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AZW-27-070  
HANDBOOK  
WEIGHT AND BALANCE DATA  
ASM-65-28L



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# UNCLASSIFIED HANDBOOK

Report AZW-27-070  
Date 19 October 1959

Classification Changed To:

**UNCLASSIFIED**

Authorized By: DD 27-10006  
Reclassified By: *Richard J. Cook*

Date 5-14-65  
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## WEIGHT AND BALANCE DATA

MODEL XSM-65D-28D MISSILE  
SERIAL NO. USAF 58-2199

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FOREWARD

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This Handbook is presented for use by field personnel as a device for instruction and accounting in maintenance of accurate weight and balance data for missiles after factory delivery.

There is, at this date, no official requirement for this Handbook among the Operational missile documentation records. Further, there is no theoretical requirement to maintain field weight and balance control for the Operational missiles if it be assumed that changes to configuration after factory delivery will not significantly affect the flight weight status, and, if it be assumed also that mission objectives will always be within the contractual performance limitation.

However, practical considerations make it necessary to presume that configuration changes of significant and indeterminate effect on the missile weight status are likely, at least during the balance of the Atlas R&D program, and are possible for modernization modifications after completion of the R&D program. Also, since Atlas possesses considerable excess performance capability, it appears likely that mission objectives in excess of contractual performance limitations will from time to time, be desired either because of new military target assessment, or because of new special missions which the Air Force may wish to undertake. The latter case will, in all likelihood, be accompanied by special or revised instrumentation.

In either case, ( - i.e., - changes to configuration producing significant weight changes in the flight weight status, or mission objectives in excess of contractual performance limitations) a precise re-evaluation of the flight weight status will be required in order to furnish valid input to the Guidance Equations for the desired missions.

This Handbook is an interim instrument for use until it becomes an official requirement. It is also preliminary as it is under development with R&D testing, and lacks portions required for interpretation and evaluation of the effects of propellant loading variations.

PART I  
INTRODUCTION  
AND  
GENERAL DIRECTIONS

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PART I

INTRODUCTION

This is the first Handbook to be presented for use in the field. It presents the weight and balance characteristics of the XSM-65-28D Missile and is the eleventh D-R&D missile weighed.

Portions of this Handbook (Parts IV thru VI) are in development and not included in the Handbook at this time.

Part II shows the actual dry weight and balance in the condition as weighed at the factory, and the computed dry weight and balance for flight condition based on the asweighed condition. The latter is compared for reference purposes to the predicted flight dry weight and balance derived before weighing.

Part III is presented for the purpose of keeping accurate records of dry weight and balance by field personnel.

For the use of Parts II and III see the Introductions and Directions in those parts.

Extra charts are available in Part VII to be inserted in the various portions of the Handbook when and where needed.

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PART II

FACTORY WEIGHING

PART II

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PART II

INTRODUCTION

This portion of the Handbook presents the weight and balance characteristics of the XSM-65-28D Missile based on the shop weighing of the total missile on 13 August 1959.

The actual weight is within 19 pounds of the predicted weight. This comparison is shown in detail on page 7.

The final actual dry weight and balance for flight is entered on line 5 on page 5 and final dry weight and balance of the booster and second stage are on lines 6 and 7 respectively of the same page.

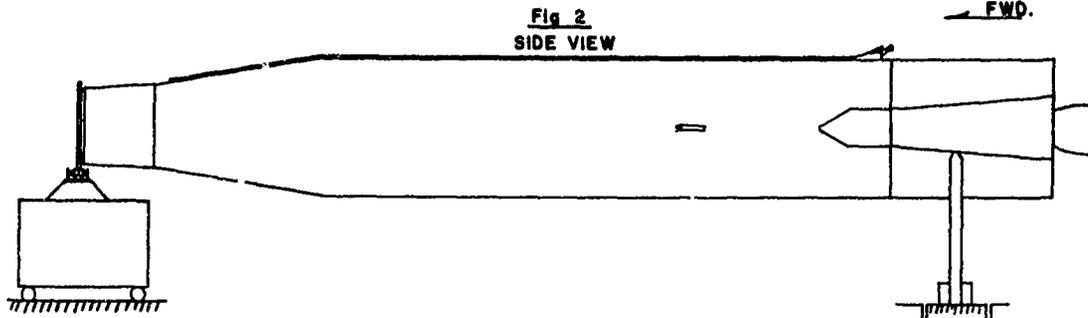
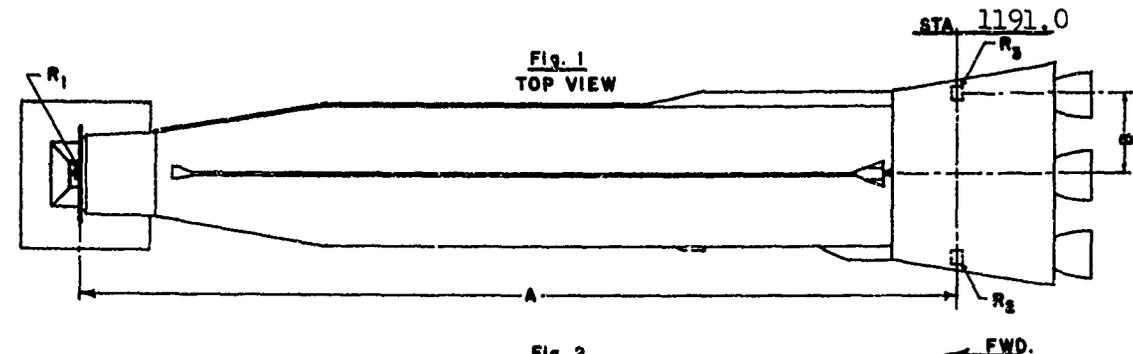
These weights can be used if no change to the missile configuration as described in this Handbook occurs at the launch site.

The weight of the missile as weighed, including items used for handling but not including airborne items which were not on during weighing is on line 1 of page 5 and this weight is carried on to Chart C, page 36 as the first entry. For use of Chart C refer to the directions on page 18.

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MISSILE WEIGHING DIAGRAM (JI)



VIEWS LOOKING FWD.

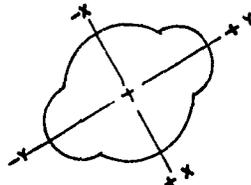


Fig. 3  
45° LEFT  
P<sub>2</sub>

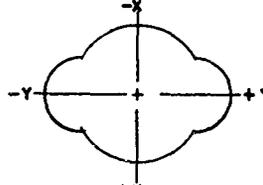


Fig. 4  
0°  
P<sub>1</sub>

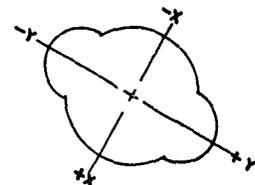


Fig. 5  
45° RIGHT  
P<sub>3</sub>

A = 758.5" The distance from aft jig point (R<sub>2</sub> & R<sub>3</sub>) to fwd jig point (R<sub>1</sub>) (or distance between fore & aft reactions).

B = 68.95" The distance from reference datum to center line of reaction R<sub>3</sub>.

SEE MISSILE WEIGHING DATA SHEET (JI)

$$\bar{Z} = \frac{1191.0}{\text{Total gross wt.}} - \frac{R_1 \times A}{\text{Total gross wt.}} \quad \text{Used with all positions.}$$

$$P_1 = \frac{(R_3 - R_2) \times B}{\text{Total gross wt.}} \quad \text{Use 0° weight: (Fig. 4)}$$

