DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188

1. TITLE
MASS PROPERTIES DATA REPORT (SUBMARINES)

2. IDENTIFICATION NUMBER
DI-MISC-81507

3. DESCRIPTION/PURPOSE

3.1 The Mass Properties Data Report is to establish technical management of configuration control of the submarine and to ensure that predetermined Naval Architectural limits and stability characteristics are not compromised.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE
960107	NAVSEA-03H2		

7. APPLICATION/INTERRELATIONSHIP

7.1 This Data Item Description (DID) contains the format and content preparation instructions for the mass properties data report resulting from work task requirements delineated in the contract.

7.2 Reference documents cited herein may be obtained as specified in the contract.

7.3 This DID supersedes DID UDI-23204C.

7.4 NAVSEA S9040-AA-IDX-010/SWBS 5D and NAVSEA S9040AA-IDX-020/SWBS 5D may be obtained by contacting the Fleet Logistics Support Directorate (NAVSEA 04), Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington VA 22242-5160.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER
		N7177

10. PREPARATION INSTRUCTIONS

10.1 Reference documents - The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be specified in the contract.

10.2 Format - The Mass Properties Data Report shall be machine written on 8-1/2 by 11 inch bond paper, and shall be protected by covers, but not permanently bound therein.

10.3 Content - The Mass Properties Data Report shall be in detail. Each detail line item shall include columns for the following except as noted:

(a) Three-digit weight classification number
(b) Item number
(c) Item description
(d) Current weight
(e) An indicator to show confidence of current weight value
(f) Current vertical lever
(g) Current vertical moment
(h) Current longitudinal lever
(i) Current longitudinal moment
(j) Current transverse lever
(k) Current transverse moment
(l) An indicator to show last revision

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

Distribution Statement A: Approved for public release; distribution is unlimited.

Block 10. Preparation Instructions (continued)

10.3.1 Three-digit system - Items shall be grouped and sequenced in accordance with NAVSEA S9040-AA-IDX-010/SWBS 5D and NAVSEA S9040-AA-IDX-020/SWBS 5D (the Expanded Ship Work Breakdown Structure, ESWBS). Figure 1 is an example of three-digit system format.

10.3.2 Sign convention - Vertical levers shall be indicated by a "-" for below the baseline, and a "+" or a blank for above the baseline. Longitudinal levers shall be indicated by an "F" or a "-" for forward of the reference plane, and an "A", a "+", or a blank for aft of the reference plane. Transverse levers shall be indicated by a "P" or a "+" for port, and an "S" or a "-" for starboard.

10.3.3 Specific content requirements - The report shall contain the following:

(a) A table of contents
(b) A legend of all special coding symbols used throughout the concurrent submittal
(c) A set of all detailed net changes completed since the prior submittal sequenced in accordance with the three-digit system including recommendations for reversing unsatisfactory trends toward exceeding established margins or limits
(d) Listing of potential changes including weight and margin impact
(e) Summaries in a form similar to figure 2 covering all items representing the ship in Condition A, N-Surfaced, and N-Submerged for the interim and ultimate ship
(f) Summaries in a form similar to figure 3 covering solid ballast and margin required for ship balance for the interim and ultimate ship
(g) Summaries for submerged displacement including hull form, positive and negative appendages, and net submerged displacement for the interim and ultimate ship
(h) Detailed tank capacity along with vertical and longitudinal center data for all tanks
(i) Summaries for fixed and variable loads for all equilibrium conditions as required by the ship specifications
(j) Equilibrium polygon(s) as required by the ship specifications including the detailed calculations upon which each point in the polygon(s) is based
(k) One-digit and three-digit summaries. The one-digit summary is the collection of one-digit groups with the total weight and moments and resulting levers for Condition A-1. Each three-digit summary is the total collection of three-digit elements with a common first digit and the total weight and moments and resulting levers of the collection for Condition A-1, and normal fixed and variable loads. The content requirements of 10.3 apply to each line of these summaries except:
    (1) Item 10.3(c) shall be the title of the group or element,
    (2) Item 10.3(d) shall also include a column for the Accepted Weight when it is established
    (3) Item 10.3(e) shall be the current composite percent completion for the total group or element,
    (4) Items 10.3(b) and 10.3(1) shall be omitted
(l) Details that constitute Condition A-1, normal fixed and variable loads

(m) Details of submerged displacement including the positive and negative appendage values used to determine the submerged displacement with associated centers of gravity

(n) Details of capacity for each main ballast tank including the gross capacity, the net capacity, and the details of all deductions used to determine the net capacity

(o) Listing of machinery plant items classified in the category system as defined by NAVSEA 0900-LP-039-9020, and divided into four sections. Sections II, III and IV each contain a summary of applicable items by category totals, a summary by three digit element, and a breakdown of each category by three-digit element.

(1) Section I contains a summary of all category items by category totals and a breakdown of each category in accordance with the three-digit system

(2) Section II contains details of those items in the category system which are nuclear responsibility

(3) Section III contains details of those items in the category system which are in the engine room and reactor compartment and are non-nuclear responsibility

(4) Section IV contains details of the remaining items in the category system and are strictly non-nuclear

(p) A listing of all contract modifications (including field changes) related to items covered by NAVSEA development margin. All contract modifications are listed numerically by NAVSEA number and include either unadjudicated or adjudicated values for the net change in weight, displacement, moments, and an identifier that indicates whether the data is unadjudicated or adjudicated. Each item also includes the Accepted Weight (when established). For those listed modifications which affect NAVSEA development margin, the resulting margin impact shall be given. Supporting details, including description, for each change are included and sequenced in accordance with the three-digit system.

