floor?

a. No - 185 lbs per sq ft (turn to page 140)

b. No - 155 lbs per sq ft (turn to page 141)

c. Yes - 141 lbs per sq ft (turn to page 139)

d. Yes - 139 lbs per sq ft (turn to page 142)

(Cont'd from page 137)

Frame
137 Check for errors in your work. If you still get the same answer, turn back to page 121, Frame 122 and study the formula.

Then re-work the problem on page 137 and select the right answer.

(Cont'd from page 137)

Frame
138 Go back over the problem and check your work. Then turn to page 121, Frame 122 and study the formula.

Then turn to page 137 and re-work the problem and select the right answer.

(Cont'd from page 137)

Frame
139 Right! Go on to page 143.

(Cont'd from page 137)

Frame
140 Check your work for errors. If you still get the same answer, turn to page 121, Frame 122 and study the formula.

Then go back to page 137, re-work the problem and select the right answer.

Frame

CARGO CENTER OF GRAVITY

141 For an Airmobile mission the method for computing Center of Gravity is the DD Form 365F, commonly called "Form F". This form gives exact CG for the entire aircraft for mission planning purposes.

142 However, under certain field or combat conditions it may be necessary to quickly compute CG without using the Form F.

143 If the aircraft is within CG itself, you can use the methods in the following section to compute the cargo CG to insure safe flight.

144 IF THE CG OF YOUR CARGO IS WITHIN CG LIMITS OF THE AIRCRAFT, IT IS SAFE TO FLY.

145 To fully utilize the space in the aircraft, the DD Form 365F should be used. The cargo CG, using this form, does not necessarily have to be within the CG limits, but for our purposes here cargo CG must be within

c_____ of g_____limits of the aircraft.

(c)enter (g)ravity

Frame

146 Helicopter Cargo center of _____ is that point at which the cargo would balance if suspended.

147 In most utility and medium cargo helicopters, the method used to compute cargo center of gravity is the station method.

gravity

Frame

148 The cargo's _____ of _____ is that _____ at which the _____ would balance if _____.

149 And the method used for determining cargo CG is the s_____ method.

center gravity

point cargo

suspended

(s)tation

Frame

150 The method used for solving for center of gravity is the Station Method.

151 This method is normally used when we must compute CG for a cargo that contains a few l_____ items of e_____.

(l)arge (e)quipment

Frame
152 The formula for the Station Method is:

$$\frac{\text{TOTAL MOMENT}}{\text{TOTAL WEIGHT}} = \text{CG of the CARGO}$$

153 Total weight is easy. We will explain how to get Total Moment on the next few pages.

Frame
154 In the S_____ Method we need to know two items of information:

1. The weight of the item.
2. The station number at which the CG of the item is located.

155 From these two items of information we can determine the Moment.

Note: If the CG of a large item of cargo is unknown, it could be balanced on a pipe or log and the balance point marked with chalk. This would then be the item's CG.

(S)tation

Frame

156 When we have both of these items of information, we need to find from them the moment of that item.

157 To do this multiply the weight of the item by the station number at which its CG is located:

WEIGHT X STATION NUMBER = MOMENT

158 The two items we must know to work a CG problem using the _____ method are:

1. The w_____ of the item.
2. The _____ _____ at which the CG of the item is located.

station

(w)eight

station number

Frame

159 Find the moments of the following items of cargo:

Weight	Station number	Moment
675	102	_____
820	174	_____
500	220	_____

160 The S_____ Method is used when we want to find the CG of a load which has only a f _ _ _____ items of c_____.

68,850

142,680

110,000

(S)tation

(f)ew large

(c)argo

Frame
161 The formula for the _____ method is:

$$\frac{\text{TOTAL}\_\_\_\_\_}{\text{TOTAL}\_\_\_\_\_} = \_\_\_\_\_ \text{ of the CARGO}$$

162 So after we find the m_____ for each item we:

1. Add all the moments to give total _____.
2. Add all the weights to give total _____.

station

Moment

CG

Weight

(m)oment

Moment

Weight

Frame
163 Get in the habit of setting up the problem in the following way - it makes it very simple:

Example:

Weight		Station No.		Moment
675	X	102	=	68,850
820	X	174	=	142,680
500	X	220	=	110,000
1995				321.530
(total Weight)				(total Moment)

164 This gives you the two figures you need to work a problem.

1. Total _____.

2. Total _____.

moment

weight

Frame
165 Let's solve a sample problem:

You have three items to transport. Item No. 1 weighs 525 pounds and is located at station 110. Item No. 2 weighs 680 pounds and is located at station 152. Item No. 3 weighs 720 pounds and is located at station 200. The CG limits of the helicopter are 150-158.