$$P_2 = \text{Same as } P_1 \quad \text{Use 45° Left weights. (Fig. 3)}$$

$$P_3 = \text{Same as } P_1 \quad \text{Use 45° Right weights. (Fig. 5)}$$

$$\bar{Y} = \text{Result of } P_1 + 100$$

$$\bar{X} = (P_2 \times 1.414) - P_1 + 100 \quad \text{45° Left (Fig. 3)}$$

$$\bar{X} = P_1 - (P_3 \times 1.414) + 100 \quad \text{45° Right (Fig. 5)}$$

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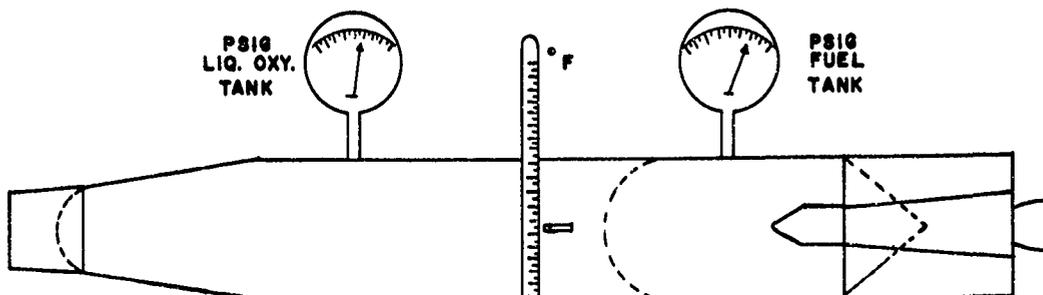
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| MISSILE WEIGHING DATA SHEET (JI)   |                |                     |  |                               |          |         |            |
|------------------------------------|----------------|---------------------|--|-------------------------------|----------|---------|------------|
| DATE WEIGHED<br>13 August 1959     |                | MODEL<br>XSM-65-28D |  | SERIAL NUMBER<br>USAF-58-2199 |          |         |            |
| PLACE WEIGHED<br>Convair Plant 71  |                |                     | WEIGHING PERSONNEL<br>Astronautics Weights Group |                               |          |         |            |
| REACTION POINTS                    | SCALE READINGS |                     |  |                               |          |         | AVERAGE    |
|                                    | 0°             | 45° L               | 45° R  | 0°                            | 45° L    | 45° R   |            |
| FWD. POINT (R <sub>1</sub> )       | 2499           | 2508                | 2571   | 2542                          | 2541     | 2554    | XXXXXXXXXX |
| AFT. POINT LEFT (R <sub>2</sub> )  | 4688           | 4907                | 4603   | 4653                          | 4930     | 4629    | XXXXXXXXXX |
| AFT. POINT RIGHT (R <sub>3</sub> ) | 5830           | 5583                | 5854   | 5828                          | 5560     | 5832    | XXXXXXXXXX |
| TOTAL (As Weighed)                 | 13017          | 12998               | 13028  | 13023                         | 13031    | 13015   | 13018.7    |
| * $\bar{Z}$ DIMENSION (in.)        | 1045.4         | 1044.0              | 1041.3   | 1042.9                        | 1043.1   | 1042.2  | 1043.3     |
| * P <sub>1</sub> DIMENSION (in.)   | 6.04           |                     |  | 6.22                          |          |         |            |
| * P <sub>2</sub> DIMENSION (in.)   |                | 3.58                |  |                               | 3.33     |         |            |
| * P <sub>3</sub> DIMENSION (in.)   |                |                     | 6.62   |                               |          | 6.37    |            |
| * $\bar{Y}$ DIMENSION (in.)        | 106.04         |                     |  | 106.22                        |          |         | 106.1      |
| * $\bar{X}$ DIMENSION (in.)        |                | 97.62               | 96.68  |                               | 96.92    | 97.21   | 97.1       |
| DERIVATION OF ACTUAL DRY WEIGHT    |                |                     |  |                               |          |         |            |
| ITEM                               | WEIGHT         | Z                   | Y  | X                             | WZ       | WY      | WX         |
| 1 MISSILE AS WEIGHED               | 13018.7        | 1043.3              | 106.1  | 97.1                          | 13582410 | 1381284 | 1264116    |
| 2 LESS NON-FLIGHT OVERAGES         | 1886.1         | XXXXXXXXXX          | XXXXXXXXXX                                       | XXXXXX                        | 1068169  | 188532  | 189421     |
| 3 LESS GAS IN TANKS                | 132.6          | XXXXXXXXXX          | XXXXXXXXXX                                       | XXXXXX                        | 114302   | 13256   | 13256      |
| 4 PLUS SHORTAGES                   | 3519.2         | XXXXXXXXXX          | XXXXXXXXXX                                       | XXXXXX                        | 2232694  | 378154  | 356708     |
| 5 TOTAL MISSILE ACTUAL WEIGHT      | 14519.2        | 1007.8              | 107.3  | 97.7                          | 14632633 | 1557650 | 1418147    |
| 6 LESS Predicted BOOSTER WEIGHT    | 5879.8         | 1218.5              | 101.4  | 91.0                          | 7164536  | 677332  | 535062     |
| 7 2ND STAGE ACTUAL WEIGHT          | 8639.4         | 864.4               | 101.9  | 102.2                         | 7468097  | 880318  | 883085     |
| * SEE WEIGHING DIAGRAM             |                |                     |  |                               |          |         |            |

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GAS CALCULATION DATA SHEET



Barometric Pressure 14.7 psi      Liq. Oxy. Tank Pressure 5.8 psig  
 Outside Air Temperature 74.0 °F      Fuel Tank Pressure 9.5 psig

Weight GN<sub>2</sub> in Liq. Oxy. Tank =  $\frac{144(\text{B.P.} + \text{PSIG}) \times \text{Liq. Oxy. Tank Volume}}{\text{LN}_2 \text{ Gas Constant} \times (460 + \text{Ambient Temp.})}$

$\frac{144( 20.5 ) \times 2503.2}{55.16 \times ( 534 )} = 250.86$  lbs.

Weight GN<sub>2</sub> in Fuel Tank =  $\frac{144(\text{B.P.} + \text{PSIG}) \times \text{Fuel Tank Volume}}{\text{LN}_2 \text{ Gas Constant} \times (460 + \text{Ambient Temp.})}$

$\frac{144( 24.2 ) \times 1539.8}{55.16 \times ( 534 )} = 182.16$  lbs.

Weight Displaced Air (both tanks) =  $\frac{144 \times \text{B.P.} \times \text{Total Tank Volume}}{\text{Air Constant} \times (460 + \text{Ambient Temp.})}$

$\frac{144( 14.7 ) \times 4043.0}{53.34 \times ( 534 )} = 300.46$  lbs.

GAS CENTER OF GRAVITY DETERMINATION

| ITEM  | WEIGHT | Z      | Y   | X   | WZ     | WY    | WX    |
|---|--------|--------|-----|-----|--------|-------|-------|
| GN <sub>2</sub> in Liq. Oxy. Tank                     | 250.86 | 709.0  | 100 | 100 | 177860 | 25086 | 25086 |
| (+)GN <sub>2</sub> in Fuel Tank                       | 182.16 | 1063.0 | 100 | 100 | 193636 | 18216 | 18216 |
| (-)Wt. Displaced Air                                  | 300.46 | 856.0  | 100 | 100 | 257194 | 30046 | 30046 |
| Gas in Tanks—Insert on MISSILE WEIGHING RECORD—Item 3 | 132.56 | 862.3  | 100 | 100 | 114302 | 13256 | 13256 |

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RECONCILIATION OF ACTUAL DRY WEIGHT

| <u>ITEM</u>  | <u>WEIGHT</u> | <u>Z</u> | <u>Y</u> | <u>X</u> |
|--|---------------|----------|----------|----------|
| 26D 2nd Stage Predicted<br>Weight Converted to 28D | 8613.4        | 867.9    | 109.9    | 99.2     |
| Nose Cone  | +59.2         | 378.0    | 100.0    | 100.0    |
| Horizontal Adapter                                 | -10.3         | 479.0    | 100.0    | 100.0    |
| Spacer - Adapter to Nose                           | -9.8          | 453.0    | 100.0    | 100.0    |
| Xducer Change                                      | -.7           | 1219.0   | 70.0     | 108.0    |
| Tlm. Battery Redesign                              | +6.6          | 1097.0   | 164.0    | 114.0    |
| Predicted 28D 2nd Stage                            | 8658.4        | 865.7    | 109.9    | 99.2     |
| <br>   |               |          |          |          |
| 26D Booster Predicted<br>Weight Converted to 28D   | 5880.3        | 1218.5   | 101.4    | 91.0     |
| Xducer Changes                                     | -.5           | 1213.0   | 154.0    | 132.0    |
| Predicted 28D 2nd Stage                            | 5879.8        | 1218.5   | 101.4    | 91.0     |
| <br>   |               |          |          |          |
| Total 28D Predicted                                | 14538.2       | 1008.4   | 106.5    | 95.9     |
| Total 28D Actual                                   | 14519.2       | 1007.8   | 107.3    | 97.7     |
| Total Missile Variation                            | -19.0         | -.6      | +.8      | +1.8     |

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AIRBORNE SHORTAGES-SECOND STAGE

| <u>ITEM</u>                                     | <u>WEIGHT</u> | <u>Z</u> | <u>Y</u> | <u>X</u> |
|---|---------------|----------|----------|----------|
| Re-entry Vehicle                                | 2143.2        | 378      | 100      | 100      |
| Horizontal Adapter                              | 132.4         | 479      | 100      | 100      |
| Spacer-Adapter to Nose                          | 84.2          | 453      | 100      | 100      |
| Fwd Bulkhead Door Boil-off Valve<br>Instl (Est) | 50.0          | 480      | 100      | 100      |
| Photo-flash tunnels & Harnesses                 | 18.0          | 740      | 163      | 100      |
| Photo-flash Cartridge                           | 8.0           | 740      | 163      | 100      |
| Photo-flash Programmer                          | 4.1           | 801      | 161      | 101      |
| Main Missile Battery                            | 42.4          | 1019     | 163      | 113      |
| RSC Battery                                     | 8.0           | 976      | 163      | 114      |
| Liq. Oxy. Manometer                             | 15.3          | 1059     | 162      | 85       |
| RP-1 Manometer                                  | 9.9           | 1055     | 163      | 89       |
| Tlm. Battery                                    | 30.1          | 1097     | 164      | 114      |
| G.E.I.P. Antenna                                | 35.4          | 1099     | 53       | 147      |
| Reto-Rockets (2)                                | 10.3          | 887      | 163      | 100      |
| Destruct Charge (1)                             | 6.1           | 960      | 162      | 84       |
| Vernier Clamshells (2)                          | 5.8           | 1126     | 100      | 100      |
| Upper Vern Fairing & Fireshield                 | 8.1           | 1128     | 100      | 30       |
| APS Fairing                                     | 20.0          | 1077     | 100      | 30       |
| Lower Vern Fairing & Fireshield                 | 9.6           | 1128     | 100      | 170      |
| RP-1 Disconnect Valve                           | 12.9          | 1180     | 68       | 69       |
| ASI Single Tube System                          | 45.0          | 919      | 178      | 100      |
| Liq. Oxy. Disc. Valve                           | 33.7          | 1145     | 145      | 48       |
| Liq. Oxy. Disc. Valve Heat Shield               | 5.6           | 1139     | 145      | 48       |
| Vern Solo                                       | 55.9          | 1210     | 129      | 86       |
| Jettison Separation Xducer                      | .5            | 1132     | 162      | 112      |
| Liq. Oxy. Tk. Press Xducers (2)                 | 3.0           | 480      | 88       | 132      |
| Total Shortage - 2nd Stage                      | 2797.5        |          |          |          |