(q) A summary and detail listing by three-digit element of government furnished material (non-nuclear). The content requirements of 10.3 apply except as follows:

(1) Item 10.3 b) shall be the schedule "A" line and item number

(2) Item 10.3(d) the summary listing shall also include a column for the Accepted Weight when it is established

(r) Listing in accordance with the three-digit system of the ultimate items, interim items, post shakedown availability items, and post delivery contract modifications and their individual effects on margin.

(s) When specifically required by the contract, weight moment of inertia data shall be included for condition N-surfaced and condition N-submerged. Current weights, centers of gravity, and engineering information describing the shape and orientation of each data element shall be used to develop weight moment of inertia data. The minimum data required are as follows:

(1) Ship oriented roll, pitch, and yaw weight moments of inertia about each individual data element's centroidal axes.

(2) Ship oriented roll, pitch, and yaw weight moments of inertia about the ship's centroid in condition N-surfaced and condition N-submerged.

10 4 Mass properties - Mass properties data shall be prepared in accordance with the requirements of 10.3 of this DID. Within the context of the Weight

Control Program, the words "mass" and "mass properties" are synonymous with the word "weight".

10.4.1 Design Weight Estimate - Prepared by the contractor at the beginning of the detail design phase, based on the ship specifications and all documents referenced therein.

10.4.2 Accepted Weight Estimate (AWE) - This is the best evaluation of the ship with respect to weight and the vertical, longitudinal, and transverse (when required) location of center of gravity. It is derived by analysis of the Contractor's Design Weight Estimate.

10.4.3 Quarterly weight report - This represents the regular periodic updating of information presented in the AWE. Weights, levers and displacements of detail line items change as the design matures and actual weights replace estimated or calculated weights. Additional detail line items incorporated into the report maintains clarity of the information and include contract changes and other changes over which the contractor has no control.

10.4.4 Final weight report - This represents the last update of the submarine mass properties. This shall include all contract changes, actual weights of items that have been weighed, and changes in weights and levers so that the report accurately reflects the inclining experiment and the trim dive.

10.5 INPUT DATA FILE FORMAT AND TRANSFER

10.5.1 Format - Input data files, when required by the design contract or Ship Specifications, shall be in accordance with the following format. In general, for each item in the weight estimate there shall be two lines of data in the file. The first line is mandatory and shall contain information regarding the weight and center of gravity of the item. The second line is optional, depending upon the specification requirements, and shall contain information regarding the inertia characteristics of the item. An example of the Navy standard weight estimate format is shown on figure 4.

10.5.1.1 First line of data - The format for the first line of data is as follows:

Columns 1 through 5. Classification Number. Columns 1 through 3 are based on the Expanded Ship Work Breakdown Structure (ESWBS). Columns 4 and 5 provide for special subtotals within the classification number. Columns 4 and 5 shall contain only numeric data. Generally, two zeroes are used to designate an ESWBS element title. For example; Main Deck would be designated 13100 for ESWBS. It is noted that ESWBS subgroups ending in a zero are not to be used for input data such as 110, 120, 230, 240, and so forth.

Column 6. Column 6 is used for functional category designation when required for nuclear powered ships. These categories are defined by NAVSEA 0900-LP-039-9020.

Columns 7 through 10. Item Number. The item number provides the means of identification of each line within any five-digit element number. The following rules apply:

a. Each line shall have an item number.
b. All titles representing any of the basic ESWBS titles shall include a zero in column 10.
   NOTE: Titles for special subtotals within an ESWBS element may contain any item number desired.
c. Care shall be taken not to repeat any item numbers within a five-digit element.
d. Do not use any leading zeroes in the item number, such as 0010.
e. Item numbers for entries should be entered in increments of ten, such as 10, 20, and 30, in lieu of 1, 2, and 3.
f. All item numbers shall be right justified.

Column 11, Station. This column is used in conjunction with the standard longitudinal weight distribution for subsequent strength calculations. For weight distribution, the ship is divided into 22 stations which are lettered A through X (excluding I and O). Station A is designated to contain all items whose longitudinal center of gravity (LCG) is forward of the forward perpendicular. Station B contains all items with an LCG between the forward perpendicular and ship station 1. Station C contains items between ship station 1 and ship station 2, and so on to station X which contains all items aft of the aft perpendicular. For each item (except titles and items with no weight), column 11 shall contain a letter from A through X (excluding I and O), unless one of the following special options is used:

a. An asterisk inserted in column 11 for any item indicates the weight will be automatically distributed in a 22-station longitudinal distribution in proportion to the basic hull structure. The basic hull structure for ESWBS consists of group 1 from 110 through 159, except 114 and 123 through 126. Items in the basic hull structure shall not use the asterisk option.
b. A digit of 2 through 9 in column 11 indicates the weight for the given item will be distributed over 2 through 9 stations centered about the item's LCG. If enough stations are not available to do a particular distribution, the distribution will be done over as many stations as are available. For instance, if a six-station distribution is required within two stations of either end of the ship, then a four-station distribution will occur.