What is the CG of this cargo and is the helicopter safe to fly?

a. 156.0 - yes (turn to page 168)
b. 158.5 - no (turn to page 167)
c. 161.5 - no (turn to page 165)
d. 154.5 - yes (turn to page 166)

(Cont'd from page 163)

Frame
166 Go back and check over your work for errors. Check it with the answer below and see where your mistake is.

Weight		Station No.		Moment
525	X	110	=	57,750
680	X	152	=	103,360
720	X	200	=	144,000
1925				305,110

$$\frac{305,110}{1925} = 158.5$$

The CG of this load is 158.5. This is not within the CG limits so it would have to be re-loaded before it could be flown.

Go on to page 169 and work another sample problem.

(Cont'd from page 163)

Frame

167 Go on to page 165.

(Cont'd from page 163)

Frame
168 Right! Go on to page 175

Note: There is another sample problem on page 169 if you think you need more practice on the Station Method.

(Cont'd from page 163)

Frame
169 Go on to page 165.

Frame
170 Here is another sample problem:

You have three items of cargo to transport. Item No. 1 weighs 430 lbs and is located at station 98. Item No. 2 weighs 570 lbs and is located at station 160. Item No. 3 weighs 700 lbs and is located at station 200. The CG limits of your helicopter are 155-167.

What is the CG of this cargo and is it safe to fly?

a. 158.0 - yes (turn to page **172**)
b. 159.5 - yes (turn to page **171**)
c. 167.5 - no (turn to page **173**)
d. 161.0 - yes (turn to page **174**)

(Cont'd from page 169)

Frame
171 Check over your work for errors. Then check it against the solution below:

Weight	Station No.	Moment
430	98	42,140
570	160	91,200
700	200	140,000
1700		273.340

$\frac{273,340}{1700}$ = 160.7 or 161 = CG of the Cargo

After you have re-worked the problem - turn to page 169 and select the right answer.

(Cont'd from page 169)

Frame

172 Go to page 171.

(Cont'd from page 169)

Frame
173 Go to page 171.

(Cont'd from page 169)

Frame
174 Right! Go on to page 175.

TROOP BRIEFING CONSIDERATIONS

Frame

175 This section deals with the briefing of transported troops and coordination with the troop leader of the troops in your helicopter.

176 By this coordination we mean that there is one very important item that must be understood by both the aircraft commander and the troop leader of the personnel being transported.

177 That item is:

The direction of landing in the Objective area.

Frame

178 The troop leader in the helicopter must know the _____ of landing so he can properly control the direction of his attack.

179 In helicopters with limited visibility from the troop compartment (such as the CH-34 or the CH-47) the troop leader might not be able to tell the direction of landing.

180 So: 1. You as aircraft commander should inform the troop leader prior to take-off of your intended direction of landing.

2. If you must change this direction of landing because of wind, enemy action, etc., you must inform the troop commander prior to landing. This is so that he can revise his plan of at _____ and will not be confused when he exits the helicopter.

direction

(at)tack

Frame
181 So the direction of landing on the o_____

must be known to the t_____ l_____ in your

helicopter. If he does not know the _____ of

landing, he will not know in what direction to attack.

182 Now prior to transporting troops, they must be given a briefing as to what is expected of them as passengers and what to be careful of when operating around a helicopter.

183 The aircraft commander is responsible to see that this briefing is conducted.

(o)bjective

(t)roop (l)eader

direction

Frame
184 The _____ _____ is responsible to see that the troops in his helicopter are b_____ prior to flight.

185 This briefing should include the following elements:

1. Safety precautions during the operation.
2. Loading procedures.
3. Enroute procedures (what to do and what not to do while airborne).
4. Exiting procedures (upon arrival in the objective area).

aircraft commander

(b)riefed

Frame

186 These elements are easy to remember and should always be given to the troops being transported.

187 The person giving the briefing can be the crew chief, the co-pilot, or any other qualified person, but the

_____ _____ is responsible to see that it is done.

188 The four steps are:

1. S_____ precautions.
2. L_____ procedures.
3. En_____ procedures.
4. Ex_____ procedures.

aircraft commander

(S)afety

(L)oading

(En)route

(Ex)iting

Frame

189 The most important point that must be coordinated between the aircraft commander and the troop leader of the troops being transported is:

_____

_____.

190 Why?

_____

_____.

The direction of landing in the objective area. The troop leader must know this direction of landing in order to properly employ his troops in the right direction.

Frame
191 The elements that must be included in the briefing of the transported troops received prior to flight are:

_____

_____

_____

_____

Safety precautions

Loading procedures

Enroute procedures

Exiting procedures

Frame
192 You have now completed the programed course on Tactical Loading of Helicopters.

Turn to Performance Check #2 in your Advance Sheet and answer those questions. If you have difficulty with any question, refer to this programed text and restudy that section.