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AIRBORNE SHORTAGES - BOOSTER

| <u>ITEM</u>                                 | <u>WEIGHT</u> | <u>Z</u> | <u>Y</u> | <u>X</u> |
|---|---------------|----------|----------|----------|
| Forward Nacelle Doors (4)                   | 111.0         | 1183     | 100      | 100      |
| Nacelles (2), Splice Plates<br>& Mtg. Hrdw. | 433.6         | 1245     | 100      | 100      |
| Upper Bal. Fitting Heat Shield              | 1.7           | 1185     | 100      | 161      |
| Lower Vern Cylinder Shield                  | 7.8           | 1185     | 100      | 42       |
| RP-1 Flex Bellows                           | 12.4          | 1189     | 68       | 69       |
| LN <sub>2</sub> Drain Provisions            | 2.3           | 1168     | 124      | 152      |
| Sust. & Booster Heat Boots                  | 102.5         | 1277     | 100      | 100      |
| Liq. Oxy. F&D Valve                         | 23.0          | 1218     | 145      | 48       |
| Liq. Oxy. Disc. Bellows                     | 23.6          | 1165     | 145      | 48       |
| Bellows Heat Blanket                        | 1.6           | 1165     | 145      | 48       |
| Fwd. NAC Braces (2)                         | 2.2           | 1171     | 100      | 104      |
| <br>  |               |          |          |          |
| Total Shortage - Booster                    | 721.7         |          |          |          |
| <br>  |               |          |          |          |
| Total Shortage - Missile                    | 3519.2        |          |          |          |

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NON-AIRBORNE OVERAGES - SECOND STAGE

| <u>ITEM</u>                               | <u>WEIGHT</u> | <u>Z</u> | <u>X</u> | <u>Y</u> |
|---|---------------|----------|----------|----------|
| Nose Hato                                 | 1399.0        | 434      | 100      | 100      |
| Padding Nose                              | 2.0           | 470      | 110      | 120      |
| Photo-Flash Tunnel Cover                  | 1.6           | 742      | 163      | 101      |
| Handling Adapter                          | 182.5         | 468      | 100      | 98       |
| Liq. Oxy. Press Gage & Valves             | .7            | 774      | 55       | 140      |
| Fuel Press Gage & Valves                  | 2.6           | 1100     | 55       | 140      |
| Vern Dessicant Covers (2)                 | .6            | 1128     | 100      | 100      |
| Timer-Azusa                               | 1.1           | 1005     | 162      | 96       |
| Timer - Inverter                          | 1.5           | 995      | 162      | 116      |
| Timer - Gyro                              | 1.4           | 960      | 166      | 105      |
| Timer - Programmer                        | 1.4           | 1100     | 166      | 105      |
| Fuel Line Cover Plate                     | 14.6          | 1175     | 68       | 69       |
| Sust. Eng. Brace                          | 46.0          | 1263     | 100      | 132      |
| Sust. Eng. End Cover                      | 13.9          | 1312     | 100      | 100      |
| Sust. Eng. Side Covers                    | 26.1          | 1265     | 100      | 100      |
| Sust. Eng. Sil. Gel                       | 2.2           | 1303     | 100      | 100      |
| Liq. Oxy. Single Boil-off Valve<br>& Duct | 4.4           | 480      | 81       | 118      |
| Timer - PU Pkg.                           | 1.4           | 1019     | 164      | 86       |
| Total Overages-Second Stage               | 1703.0        |          |          |          |

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NON-AIRBORNE OVERAGES - BOOSTER

| <u>ITEM</u>                 | <u>WEIGHT</u> | <u>Z</u> | <u>Y</u> | <u>X</u> |
|-----------------------------|---------------|----------|----------|----------|
| Liq. Oxy. Fill & Drain      |               |          |          |          |
| Valve Cover (2)             | 1.0           | 1225     | 145      | 48       |
| Booster Actuator Locks (4)  | 4.5           | 1226     | 100      | 90       |
| Trailer Fittings (2)        | 39.0          | 1171     | 100      | 100      |
| Fuel Fill & Drain           |               |          |          |          |
| Valve Cover Plate           | .3            | 1207     | 64       | 46       |
| Quad I Transducer Hato      | 2.5           | 1211     | 145      | 130      |
| Booster Eng. End Covers (2) | 30.6          | 1310     | 100      | 100      |
| Booster Eng. Side Covers    | 98.2          | 1285     | 100      | 100      |
| Booster Eng Silica Gel      | 4.4           | 1303     | 100      | 100      |
| RP-1 Disc. Valve Cover      | 2.0           | 1195     | 68       | 69       |
| Quad 3 Umbilical Brkt.      | .6            | 1240     | 60       | 60       |
| <br>                        |               |          |          |          |
| Total Overages - Booster    | 183.1         |          |          |          |
| <br>                        |               |          |          |          |
| Total Overages - Missile    | 1886.1        |          |          |          |

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, USC, Sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

~~CONFIDENTIAL~~

PART III  
FIELD WEIGHING

## SECTION I

## INTRODUCTION

## PURPOSE

This Handbook of Weight and Balance Data provides the service activities with a standard system of field weight and balance control. It contains brief instructive information and is to be used as the permanent binder for the forms and charts which provide for continuous control of weight and balance of the missile. The data to be inserted on the charts and forms in this Handbook are applicable only to the individual missile, the serial number of which appears on the title page and on the various forms and charts. This Handbook is to remain with the missile until flight, then be disposed in the prescribed manner.

The charts and forms referred to herein differ in nomenclature and arrangement from those shown in previously published copies of this Handbook, since these charts are revised from time to time; however, the general principle of use will not change.

## CHARTS AND FORMS

**GENERAL.** The standard system of field weight and balance control requires the use of several different charts and forms. They are identified as follows:

- a. Record of Weight and Balance Personnel.
- b. Equipment Location Zone Chart.
- c. Chart A - Basic Weight Check List.

- d. Missile Weighing Diagram.
- e. Missile Weighing Data Sheet.
- f. Gas Calculation Data Sheet.
- g. Chart C - Basic Weight and Balance Record.

## RESPONSIBILITY

The Missile manufacturer inserts all missile identifying data on the title page of this Handbook and on the various charts and forms. He completes all charts at the time of delivery. This record constitutes the basic weight and balance data of the missile at delivery. All subsequent changes in weight and balance are compiled by the weight and balance technician in accordance with instructions contained herein.

## MISSILE WEIGHINGS

Missiles must be weighed

- a. Periodically as required by pertinent directives.
- b. When major modifications or repairs are made.
- c. When the basic weight data contained in this Handbook are suspected to be in error.

The basic weight and cg location obtained from a weighing can only be as accurate as the scale equipment employed. Scales must be calibrated as required by existing directives.

PART III

SECTION II

DEFINITIONS

WEIGHT DEFINITIONS

**BASIC WEIGHT.** The "basic weight" of a missile is defined as the exact weight configuration at the time of weighing (or check-out) and is the same as the weight of the missile as weighed. This weight includes all overages, but does not include shortages or tare weight.

**DRY WEIGHT.** The "Dry weight" of a missile is defined as the basic weight modified by the removal of all overages and the addition of all shortages to convert the missile as weighed (or checked out) to a flight ready configuration. Dry weight equals basic weight minus overages, minus gas in tanks, plus shortages. This weight includes hydraulic fluid, but no other fluids or gases.

**OVERAGE.** An "overage" is any non-airborne item attached to or included within the missile at the time of weighing (or checking out) which must be removed before flight. Such items as engine protective covers, dessicant bags, dummy destruct packages, propellant tank gases are all overages.

**SHORTAGE.** A "shortage" is any airborne item not attached to or included within the missile at the time of weighing (or checking out) which must be added to the missile before flight. Main missile battery, nosecone, etc. are examples of shortage items.