Column 12, Special Designator. This column shall contain designators established by the Government. Where no designator is applicable, this column shall be left blank. In the event of a conflict in determining which designation is to be used, the order of precedence shall be by alphabetical order. This designator provides for dual purpose as follows:

a. Provides for extractions across the entire ship for summaries, such as plates, extruded shapes, weldments, primary, secondary, and others, as required.
b. Provides for listing within the three-digit element, such as controls, components, distribution, and others, as required.

c. The following designators are applicable:

C - Controls, such as valves, switches, regulators, gear boxes, and shutters.
D - Distribution items, such as ducts, pipe, wire, wireways, connectors, waveguides, propeller shafts, and propeller shaft bearings.
E - Plating and sheeting.
F - Forgings, extruded shapes, rolled shapes, built-up shapes, and castings.
G - Weldments.
M - Major components, such as air conditioner units, antennas, actuators, batteries, blowers, boilers, compressors, computers, cranes, davits, distillers, transmitters, receivers, transceivers, engines, fans, generators, motors, propellers, pumps, turbines, winches, and replenishment-at-sea (RAS) equipment.
P - Secondary, peripheral, and interface components, such as hydraulic reservoirs, electrical power supplies, non-integral tanks, filters, heat exchangers (for system), and subbases.

Column 13, Special Modifier. This column shall contain a modifier established by the Government for the column 12 designator for those items in groups 1 through 7 only (that is, not including items of variable load). In the event a modifier cannot be determined, a "Z" shall be inserted. This modifier provides for dual purpose, as follows:

a. Provide for extractions across the entire ship for various material types, such as all steel, all aluminum, and others, as required.
b. Provide for special systems summaries across the entire ship or within certain elements, such as all payload, all habitability, and special systems such as hydrofoils and air cushions.
c. The following modifiers are applicable:

A - Aluminum.
B - Brass and bronze.
C - Copper, copper-nickel, and nickel-copper.
D - Ordinary strength steel.
E - Higher strength steel.
F - Fiberglass, plastic, and insulation material.
H - Habitability items, such as berthings, clothing and personal effects stowage, leisure systems, sanitary systems, messing, personal service, utility, and work systems (this modifier shall supersede any material type modifiers).
J - Wood material.
K - Liquids.
L - Lead.
M - Miscellaneous metallic material.
N - Miscellaneous non-metallic material.
P - Payload which includes items that are peculiar to the specific missions of a particular ship, such as mine-

sweep gear on a minesweeper, oceanographic gear on an oceanographic ship, and so forth (this modifier shall supersede any material modifiers).

W - Welding, riveting, and fastening.

Columns 14 through 45, Description. These 32 columns shall be used to adequately describe each item. Whatever is entered as input data is reproduced exactly on the weight estimate or report printout: Any combination of alphanumeric characters or blanks can be used. Clear and complete description is essential. However, if budget weights are being used, the description field shall be limited to 24 columns (columns 14 though 37). Columns 38 through 45 will then be used for budget weights (see the following paragraph).

Columns 38 through 45, Budget Weight. Budget weight, if used, is entered in pounds on ESWBS titles only. This allows weight values from 0 to 99,999,999 pounds (to be entered 99999999).

Columns 46 through 53, Unit Weight. Always enter unit weight of any item in pounds. The broken line on the Standard Navy Transmittal Form (NAVSEA 5230/32) between columns 51 and 52 provides a decimal point, allowing a unit weight up to 999,999.99 pounds. When the unit weight is a whole number, enter two zeroes behind the implied decimal point. If the weight is a deduction, enter a minus sign (-) immediately before the unit weight number.

Columns 54 through 57, Number of Units. Values from .001 to 9999 units can be entered. This number is multiplied by unit weight to produce total weight for each line item. Unit weight, number of units, and total weight are all printed in the detail output.

Columns 58 through 62, Vertical Center of Gravity (VCG). These columns shall be used for entering the VCG of each item. VCG's shall be carried out to the hundredth decimal place. When the VCG is a whole number, two zeroes must be entered after the decimal point. If the VCG is negative (a weight below the baseline), enter a minus sign immediately before the VCG number. All VCG's are measured in feet. The VCG will be multiplied by the computed total weight, and the resultant vertical moment will be printed.

Columns 63 through 67, Longitudinal Center of Gravity (LCG). These columns shall be used for entering the LCG of each item. LCG is measured in feet and carried out to the hundredth decimal place. Always enter a positive LCG, no sign is necessary. When the LCG is a whole number, enter two zeroes behind the implied decimal point. The LCG will be multiplied by the computed total weight, and the resultant longitudinal moment will be printed.

Column 68, LCG Sign. As mentioned above, the LCG is always entered as a positive value. Enter "F" or "A" to indicate whether the weight is located forward or aft of the longitudinal reference datum. A blank in column 68 is interpreted to mean "A" or aft.

Columns 69 through 73, Transverse Center of Gravity (TCG). These columns shall be used for entering the TCG of each item. TCGs shall be

carried out to the hundredth decimal place. When the TCG is a whole number, two zeroes must be entered after the decimal point. All TCGs are measured in feet port or starboard of the centerline, with the exception when port and starboard symmetry exists. If a line item has port and starboard symmetry, the TCG is measured in feet from the transverse center of one side (port or starboard) of the symmetrical item. This is essential in order to calculate the weight moment of inertia value of the line item. Always enter a positive TCG, no sign is necessary. If the TCG is not applicable, leave columns 69 through 73 blank. The TCG will be multiplied by the total weight, and the resultant transverse moment will be printed.

Column 74. TCG Sign. As mentioned above, the TCG is always entered as a positive value. Enter "P" or "S" to indicate whether the weight is port or starboard of the centerline. However, when a line item has port and starboard symmetry about the centerline, enter "X" to indicate the transverse center of one side (port or starboard) of the symmetrical line item. This distance will only be used to calculate the weight moment of inertia of the line item. A blank in column 74 is interpreted to mean "P" or port.

Column 75. Reservation Indicator (RES). This column is used to indicate reservation items or design responsibility. The letter "R" shall be used to designate a reservation item. The letters "A" through "Z" (except "R") may be used, as required, to indicate design responsibility, such as:

H - Hull design.
M - Machinery design.
E - Electrical design.

Column 76. Reason for Change. This column is used to indicate the reason for change as follows:

0 - Nomenclature change (no weight change).
1 - Contract modification change.
2 - Government-furnished material change.
3 - Change to class status, such as estimated to calculated, or calculated to actual.
4-9 and A-Z user assigned reasons. The column appears under "CHG" in the output.

Column 77. Material Source Indicator. The column is used to indicate the source of an item as follows:

G - Government-furnished material
F - Contractor-fabricated material
P - Contractor-purchased material

Column 78. Class Status. Used to indicate the confidence of the weight value entered for the line item as follows:

E - Estimated weight
C - Calculated weight
A - Actual (scale) weight

V - Vendor or catalog weight (to be changed to "A" upon actual weight determination of the item).

Columns 79 and 80, Report Number. Enter the report number where the change was first incorporated. Report number "AO" shall be used for the first submittal of input. Line items changed prior to the first periodic weight report shall carry report number "BO" for the first such change, "CO" for the second, etc. The first periodic weight report shall have a "0" or blank in column 79, and a "1" in column 80, and so forth. Deletions may contain the letters "DD" in columns 79 and 80, in lieu of a report number, or the deletion line may be erased.

10.5.1.2 Second line of data - The second line of data for each item contains the gyradius data for the item and must immediately follow the first line of data in the file. The format for the second line of gyradius data is as follows:

Columns 1 through 5, Classification Number. These columns must contain the same five digit classification number as the line of weight data which precedes it in the file.

Column 6, I_o Designator. An asterisk (*) must be included in this field to designate the line as a second line containing inertia data for the previous line.

Columns 7 through 10, Item Number. These columns must contain the same item number as the preceding line which contains the weight data for the item.

Column 20, Shape Of I_o Item. This field is used to indicate what kind shape is to be used to estimate the I_o for the weight item. The following are shapes which may be used:

0 - The I_o calculation is to be the ratio or a percentage of a three-digit element's I_o.
1 - The I_o data are actual inertias.
2 - Rectangular Prism.
3 - Hollow Frustrum of a Cone.
4 - Hollow Right Circular Cylinder.
5 - Right Rectangular Pyramid.
6 - Hollow Hemisphere.
7 - Square Diamond.

Drawings showing the geometry and orientation of shapes 2 through 7 can be found on figure 5. If this field is blank or contains a zero the I_o will be calculated as a percentage of the three digit element specified in columns 41-50.

Column 25, Orientation Of The I_o Shape. This field is used to define the relationship between the local coordinate system of the I_o item as shown on figure 5 and the ship's coordinate system. The entries to be used are as follows:

0 - X axis of the shape as shown on figure 5 is oriented in the ship's longitudinal direction.

1 - X axis of the shape as shown on figure 5 is oriented in the ship's transverse direction.
2 - X axis of the shape as shown on figure 5 is oriented in the ship's vertical direction.

Note that the orientation of the shape relative to the ship's coordinate system need not have any sign for the calculation of the inertia. For example the inertia of the pyramid (shape 5 on Figure 5) about all three axis is the same whether the point of the pyramid is pointing in the positive X (to the right) or negative X direction (to the left). Therefore, for an item which is to be modeled as a pyramid with the point oriented to the stern of the ship, the value to be entered for the orientation in column 25 would still be "0", which is the same as if it were pointing to the bow.

Columns 31-40, X-Dimension. For each of the shape definitions given in column 20 the following information must be entered. The format for this field is right justified with an implied decimal point between columns 38 and 39.

Shape (Column 20)		X-Dimension (Columns 31-40)
0 or Blank	-	Blank or zero means the ratio of current weight to the weight of the specified element (entered in the Y-Dimension field) is used to calculate the I_o and/or I_t (if 999 is entered in the Z-Dimension field) based on the specified element's I_o and/or I_t.
	-	Percentage which is used to calculate the item's I_o and/or I_t based on the specified element's (entered in the Y-Dimension field) I_o and/or I_t. For 1% enter 100, for 0.05% enter 5, etc..
1	-	I_o about the local axis oriented in the ship's longitudinal direction.
2, 3, 4, 5, 7	-	X dimension (A of figure 5).
6	-	Blank.