**TARE.** "Tare" as used in this handbook is the weight of the weighing fixture or the weighing trailer only and is not considered an overage.

The tare weight is directly subtracted from the total weight readings at the time of weighing.

BALANCE DEFINITIONS

**REFERENCE DATUM.** "Reference datum" is an imaginary plane outside the missile envelope from which distances are measured for balance purposes. Three reference data are used in measuring the center of gravity of missiles. The first is a vertical plane forward of the missile nose from which all fore and aft distances (Z dim.) are measured. The second is a vertical plane 100 inches to the left of missile centerline from which all lateral distances (X dim.) are measured. The third is a horizontal plane 100 inches below the missile centerline from which all vertical distances (Y dim.) are measured.

**ARM.** "Arm" for balance purposes is the distance in inches from one of the three reference data to the center of gravity of the item.

**MOMENT.** "Moment" is the weight of an item multiplied by its arm. The value of a moment is in inch pounds. Because of the large value for the total missile moment, the moments entered on Chart C are divided by 1000. Therefore, three zeros must be added to the Chart C moments when they are used.

PART III

SECTION II

DEFINITIONS (CONTINUED)

**AVERAGE ARM.** "Average arm" is the arm obtained by adding the weights and adding the moments of a number of items and dividing the total moment by the total weight.

**BASIC MOMENT.** "Basic moment" is the sum of the moments of all items making up the basic weight. When using data from an actual weighing of a missile, the basic moment is the total moment of the basic missile with respect to the reference datum.

**CENTER OF GRAVITY (CG).** "Center of gravity" is the point about which a missile would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the missile.

**TANK GASES.** Tank gas is that which is used to pressurize the tank for rigidity for handling and is included as part of the "BASIC WEIGHT" but is not part of the "DRY WEIGHT". For more detailed information see Part II, Section IV, Gas Calculation Data Sheet.

## SECTION III

## INSTRUCTIONS FOR USE OF THE FORM AND CHARTS

**GENERAL.** Correct information as to the basic weight and moment is controlled by Charts A and C after the basic weight and balance have been determined by weighing the missile. Lay out for these forms is similar to the forms used in Aircraft Weight and Balance Handbook, AN-01-1B-40, however, use of these forms is slightly different due to the peculiar requirements of missile weight and balance. While aircraft are re-usable items, missiles are not and the repeated weighings and loading of aircraft do not apply to missiles. Therefore, accurate weight must be determined for a single mission only and the quality of this weight and balance is depend upon proper use of Charts A and C.

**RECORD OF WEIGHT AND BALANCE PERSONNEL.**

Listed at the top of this form are the missile model and serial number. The form provides a continuous record of the name and grade (civilian or military) of weight and balance personnel responsible for the Handbook records, the station, the date assigned and the date relieved. All entries should be complete and legible.

**PRELIMINARY WEIGHING INSTRUCTIONS.**

Specific weighing instructions are given at the end of Section IV. Numerous methods of weighing the missile can be used. For all weighings, assemble the necessary equipment, remove dirt, work pads, platforms, etc. from missile and see that reservoirs for hydraulic fluids are filled to normal level. Conduct an inventory of all equipment actually attached to or included within the missile. This shall be accomplished on the Chart A - Basic Weight Check List.

**NOTE**

The missile must be weighed in a closed hanger.

**EQUIPMENT ZONE CHARTS.** Equipment zone charts are provided to help locate and identify major items of missile airborne and non-airborne equipment. These items are listed with the zone reference on Chart A. The zone charts are of a general nature and will not describe each specific missile in detail.

**CHART A - BASIC WEIGHT CHECK LIST.** The Basic Weight Check List is a tabulation of all operating airborne equipment that is or may be installed and for which provision or fixed stowage has been made in a definite location in the missile. It also lists all non-airborne equipment that is used to maintain or handle the missile which must be removed before flight. It gives the weight and arm of the individual items for use in correcting the basic weight and moment on Chart C as changes are made in this equipment.

Inventories should be made when:

1. The missile is completed at the factory, prior to delivery.
2. The missile is received at the launch base.
3. The missile undergoes modification, major overhaul or repair.
4. Changes in equipment are made for a different type of operation or mission.
5. The missile is re-weighed.
6. Upon erection at the launch complex.
7. X-1 day from launch.
8. Putting into or breaking out of storage.

PART III

SECTION III

INSTRUCTION FOR USE OF THE FORMS AND CHARTS (CONTINUED)

9. When weight is critical for a particular mission.

The above requirements for inventories should be carried out under the following three cases. Case I - Normal operational situation with no anticipated modifications, Case II - Normal operational situation with expected site modifications, Case III - Special operational situation for missions in excess of contractual performance.

The following table clarifies:

| Requirement | Case I | Case II | Case III |
|-------------|--------|---------|----------|
| 1           | x      | x       | x        |
| 2           |        |         | x        |
| 3           |        | x       | x        |
| 4           |        | x       | x        |
| 5           |        | x       | x        |
| 6           |        |         | x        |
| 7           |        |         | x        |
| 8           | x      | x       | x        |
| 9           |        |         | x        |

**USE OF CHART A.** The Basic Weight Check List is prepared by the manufacturer before delivery of the missile to the launching base. The manufacturer will write into Chart A all major items that are applicable to that missile for its original mission. Any item which is not applicable for that mission will be struck out by a continuous line through the items on Chart A. For all items that are applicable, the manufacturer will indicate when that item is airborne or non-airborne in the following manner:

**Airborne equipment.** Place an X in column titled "Airborne Equipment" if the item is necessary for flight. This X must appear even though the item was not on the missile during weighing (or checking out).

**Non-airborne equipment.** Place a 0 in column titled "Airborne Equipment" if the item is necessary to handle the missile but must be removed before flight. This 0 must appear even though the item was not on the missile during weighing (or checking out).

It should be pointed out that the markings in the "Airborne Equipment" column describe the desired configuration of the missile for its specific mission, but does not describe the configuration at the time of weighing (or checking out). The actual configuration at the time of weighing (or checking out) is indicated under the column titled "Original Check".

The manufacturer will enter the date of weighing in the title block of the "Original Check" Column. This column must be used in the following manner:

1. Any applicable airborne item which was on the missile when weighed or checked out will have a line drawn through the "Shortage & Overage" columns. This indicates that the basic weight includes that item.
2. Any applicable airborne item which was off the missile when weighed or checked out will have a check mark in the shortage column. This indicates that the basic weight does not include that item.
3. Any applicable non-airborne item which was on the missile when weighed or checked out will have a check mark in the overage column.

## SECTION III

## INSTRUCTIONS FOR USE OF THE FORMS AND CHARTS (CONTINUED)

This will indicate that the basic weight includes that item.

4. Any applicable non-airborne item which was not on the missile when weighed or checked out will have a line drawn through the "Shortage & Overage" columns. This will indicate that the basic weight does not include that item.

NOTE

The markings in this column are directly opposite for airborne and non-airborne items. The check mark indicates that the basic weight must be corrected for these items on Chart C, Part III and on the Report of Weighing in Part II of this Handbook. A line drawn through this column indicates no correction is necessary to the basic weight.

The "original check" column, therefore represents the actual missile configuration at the time of original weighing or check-out.

"Check" columns 2 through 8 will be used by launch site personnel each time a missile weighing or check-out is required and must be accomplished for the X-1 day check. Enter the date of check-out in the blank space at head of check column as provided. Perform missile inventory. Put a check mark in the "In Missile" column for items on missile during check-out and leave blank if item is not on. After the inventory, compare with previous check-out. If no change has occurred, draw a line through the "In Missile"

and "See Chart C" columns. If a change has occurred, put a check mark in the "See Chart C" column and make the appropriate entry in Chart C.

New entries should be written into Chart A whenever changes to the original mission or configuration occur.

Preparation of Chart A through the "Original Check" column is done by the manufacturer. The remainder of Chart C entries must be made by the launch site personnel.

CHART C - BASIC WEIGHT AND BALANCE RECORD. Chart C is a continuous history of the basic weight, moment and balance resulting from structural and equipment changes in service. At all times the last weight and moment are considered the current weight and balance of the basic missile. The basic weight as generated by Chart C entries represents the weight of the missile as described in the last Chart A check-out condition and is not the desired, or predicted final dry weight. In order to determine the final dry weight, the last basic weight from Chart C must have all flight items still missing added to it and all non-flight items subtracted from it. In theory, the X-1 day check should produce a basic weight equal to the predicted final dry weight. This weight should agree with the dry weight obtained in Part II of this Handbook if no missile configuration changes occur. It should agree when any modifications after delivery are applied to the dry weight in Part II.

PART III

SECTION III

INSTRUCTIONS FOR USE OF THE FORMS AND CHARTS (CONTINUED)

USE OF CHART C. Each time an inventory is made, Chart C should be brought up to date. The manufacturer will make the first basic weight entry in Chart C and this weight is the same as the missile as weighed. This basic weight includes all non-flight overages on the missile, all gases in propellant tanks, but does not include flight items that were short during weighing. Part II of this Handbook converts the basic weight into a predicted dry weight by making corrections for the overages and shortages. Chart C accomplishes the same thing at the launch site as these changes occur.