For the percentage option (0 or blank in column 20) there are two possible options for calculating the I_o and/or I_t terms. For the first option, the X-Dimension field is left blank and there is a three-digit element number contained in the Y-Dimension field. For this case the I_o for the data line will be calculated as a percentage of the I_o for the specified element. The percentage used will be the weight of the data line to the element weight. If 999 is entered in the Z-Dimension field, the I_t will be calculated in a similar manner. If a percentage is inserted in the X-Dimension field and an three-digit element number is in the Y-Dimension field, the I_o will be calculated as the defined percentage of the I_o for the specified element. If 999 is entered in the Z-Dimension field, the I_t will be calculated in a similar manner.

Columns 41-50, Y-Dimension. For each of the shape definitions given in column 20 the following information must be entered. The format for this field is right justified with an implied decimal point between columns 48 and 49.

Shape (Column 20)		Y-Dimension (Columns 41-50)
0 or Blank	-	Three-digit element on which I_o and/or I_t percentage calculation is based. If blank the calculation will be based on the current three-digit element.
1	-	I_o about local axis oriented in the ships transverse direction.
2, 5, 7	-	Y dimension (B of figure 5)
3, 4, 6	-	Outer Radius (R of figure 5)

Columns 51-60, Z-Dimension. For each of the shape definitions given in column 20 the following information must be entered. The format for this field is right justified with an implied decimal point between columns 58 and 59.

Shape (Column 20)		Z-Dimension (Columns 51-60)
0 or Blank	-	If blank, only the I_o calculation will be done using a ratio or an entered percentage. If 999 is entered, then both the I_o and I_t calculation will be done using a ratio or an entered percentage.
1	-	I_o about the local axis oriented in the ship's vertical direction.
2, 5	-	Z dimension (C of figure 5).
3, 4	-	Inner Radius (r of figure 5).
6, 7	-	Blank.

Columns 61-70, T-Dimension. For each of the shape definitions given in column 20 the following information must be entered. The format for this field is right justified with an implied decimal point between columns 68 and 69.

Shape (Column 20)		T-Dimension (Columns 61-70)
0, 1, 2, 4, 5, 7 or Blank	-	Blank.
3, 6	-	Thickness (t of figure 5).

Columns 79-80, Report Number. Enter the report number where the change was first incorporated as described for the first line of data.

10.5.2 Data transfer - Input data files, when required by the design contract or Ship Specifications, shall be provided. The specific transfer media and protocol shall be as defined in the contract.

10.6 Weight control information - Milestones and single events are keyed to special weight control information. The following shall be included:

10.6.1 Weight control plan - This outlines the procedures to be followed in meeting the contractual weight control responsibilities. This shall be in narrative format and shall include the following topics:

(a) A discussion of the design with respect to the ship naval architectural characteristics and where emphasis on weight control is to be applied.

(b) A discussion of how weight control will be incorporated in the design and/or construction decision process of the whole ship and at the individual systems and components levels.
(c) A schedule for management briefings concerning the ship naval architectural condition throughout the detail design and construction phases. The individual who will give the briefings shall be identified.
(d) A description of the computer systems, both hardware and software, that will be utilized in the weight control effort.
(e) The degree of weighing required or planned for material, outfitting, samples, equipment, and components (GFM and CFM) in order to establish the accuracy of calculated weights and unit weights. A discussion of how the weighing program will be integrated into the construction process should be included.
(f) The percentage of working drawings to be reviewed.
(g) A discussion of special weight problems.
(h) The method of tracking weight trends, percent calculated, and age of weight data on a whole ship and major ship system level.
(i) The detail to which working drawings will be calculated, and the time interval between drawing issue and revision of the weight report.
(j) The reporting schedule and cut-off dates for weight calculations.
(k) The planned or required action for verification of mill tolerances, welding, and paint factors.
(l) The management and technical authority of the weight control coordinator relative to the overall design effort anticipated.
(m) The method of communicating to line personnel the condition of the ship.
(n) The method of detecting adverse weight trends both on a total ship and major ship system level.
(o) The criteria for establishing acceptable margin depletion rates, acceptable calculation rates, and acceptable age of weight data and the corrective action to be taken if the criteria is not met.
(p) Contractor projected margin depletion curves including the criteria used in establishing the curves against which margins can be evaluated at any point in the design and/or construction.
(q) A discussion as to when margins will be considered unsatisfactory relative to the margin depletion curves and what type of action will be initiated if margins are determined to be unsatisfactory.
(r) The action which will be taken upon detection of weight or moment trends tending to cause estimated values to be exceeded.
(s) The method of facilitating the submittal of weight reduction ideas from line personnel.
(t) The method and degree of weight control that will be required of vendors. Included should be a discussion of what weight control requirements (e.g., not-to-exceed net weight limits and development of weight control plans) the Contractor will invoke on vendors and what level of responsibility vendors will have to identify and halt or reverse any adverse weight trend during the development and manufacturing phases.

10.6.2 Adverse trends - Adverse trends which can lead to delivery of the submarine with less than the minimum naval architectural requirements of the contract shall be highlighted at any time during the term of the contract. This shall be in narrative format and shall include:

(a) An analysis or the conditions that led to the adverse condition,
(b) An evaluation of the ultimate effect of the trend, and
(c) Proposed corrective action to halt and reverse the adverse trend.

10.6.3 Accepted ship - Using the inclining experiment and trim dive as a base, the calculative breakdown of total solid ballast is updated. The calculative breakdown shall reflect the effect of ultimate, interim and all known PSA items, along with contract modifications and government furnished material (non-nuclear). The measure of an accepted ship shall be determined by the remaining margin at the time of delivery and by the surfaced GM and submerged BG as specified in the specifications. The accepted ship shall be reported following the format of figure 6.