After completion of any Chart A check-out, enter all indicated Chart C entries from Chart A onto Chart C as follows:

1. Enter the date the check-out was made in the left column of Chart C.
2. Indicate by a check mark, in the second or third column, whether an item is being added to or removed from the missile.
3. Write out a complete description of the item in the fourth column.
4. In the weight change columns enter the weight to the nearest tenth, the three arms to the nearest tenth and the moments divided by 1000.
5. Indicate items added or removed by plus or minus signs before the weights and moments.
6. When all applicable entries for the particular check-out are made, retotal Chart C and enter the new basic weight below the previous one in the small block at the bottom of Chart C.

7. The dates entered on Chart C must be the same as the dates of the check-outs on Chart A.

8. The X-1 day check-out should remove any remaining non-flight items and install all remaining flight items, yielding either the original predicted dry weight from Part II of this Handbook or that predicted weight plus modification that have occurred since the original weighing.

NOTE

All basic weights in the Handbook include the gases in the propellant tanks. When a predicted dry weight is desired, the gas present at the time of the last weighing and calculated on the form provided in the Handbook should be deleted from the Basic Weight. Tank gases must be recalculated as a part of each successive weighing procedure. Atmospheric and internal tank gas condition must be known in order to perform each gas calculation. These gases must be deleted on Chart C after the X-1 day check-out or whenever predicted performance weights are to be generated. Flight weight gases are included with residuals in Part V, Chart F, Line 2.

EXAMPLE IN THE USE OF CHART A

| PAGE OF PAGES |                                      | MISSILE MODEL XSM-650 |      | SERIAL NUMBER X.X.D |     | WEIGHT |    | ARJIS |   | RECORD OF CHECKS (See Page 19) |   |   |   |   |   |   |    |
|---------------|--------------------------------------|-----------------------|------|---------------------|-----|--------|----|-------|---|--------------------------------|---|---|---|---|---|---|----|
| ITEM NUMBER   | ITEMS AND LOCATION (Grouped by Zone) | Z                     | Y    | X                   | D   | W      | HT | 1     | 2 | 3                              | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A-1           | LOW DRAG PAIRING                     |                       |      |                     |     |        |    |       |   |                                |   |   |   |   |   |   |    |
| A-2           | NOSE - MK 8 - MOD VI                 | 400                   | 100  | 100                 | X   | 5500.0 |    |       |   |                                |   |   |   |   |   |   |    |
| A-3           | NOSE MATO                            | 400                   | 100  | 100                 | 0   | 1500.0 |    |       |   |                                |   |   |   |   |   |   |    |
| A-4           | ADAPTER - VERTICAL                   |                       |      |                     |     |        |    |       |   |                                |   |   |   |   |   |   |    |
|               | ADAPTER - HORIZONTAL                 |                       |      |                     |     |        |    |       |   |                                |   |   |   |   |   |   |    |
|               | SPACER - ADAPTER TO NOSE             | 2046                  | 475  | 100                 | 100 | X      |    |       |   |                                |   |   |   |   |   |   |    |
|               | HANDLING ADAPTER                     | 2000                  | 490  | 100                 | 100 | 0      |    |       |   |                                |   |   |   |   |   |   |    |
| C-7           | BOOSTER ENG SIDE COVERS              | 982                   | 1285 | 100                 | 100 | 0      |    |       |   |                                |   |   |   |   |   |   |    |
| A-5           | POD TO NOSE WIREWAY                  |                       |      |                     |     |        |    |       |   |                                |   |   |   |   |   |   |    |
|               | WIREWAY COVERS                       | 11.7                  | 626  | 162                 | 100 | X      |    |       |   |                                |   |   |   |   |   |   |    |

(1) Factory Weighing.  
 (2) Launch Site Weighing.  
 (3) Was originally not applicable for this mission. - condition unchanged

(4) (X) indicates item is necessary for flight. (V) in shortage Col. indicates shortage of item at factory weighing (or checking out). Line drawn through Col. 2 check columns indicates condition unchanged at launch site weighing (or checking out).

(5) (0) indicates item necessary to handle missile. (V) in overage Col. indicates presence of item at factory weighing (or checking out). Line drawn through Col. 2 check Columns indicated condition unchanged at launch site weighing (or checking out).

(6) Was originally not applicable for this mission. - condition unchanged

(7) (X) indicates item is necessary for flight. (V) in shortage Col. indicates shortage of item at factory weighing (or checking out). (V) in the "In Missile" Col. indicates presence of item at launch site weighing (or checking out). (V) in "See Chart C" Col. indicates item is to be added on Chart "C".

(8) (0) indicates item necessary to handle missile. (V) in overage Col. indicates presence of item at factory weighing (or checking out). Blank "In Missile" Col. indicates absence of item at launch site weighing (or checking out). (V) in the "See Chart C" Col. indicates item is to be subtracted on "Chart C".

(9) (0) indicates item necessary to handle missile. Line drawn through "Shortage and Overage" Col. indicates absence of item at time of factory weighing (or checking out) (V) in the "In Missile" Col. indicates presence of item at launch site weighing (or checking out). (V) in the "See Chart C" Col. indicates item is to be added on "Chart C".

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## SECTION IV

## INSTRUCTIONS FOR ADDITIONAL DATA FORMS FOR WEIGHING

**GAS CALCULATION DATA SHEET.** Each time a missile is weighed, a calculation of the amount of gas in the propellant tanks must be made. This gas is used to pressurize the tanks for handling, but is not a part of the launch dry weight. Gas weight is part of the basic weight since it is always present during weighings (except if weighed under stretch in the trailer). Gas weight must be subtracted from the basic weight when preparing the final launch dry weight.

To calculate the amount of gas for a weighing, enter the following items on the Gas Calculation Data Sheet:

1. Barometric pressure in pounds per square inch (or the nominal value of 14.7 psi if the pressure is not obtainable).
2. Liquid oxygen tank pressure in pounds per square inch gage.
3. Fuel tank pressure in pounds per square inch gage.
4. Outside air temperature around the tank in degrees F.

Enter these values as indicated on the data sheet and determine the weight of gas in each tank.

Since only the weight of gas in excess of the weight of normal atmospheric air is actually sensed as gas weight (boyancy effect), subtract the weight of displaced air from the total gas weight to obtain the effective weight of gas.

Enter this effective value and C G on line 3 of this Missile Weighing Data Sheet.

**MISSILE WEIGHING DATA SHEET.** For launch site weighing purposes, the preferred method is by trailer weighing. The C G from the factory weighing is modified and used with the actual weight as derived in the trailer weighing.

NOTE

Missile-trailer weighing and trailer weighing must be done within one day of each other AND the same weighing kit must be used.

The trailer can be weighed just prior to installing the missile and just after to eventually determine the missile weight. Another method is to weigh the missile and trailer just prior to missile erection and then weigh the trailer as soon as it is removed from the erector.

WARNING

Trailer and missile weighings must be done in a closed area since the weighing method is unstable due to wind gusts in outside areas.

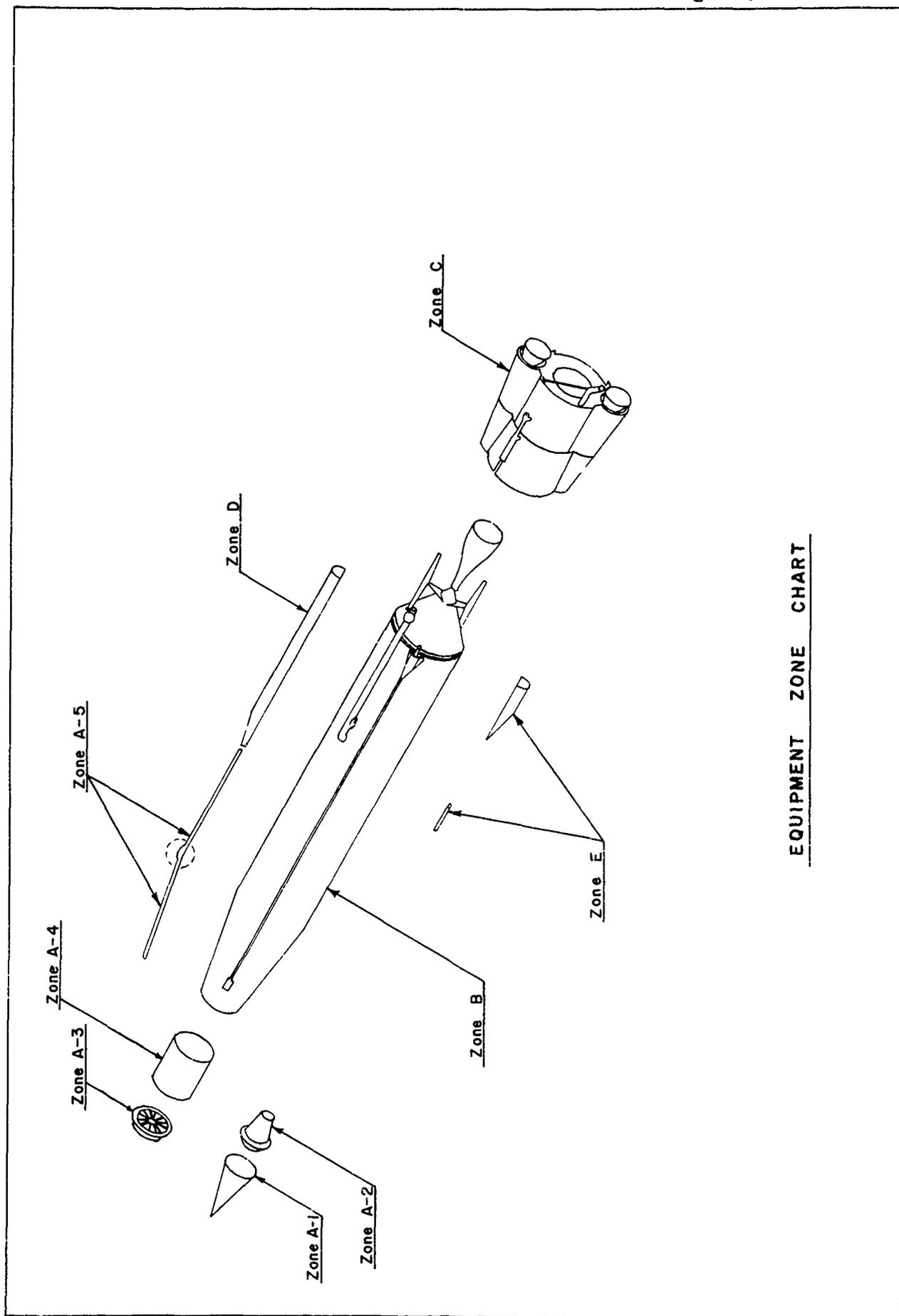
**LAUNCH SITE MISSILE WEIGHING.** Use either Missile Weighing Data Sheet (T3) for a three point weighing or Missile Weighing Data Sheet (T4) for a four point weighing. Trailer configuration must be the same for each weighing.

PART III

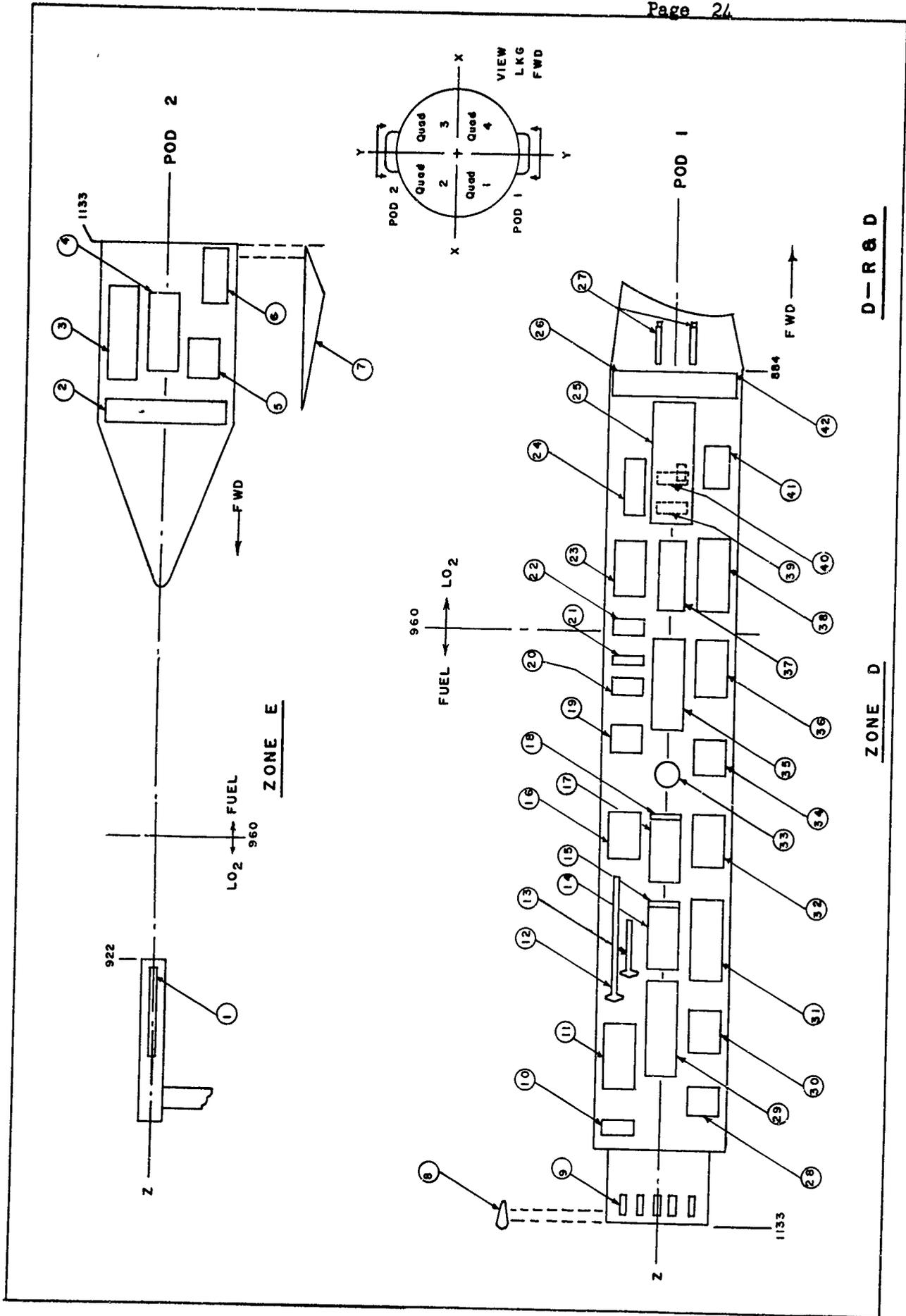
SECTION IV

INSTRUCTIONS FOR ADDITIONAL DATA FORMS FOR WEIGHING (CONTINUED)

1. Load trailer and missile on cells to a visual level condition with the trailer tires just clear of ground.
2. Read three (of four) load cells and enter in column 1 of "Scale Readings".
3. Re-read and enter in column 2.
4. Re-read and enter in column 3.
5. Unload and zero out the cells.
6. Repeat steps 1 thru 4 and enter in columns 4 thru 6.
7. Unload.
8. Repeat steps 1 thru 7 to weigh the trailer alone.
9. Enter readings in columns 1 thru 6 of "Scale Readings-Trailer".
10. Average the readings for each reaction point and the totals and enter under the "Average" column on lines 8 and 9 respectively for the missile and trailer weighing and the trailer weighing.
11. Subtract average total line 9 from average total line 8. This is the basic weight of the missile as weighed.
12. Enter this value on line 1 of "Derivation of Actual Dry Weight".
13. Correct Chart C to reflect the configuration of this weighing and the Chart A check-out. Determine the Z, Y and X arms for the new basic weight from Chart C and enter these on line 1 next to the actual weight as weighed (basic weight).
14. By reference to Chart A, summarize the weight and moments of all non-flight items still on the missile at the time of weighing and enter on line 2 of "Derivation of Actual Weight".
15. Summarize the weight and moments of all flight items not on the missile during weighing and enter on line 4 of "Derivation of Actual Weight".
16. Calculate the weight and moments for the propellant tank gases and enter on line 3 of "Derivation of Actual Dry Weight".
17. Subtract lines 2 and 3 from line 1 and add line 4 to line 1. This is the new weight and balance for the total dry launch weight.
18. If no additions or deletions were made to Chart A since the factory weighing, enter the Booster Actual Weight and moments from line 6 of the "Missile Weighing Data Sheet" from Part II of this Handbook onto line 6 of "Derivation of Actual Dry Weight" of the current data sheet.
19. If additions or deletions were made to Chart A, select only those that are Booster flight items. Summarize these weights and moments and correct the factory Booster actual weight by these amounts. Enter this new Booster weight and balance on line 6 of the current data sheet.
20. Subtract line 6 from line 5 and enter on line 7. This is the new Sustainer actual dry launch weight.