10.6.4 Design and weight data sheet - The design and weight data sheet shall follow the format of figure 7, and shall include major load and machinery items, as are appropriate to the applicable ship.

UNCLASSIFIED

SHIP USS EXAMPLE — WEIGHT AND MOMENT ESTIMATE — REPORT NO. 02

PREPARED BY 03H2 — INCH-POUND UNITS POUNDS, TONS, FEET — 28 SEPTMBER 1995

LONGITUDINAL REFERENCE IS FWD PERPENDICULAR — SHEET 315

NAVY GROUP	C ITEM	S T A	DM	DESCRIPTION	UNIT WEIGHT	NO. UNITS	CURRENT WEIGHT	E C A	VERTICAL VCG-	VERTICAL MOMENT	LONGITUDINAL LCG S	LONGITUDINAL MOMENT	TRANSVERSE TCG S	TRANSVERSE MOMENT	RCG EHF SGM	R P T
S				AUXILIARY SYSTEMS												
51700H	0	A		DISTILLING PLANT												
51700H	10	N		10,000 GPD DISTILLER - LP	5346.00	1	5346.A		25.33	135414.	93.21A	498301.	0.00	0.		02
51700H	20	S		DISTILLER INSULATION	314.00	1	314.C		24.50	7693.	93.21A	29268.	0.00	0.		01
51700H	30	G		STAVE DAMPING	4.00	1	4.C		25.33	101.	93.21A	373.	0.00	0.		01
51700H	40	H		DEMINIMERALIZER	255.00	2	510.A		23.50	11985.	88.08A	44921.	6.50X	0.		02
51700H	50	N		TANK, BRINE	385.00	1	385.C		13.21	5086.	91.79A	35339.	5.00P	1925		02
51700H	60	M		TANK, CHEM PROPORTIONER	325.00	1	325.C		23.84	7748.	97.67A	31743.	4.00S	-1300		02
51700H	70	Q		PUMP, CHEM PROPORTIONER	87.00	1	87.A		21.50	1871.	93.21A	8109.	4.00S	-348		02
51700H	80	Q		PUMP, HP BRINE	2547.00	1	2547.A		7.50	19103.	90.92A	231573.	1.00P	2547		02
51700H	90	Q		PUMP, LP BRINE 25 GPM	235.00	1	235.C		17.50	4113.	88.08A	20699.	3.00S	-705		02
51700H	100	K		PUMP, DISTILLATE 15 GPM	235.00	1	235.C		17.80	4183.	89.33A	20993.	7.00S	-1645		02
51700H	110	F		HEATERS & HEAT EXCHANGERS	4208.00	1	4208.C		23.25	97836.	91.75A	386084.	6.00X	0.		02
51700H	120	K		GAGEBOARD ASSEMBLY	279.00	1	279.E		25.25	7045.	91.75A	25598.	5.00P	1395		B0
51700H	130	K		FLOWMETERS	39.00	1	39.C		23.25	907.	91.75A	3578.	5.00P	195		02
51700H	140	K		PIPING, VALVES & FITTINGS	7239.00	1	7239.E		22.13	160199.	89.36A	646877.	7.00X	0.		A0
51700H	150	K		INSULATION, PIPE	536.00	1	536.E		22.13	11862.	89.36A	47897.	7.00X	0.		A0
51700H	160	K		HANGERS	4298.00	1	4298.E		22.13	95115.	89.36A	384069.	7.00X	0.		A0
51700H	170	K		NOTE: SYSTEM LIQUIDS ARE												A0
51700H	180	K		CALCULATED IN ESWBS 59817												A0
				SUBTOTAL-POUNDS			26588.			570261.		2415422.		2064		
				SUBTOTAL-TONS			11.87		21.45	255.	90.85A	1078.	0.08P	1.		
517				DISTILLING PLANT												
				GROUP TOTAL-POUNDS			26588.			570261.		2415422.		0.		
				GROUP TOTAL-TONS			11.87		21.45	255.	90.85A	1078.	0.00	0.		

UNCLASSIFIED

Figure 1. Example of three-digit system format.

DI-MISC-81507

UNCLASSIFIED

SHIP USS EXAMPLE

SHIP SUMMARY

REPORT NO. 02
28 SEPTMBER 1995

DESCRIPTION	WEIGHT (Tons)	VCG (abv BL)	VERTICAL MOMENT	LCG (aft FP)	LONGITUDINAL MOMENT	TCG (abt CL)	TRANSVERSE MOMENT
CONDITION A-1							
SOLID BALLAST (EFFECTIVE)							
SOLID BALLAST DISPLACEMENT CORR.							
CONDITION A *							
FIXED AND VARIABLE LOAD*							
VARIABLE BALLAST*							
RESIDUAL WATER*							
CONDITION N-SURFACED							
MAIN BALLAST WATER (UNCORR)							
RESIDUAL WATER*							
SOLID BALLAST DISPL CORR.							
MAIN BALLAST WATER (CORRECTED)							
CONDITION N-SUBMERGED							

* CORRECTED FOR FREE SURFACE

KM = . FT
KG = . FT
GM = . FT

KB = . FT
KG = . FT
BG = . FT

FWD DRAFT = . FT
AFT DRAFT = . FT.
TRIM = . FT BTWN MARKS
NAVIGATIONAL DRAFT = . FT

RESERVE BUOYANCY = %

UNCLASSIFIED

EXAMPLE

Figure 2. Example of Ship Summary.