EQUIPMENT ZONE CHART



D - R & D

ZONE D

ZONE E

| CHART A - BASIC WEIGHT CHECK LIST |   |                               |        |     |     |                       |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|-----------------------------------|---|-------------------------------|--------|-----|-----|-----------------------|---------------------------------|---------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|--|
| PAGE / OF 7 PAGES                 | MISSILE MODEL<br>XSM-65D-28             | SERIAL NUMBER<br>USAF 58-2199 | WEIGHT |     |     | AIRBORNE<br>EQUIPMENT | RECORD OF CHECKING (Enter date) |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|                                   |   |                               | Z      | Y   | X   |                       | 1                               | 2       | 3          | 4           | 5          | 6           | 7          | 8           |            |             |            |             |            |             |  |
| ZONE<br>AND<br>ITEM NUMBER        | ITEMS AND LOCATION<br>(Grouped by Zone) | WEIGHT                        | Z      | Y   | X   |                       | Shortage                        | Overage | IN MISSILE | SEE CHART C |  |
| A-1                               | <del>LOW DRAG PAIRING</del>             |                               |        |     |     |                       |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
| A-2                               | <del>NOSE MK2 MOD 2A</del>              | 3770.0                        | 434    | 100 | 100 |                       |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|                                   | <del>NOSE MK2 MOD 1E0</del>             | 3316.0                        | 430    | 100 | 100 |                       |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|                                   | NOSE - MK3                              | 2143.2                        | 378    | 100 | 100 | X                     |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|                                   | <del>NOSE RVX2</del>                    | 2500.0                        | 366    | 100 | 100 |                       |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
| A-3                               | NOSE HATO                               | 1399.0                        | 434    | 100 | 100 | O                     |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
| A-4                               | <del>ADAPTER VERTICAL</del>             | 204.4                         | 468    | 100 | 98  |                       |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|                                   | ADAPTER - HORIZONTAL                    | 132.4                         | 479    | 100 | 100 | X                     |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |
|                                   | SPACER ADAPTER TO NOSE                  | 84.2                          | 453    | 100 | 100 | X                     |                                 |         |            |             |            |             |            |             |            |             |            |             |            |             |  |





CHART A - BASIC WEIGHT CHECK LIST

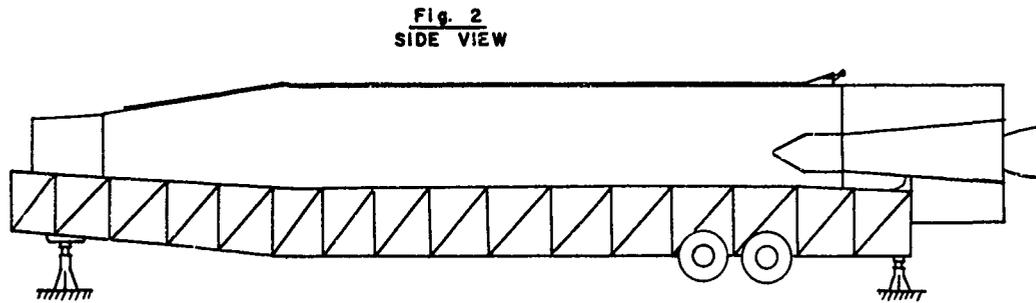
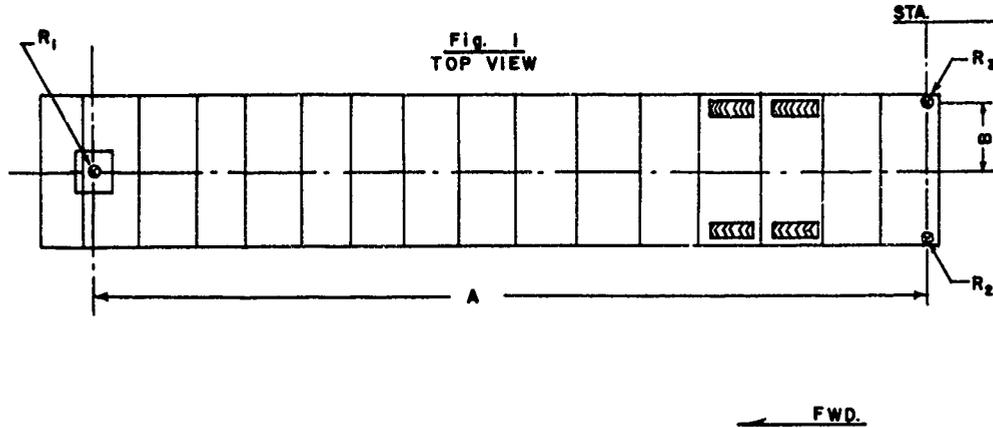
| PAGE 4 OF 7 PAGES    |   | MISSILE MODEL<br>XSM-65D-28 |      | SERIAL NUMBER<br>USAF 58-2199 |     |                    | RECORD OF CHECKING (Enter date) |   |   |   |   |   |   |   |   |
|----------------------|---|-----------------------------|------|-------------------------------|-----|--------------------|---------------------------------|---|---|---|---|---|---|---|---|
| ITEM NUMBER AND ZONE | ITEMS AND LOCATION<br>(Grouped by Zone) | WEIGHT                      | ARMS |                               |     | AIRBORNE EQUIPMENT | Shortage                        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|                      |   |                             | Z    | Y                             | X   |                    |                                 |   |   |   |   |   |   |   |   |
| C-10                 | RP-1 FILL & DRAIN VALVE COVER           | 2.0                         | 1223 | 61                            | 42  | 0                  |                                 |   |   |   |   |   |   |   |   |
| C-11                 | LIQ. OXY. FILL & DRAIN VALVE            | 23.0                        | 1218 | 145                           | 48  | X                  |                                 |   |   |   |   |   |   |   |   |
| C-12                 | LIQ. OXY. FILL & DRAIN VALVE COVER      | 2.0                         | 1225 | 145                           | 48  | 0                  |                                 |   |   |   |   |   |   |   |   |
| C-13                 | TRAILER FITTINGS                        | 39.0                        | 1171 | 100                           | 100 | 0                  |                                 |   |   |   |   |   |   |   |   |
| C-14                 | BOOSTER ENG. SIDE COVERS                | 98.2                        | 1285 | 100                           | 100 | 0                  |                                 |   |   |   |   |   |   |   |   |
| D-8                  | AZUSA BOOM ANTENNA                      | 4.6                         | 1135 | 151                           | 41  | X                  |                                 |   |   |   |   |   |   |   |   |
| D-9                  | UMBIL. DUST PLUGS                       | 10.5                        | 1128 | 163                           | 100 | 0                  |                                 |   |   |   |   |   |   |   |   |
| D-10                 | GAGE & SUPT. BRACKET                    | 2.8                         | 1105 | 161                           | 86  | X                  |                                 |   |   |   |   |   |   |   |   |
| D-11                 | AZUSA TRANSPONDER                       | 44.0                        | 1084 | 164                           | 86  | X                  |                                 |   |   |   |   |   |   |   |   |
| D-12                 | LIQ. OXY. MANOMETER                     | 15.3                        | 1059 | 162                           | 85  | X                  |                                 |   |   |   |   |   |   |   |   |
| D-13                 | RP-1 MANOMETER                          | 9.9                         | 1055 | 163                           | 89  | X                  |                                 |   |   |   |   |   |   |   |   |
| D-14                 | RSC SET                                 | 48.3                        | 1045 | 166                           | 100 | X                  |                                 |   |   |   |   |   |   |   |   |

| CHART A - BASIC WEIGHT CHECK LIST |   |                             |      |                               |     |                    |   |   |   |                                 |   |   |   |   |
|-----------------------------------|---|-----------------------------|------|-------------------------------|-----|--------------------|---|---|---|---------------------------------|---|---|---|---|
| PAGE 5 OF 7 PAGES                 |   | MISSILE MODEL<br>XSM-65D-28 |      | SERIAL NUMBER<br>USAF 58-2199 |     |                    |   |   |   | RECORD OF CHECKING (Enter date) |   |   |   |   |
| ZONE AND ITEM NUMBER              | ITEMS AND LOCATION<br>(Grouped by Zone) | WEIGHT                      | ARMS |                               |     | AIRBORNE EQUIPMENT | 1 | 2 | 3 | 4                               | 5 | 6 | 7 | 8 |
|                                   |   |                             | Z    | Y                             | X   |                    |   |   |   |                                 |   |   |   |   |
| D-15                              | <del>RSC BATTERY</del>                  | 3.7                         | 1035 | 166                           | 100 |                    |   |   |   |                                 |   |   |   |   |
| D-16                              | P/U CANNISTER                           | 45.2                        | 1019 | 164                           | 86  | X                  |   |   |   |                                 |   |   |   |   |
| D-17                              | RSC SET                                 | 48.3                        | 1016 | 100                           | 100 | X                  |   |   |   |                                 |   |   |   |   |
| D-18                              | <del>RSC BATTERY</del>                  | 3.7                         | 1007 | 166                           | 100 |                    |   |   |   |                                 |   |   |   |   |
| D-19                              | VIBRATRON TRANSDUCER                    | 3.0                         | 992  | 163                           | 87  | X                  |   |   |   |                                 |   |   |   |   |
| D-20                              | RSC RING COUPLER                        | 1.2                         | 981  | 160                           | 87  | X                  |   |   |   |                                 |   |   |   |   |
| D-21                              | RSC ARMING SWITCH                       | 1.3                         | 970  | 161                           | 84  | X                  |   |   |   |                                 |   |   |   |   |
| D-22                              | DESTRUCTOR                              | 5.7                         | 960  | 162                           | 84  | X                  |   |   |   |                                 |   |   |   |   |
| D-23                              | ACOUSTICA CANNISTER                     | 15.9                        | 943  | 164                           | 86  | X                  |   |   |   |                                 |   |   |   |   |
| D-24                              | RATE BEACON MOD III                     | 35.0                        | 920  | 166                           | 87  | X                  |   |   |   |                                 |   |   |   |   |
| D-25                              | FLUSH MOUNTED ANTENNA                   | 12.3                        | 914  | 171                           | 100 | X                  |   |   |   |                                 |   |   |   |   |
| D-26                              | RSC & TLM. ANTENNA                      | 17.0                        | 892  | 168                           | 100 | X                  |   |   |   |                                 |   |   |   |   |
| D-27                              | RETRO - ROCKETS                         | 10.3                        | 877  | 163                           | 100 | X                  |   |   |   |                                 |   |   |   |   |
| D-28                              | TLM. BATTERY                            | 30.1                        | 1097 | 164                           | 114 | X                  |   |   |   |                                 |   |   |   |   |
| D-29                              | AUTO-PILOT PROGRAMMER                   | 93.0                        | 1074 | 166                           | 100 | X                  |   |   |   |                                 |   |   |   |   |
| D-30                              | TLM. ACCESS PACKAGE                     | 21.3                        | 1077 | 167                           | 114 | X                  |   |   |   |                                 |   |   |   |   |
| D-31                              | TLM. SET                                | 84.8                        | 1045 | 164                           | 114 | X                  |   |   |   |                                 |   |   |   |   |