UNCLASSIFIED

SHIP USS EXAMPLE

SOLID BALLAST AND MARGIN SUMMARY

REPORT NO. 02
28 SEPTMBER 1995

DESCRIPTION	WEIGHT (Tons)	VCG (abv BL)	VERTICAL MOMENT	LCG (aft FP)	LONGITUDINAL MOMENT	TCG (abt CL)	TRANSVERSE MOMENT
SOLID BALLAST IN PRESSURE HULL							
SOLID BALLAST IN MBTS (EFFECTIVE)							
TOTAL SOLID BALLAST (EFFECTIVE)							
SOLID BALLAST DISPLACEMENT (CORR)							
TOTAL SOLID BALLAST (CORRECTED)							
STABILITY BALLAST							
TRIM BALLAST							
MARGIN BALLAST							
MARGINS:							
NUCLEAR MACHINERY							
NAVSEA DEVELOPMENT							
DESIGN							
BUILDING							
FUTURE GROWTH							
TOTAL MARGIN BALLAST							

UNCLASSIFIED

Figure 3. Example of Solid Ballast and Margin Summary.

EXAMPLE

WEIGHT ESTIMATE DATA FORMAT

SHIP _____ DATE _____

FIRST LINE OF DATA FORMAT

CLASSIFICATION NO.	CAT	ITEM	STA	DM	DESCRIPTION	(BUDGET WEIGHT)	UNIT WEIGHT	NUMBER OF UNITS	VCG	LCG	SYSTEM	TCG	SICK	REES	CHO	OFM	ECA	RPT
1 2 3 4 5	6	7 8 9 10	11	12 13	14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45		46 47 48 49 50 51 52 53	54 55 56 57	58 59 60 61 62	63 64 65 66 67	68	69 70 71 72 73	74	75	76	77	78	79 80
CLASSIFICATION NO.	CAT	ITEM			NAME	DESIGN	X-DIMENSION	Y-DIMENSION	Z-DIMENSION									

SECOND LINE OF DATA FORMAT

ESTIMATED BY _____ SHEET ____ OF ____

EXAMPLE

Figure 4: Example of Navy standard weight estimate format.

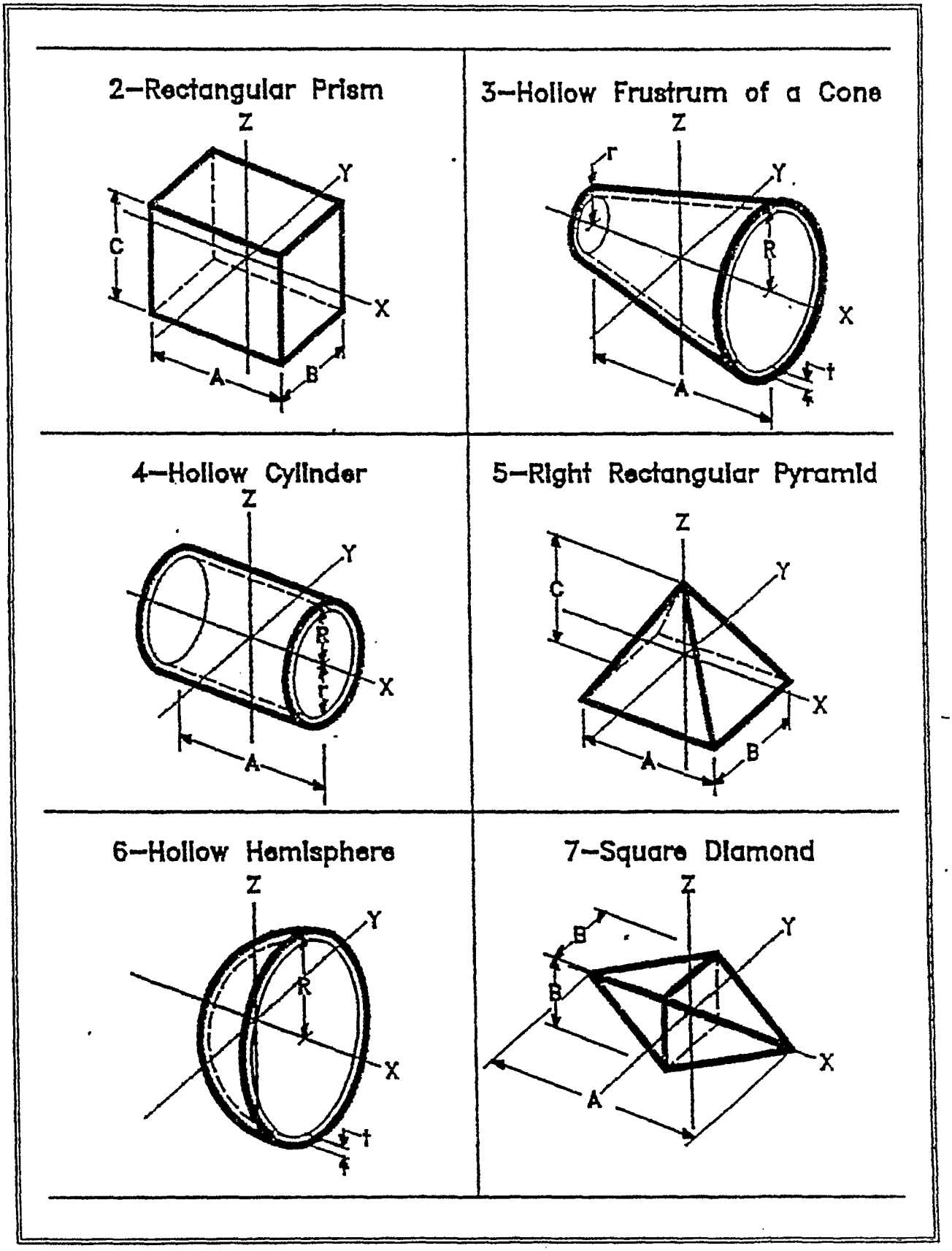

Figure 5. Shapes for I calculation.

ACCEPTED SHIP

DESCRIPTION	WEIGHT (TONS)	VCG (abv BL)	VERTICAL MOMENT	LCG (aft FP)	LONGITUDINAL MOMENT	(note 1) TCG (abt CL)	TRANSVERSE MOMENT
CONDITION A-1 (ULTIMATE) (FROM FINAL INCLINING REPORT)							
CONDITION A (ULTIMATE) (FROM FINAL INCLINING REPORT)							
CONDITION N-SURFACED (ULTIMATE) (FROM FINAL INCLINING REPORT)							
CONDITION N-SUBMERGED (ULTIMATE) (FROM FINAL INCLINING REPORT)							

	FROM FINAL INCLINING REPORT	CONTRACTUAL MINIMUM REQUIREMENTS (Note 2)	DIFFERENCE
	BG = GM =	BG = GM =	BG = GM =

MARGIN BALLAST BREAKDOWN:	AWE WEIGHT (TONS)	ASR WEIGHT (TONS)	DIFFERENCE
NUCLEAR MACHINERY			
NAVSEA DEVELOPMENT			
DESIGN			
BUILDING			
FUTURE GROWTH			
TOTAL:			

	WEIGHT (TONS)	VCG (abv BL)	VERTICAL MOMENT	LCG (aft FP)	LONGITUDINAL MOMENT	MARGIN IMPACT
NET EFFECT OF CONTRACT MODIFICATIONS (DEDUCT) - (Note 3)						
GFM-NN NET CHANGES (DEDUCT) - (Note 4)						
TOTAL:						

NOTES:
1) TRANSVERSE CENTER REQUIRED ONLY IF SPECIFIED IN THE CONTRACT
2) INSERT LIMITS AS REQUIRED IN THE CONTRACT
3) REPRESENTS SUMMATION OF ADJUDICATED AND PENDING VALUES FOR ALL CONTRACT MODIFICATIONS ACCOMPLISHED UP TO THE DATE OF THE INCLINING EXPERIMENT
4) REPRESENTS VALUES SHOWN IN STANDARD FORM 30 FOR NET WEIGHT DIFFERENCES BETWEEN THOSE GFM-NN ADJUDICATED VALUES AND THE ACCEPTED WEIGHT ESTIMATE VALUES

EXAMPLE

Figure 6. Example of Accepted Ship format

(Indicate Security Classification)

DESIGN AND WEIGHT DATA SHEET
USS EXAMPLE

General Data

Type:
Endurance:
Trial Speed:
Complement:

Hull Characteristics

LOA:	DWL From Baseline:
LBP:	Max. Beam Molded:
MP:	Depth BL to Main Deck:
Main Axis:	Depth BL to top of Fairwater:
	Max. Diam Press Hull:

Displacement and Stability Characteristics

Full Load Drafts:
Trim:
Main Water Ballast:
Residual Water:
Variable Ballast:
Reserve Bouyancy:

	Surf *Cond. N		Subm Cond. N
Displacement		Displacement	
KM		KB	
KG		KG	
GM		BG	
GM (corr for FS)			

Weight Summary Data

Group	Wt(Tons)	VCG	LCG(aft FP)
1. Hull Structure			
2. Propulsion			
3. Electric Plant			
4. Comm and Control			
5. Auxiliary Systems			
6. Outfit and Furnishings			
7. Armament			
Total Condition A-1			

Full Loads

	Wt(Tons)	VCG	LCG(aft FP)
Crew and Effects			
Ammunition and pyrotechnics			
Torpedoes and Countermeasures			
Missiles			
Provisions			
General Stores			
WRT Water in Trim Tank			
Clean Fuel oil			
Sanitary Tanks-1/3 Full			
Lube Oil in Storage Tanks			
Lube Oil Sump Tanks			
Potable Water			
Normal Fuel Oil			
Charging Water			
Consumable Hydraulic Oil			
Reserve Feed Water			
Compressed Oxygen			
Compressed Nitrogen			
Depth Control Water			
Others (as appliciable)			
Total Loads			

Propulsion Characteristics

Full Power Surfaced:
Full Power Submerged:
Submerged Snorkel:
Steam Conditions:

Propulsion Plant

Machinery	No./Ship	Rating	Manufacturer	Unit Weight Dry (Tons)

Electric Plant

Auxiliary Plant

EXAMPLE

(Indicate Security Classification)

Figure 7. Example of Design and Weight Data Sheet format