**MISSILE WEIGHING DIAGRAM (T3)**



A = \_\_\_\_\_ The distance between fore & aft reactions.

B = \_\_\_\_\_ The distance from reference datum to center line of reaction R<sub>3</sub>

SEE MISSILE WEIGHING DATA SHEET (T3)

$$\bar{Z} = \text{STA.} \quad - \quad \frac{\text{Missile } R_1 \times A}{\text{Total Missile WT.}}$$

$$\bar{Y} = \frac{\text{Missile } (R_3 - R_2) \times B}{\text{Total Missile WT.}} + 100$$

NOTE:  
C.G. DETERMINATION FOR  
REFERENCE ONLY. C.G. IS  
NOT ORDINARILY DETERMINED  
FROM TRAILER WEIGHINGS.

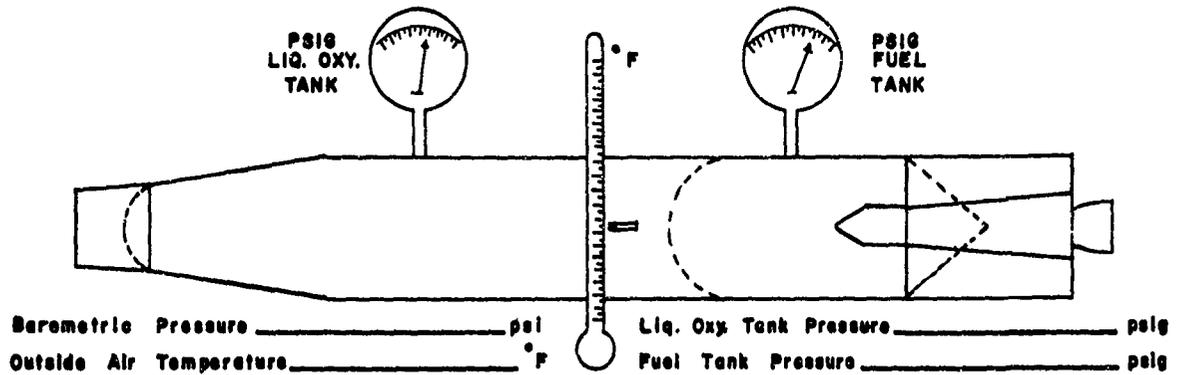
| MISSILE WEIGHING DATA SHEET (T3)   |      |                 |                 |                    |        |                 |                 |                 |         |
|------------------------------------|------|-----------------|-----------------|--------------------|--------|-----------------|-----------------|-----------------|---------|
| DATE WEIGHED                       |      |                 | MODEL           |                    |        | SERIAL NUMBER   |                 |                 |         |
| PLACE WEIGHED                      |      |                 |                 | WEIGHING PERSONNEL |        |                 |                 |                 |         |
| SCALE READINGS - MISSILE & TRAILER |      |                 |                 |                    |        |                 |                 |                 |         |
| REACTION POINTS                    | LOAD | 1 <sup>ST</sup> | 2 <sup>ND</sup> | 3 <sup>RD</sup>    | UNLOAD | 4 <sup>TH</sup> | 5 <sup>TH</sup> | 6 <sup>TH</sup> | AVERAGE |
| FWD. POINT (R <sub>1</sub> )       | LOAD |                 |                 |                    | UNLOAD |                 |                 |                 |         |
| AFT. POINT (R <sub>2</sub> ) LEFT  |      |                 |                 |                    |        |                 |                 |                 |         |
| AFT. POINT (R <sub>3</sub> ) RIGHT |      |                 |                 |                    |        |                 |                 |                 |         |
| <b>8</b> TOTAL (AS WEIGHED)        |      |                 |                 |                    |        |                 |                 |                 |         |

| SCALE READINGS - TRAILER           |      |                 |                 |                 |        |                 |                 |                 |         |
|------------------------------------|------|-----------------|-----------------|-----------------|--------|-----------------|-----------------|-----------------|---------|
| REACTION POINTS                    | LOAD | 1 <sup>ST</sup> | 2 <sup>ND</sup> | 3 <sup>RD</sup> | UNLOAD | 4 <sup>TH</sup> | 5 <sup>TH</sup> | 6 <sup>TH</sup> | AVERAGE |
| FWD. POINT (R <sub>1</sub> )       | LOAD |                 |                 |                 | UNLOAD |                 |                 |                 |         |
| AFT. POINT (R <sub>2</sub> ) LEFT  |      |                 |                 |                 |        |                 |                 |                 |         |
| AFT. POINT (R <sub>3</sub> ) RIGHT |      |                 |                 |                 |        |                 |                 |                 |         |
| <b>9</b> TOTAL (AS WEIGHED)        |      |                 |                 |                 |        |                 |                 |                 |         |

| DERIVATION OF ACTUAL DRY WEIGHT   |        |   |   |   |     |     |     |
|-----------------------------------|--------|---|---|---|-----|-----|-----|
| ITEM                              | WEIGHT | Z | Y | X | WZ  | WY  | WX  |
| 1 MISSILE AS WEIGHED              |        |   |   |   |     |     |     |
| 2 <u>LESS</u> NON-FLIGHT OVERAGES | (-)    |   |   |   | (-) | (-) | (-) |
| 3 <u>LESS</u> GAS IN TANKS        | (-)    |   |   |   | (-) | (-) | (-) |
| 4 <u>PLUS</u> SHORTAGES           | (+)    |   |   |   | (+) | (+) | (+) |
| 5 TOTAL MISSILE ACTUAL WEIGHT     |        |   |   |   |     |     |     |
| 6 <u>LESS</u> BOOSTER ACTUAL WT.  | (-)    |   |   |   | (-) | (-) | (-) |
| 7 2ND STAGE ACTUAL WEIGHT         |        |   |   |   |     |     |     |

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, USC, SECTIONS 793 AND 794 THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW

## GAS CALCULATION DATA SHEET



$$\text{Weight } \text{GN}_2 \text{ in Liq. Oxy. Tank} = \frac{144(\text{B.P.} + \text{PSIG}) \times \text{Liq. Oxy. Tank Volume}}{\text{LN}_2 \text{ Gas Constant} \times (460 + \text{Ambient Temp.})}$$

$$\frac{144( \quad ) \times 2803.2}{55.16 \times ( \quad )} = \quad \text{lbs.}$$

$$\text{Weight } \text{GN}_2 \text{ in Fuel Tank} = \frac{144(\text{B.P.} + \text{PSIG}) \times \text{Fuel Tank Volume}}{\text{LN}_2 \text{ Gas Constant} \times (460 + \text{Ambient Temp.})}$$

$$\frac{144( \quad ) \times 1539.8}{55.16 \times ( \quad )} = \quad \text{lbs.}$$

$$\text{Weight Displaced Air (both tanks)} = \frac{144 \times \text{B.P.} \times \text{Total Tank Volume}}{\text{Air Constant} \times (460 + \text{Ambient Temp.})}$$

$$\frac{144( \quad ) \times 4043.0}{53.34 \times ( \quad )} = \quad \text{lbs.}$$

## GAS CENTER OF GRAVITY DETERMINATION

| ITEM  | WEIGHT | Z      | Y   | X   | WZ | WY | WX |
|---|--------|--------|-----|-----|----|----|----|
| GN <sub>2</sub> in Liq. Oxy. Tank                     |        | 709.0  | 100 | 100 |    |    |    |
| (+) GN <sub>2</sub> in Fuel Tank                      |        | 1063.0 | 100 | 100 |    |    |    |
| (-) Wt. Displaced Air                                 |        | 856.0  | 100 | 100 |    |    |    |
| Gas in Tanks—insert on MISSILE WEIGHING RECORD—Item 3 |        |        |     |     |    |    |    |



