DATA ITEM DESCRIPTION

Form Approved
OMB No 0704-0188
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1 TITLE	2. IDENTIFICATION NUMBER
Range Safety Data for Aerodynamic Weapons (RSDAW)	DI-SAFT-80181

3 DESCRIPTION/PURPOSE

The RSDAW package provides the general information on the test plan, weapon description, desired trajectory and launch conditions. It includes a discussion of possible deviations and dispersion. It is the medium through which flight plan approval is obtained from the launch range. This data item meets the requirements of ADR 127-1.

4 APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC REQUIRED	6b GIDEP REQUIRED
860612	F/AFSC-AD		

7 APPLICATION/INTERRELATIONSHIP

7.1 This data item description contains the format and content preparation instructions for the data product generated by the specific and discrete task requirement for this data included in the contract.

7.2 This data item is applicable to all air-to-air and air-to-ground missile, rocket, and guided bomb contracts issued at Armament Division and programs which plan to conduct testing using Eglin Test Ranges to obtain Range Safety Data for Aerodynamic Weapons.

8 APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b AMSC NUMBER
		F3870

10 PREPARATION INSTRUCTIONS

10.1 Contract. This data item is generated by the contract which contains a specific and discrete work task to develop this data product.

10.2 RSDAW Package. The RSDAW package shall contain technical information on the test plan, weapon description, trajectory and dispersion necessary for test plan evaluation. Where applicable, previously furnished documentation may be referenced throughout the RSDAW package. The RSDAW shall contain a table of contents and glossary and shall include the following information.

10.2.1 Introduction. The nature of the program and scope and purpose of this submittal. Includes number and designation of launches for which the proposed test plan is applicable.

10.2.2 Vehicle Description.

10.2.2.1 Launch Vehicle. Vehicle configuration description including subsystems such as guidance, separation, deployment, tracking equipment and typical failure modes and probabilities.

10.2.2.1.1 A scaled diagram of the general arrangement and dimensions of the vehicle.

10.2.2.1.2 Vehicle weight and center of gravity (c.g.) versus time of flight.

7. APPLICATION/INTERRELATIONSHIP (CONT'D)

✓ 7.3 This data item supersedes DI-S-30638.

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10. PREPARATION INSTRUCTIONS (CONT'D)

10.2.2.1.3 Sequence and time of events such as motor ignition, burnout, separation of boosters or stages, jettisoning of components, starting or ending of control modes, initiation of recovery devices, etc.

10.2.2.1.4 A brief, general discussion of the typical failures which may occur during flight, an estimate of the probability of occurrence for each type of failure, and the expected vehicle behavior for these failures. Any other pertinent information related to vehicle stability characteristics or peculiarities, and structural or G-limits shall be provided.

10.2.2.1.5 Tracking equipment in the vehicle which can be used for range safety purposes, such as a radar transponder or telemetry transmitter, and the section where each piece of equipment is located.

10.2.2.1.6 Results of the structural analysis shall be included together with any supporting test data. This will assure that an adequate structural integrity margin will be maintained through aircraft takeoff, carriage, flight, launch, and landing conditions as required by MIL-A-8591.

10.2.2.2 Aerodynamic Characteristics. Include the aerodynamic coefficients and related aerodynamic characteristics:

10.2.2.2.1 A complete set of trimmed pitch aero coefficients C_N (or C_L) and C_A (or C_D) in digital form as a function of critical parameters such as Mach, trimmed angle of attack, and control surface deflection(S). If the vehicle employs a skid to turn control system, this data shall be given for a minimum of two suitable roll angles (a cruciform configuration shall use the "+" and "x" orientation). A roll to steer vehicle may use some useful combination of angle of attack and sideslip angle. Data shall be presented about (at least) the referenced c.g. and one other typical c.g.

10.2.2.2.2 A supplemental set of untrimmed aero data shall include pitch polar plots of C_N (or C_L) vs C_m and axial (drag) polar plots of C_N vs C_A (C_L vs C_D) at the reference c.g. Data shall be plotted for two roll angles on a skid to turn system ("+" and "x" for cruciform) with angle of attack and control surface deflection as parameters. Also present zero lift axial (drag) coefficient C_{A_O} (C_{D_O}) vs Mach for sea level, gliding flight condition plus separate plots of base pressure and skin friction correction vs Mach and altitude. Present an analgous set of trimmed aero data plots at the same conditions showing plots of C_N (C_L) vs trim angle of attach, C_N vs C_A (C_L vs C_D), plus separate plots of trim angle of attack vs trim control surface deflection. Background information shall contain definitions of reference length and area, aero reference location (reference c.g.), an illustration of vehicle's systems, sign convention, control surface deflection, etc.

10. PREPARATION INSTRUCTIONS (CONT'D)

10.2.2.2.3 Vehicle roll rate vs time.

10.2.2.3 Turning Capability. Include the turning capability or nominal vehicle profiles and malfunctioning vehicle as follows:

10.2.2.3.1 Maximum turning capability of the total velocity vector versus time of flight needed to determine, at any time, during flight the maximum angle through which the velocity vector of a malfunctioning vehicle can turn in various time intervals. This information is then used to determine how fast a vehicle can attempt to leave the test area if a malfunction should occur. Various time intervals or delays must be considered since the delays which are built into the flight termination calculations depend upon the accuracy, sensitivity, and type of presentation associated with a particular instrumentation system as well as upon vehicle characteristics.

10.2.2.3.2 Both pitch and lateral turns (lateral turn means the angle turned in the lateral direction by the total velocity vector, not the angle turned in the horizontal plane by the horizontal component). In beginning the various turn computations, assume that the vehicle has behaved normally up to the time of the malfunction which produces the turn. Data shall be provided for malfunction turns from a bounding group of the nominal trajectories to be flown. The turn data shall include atmospheric effects.

10.2.2.3.3 The information shall be presented as graphs of angle turned versus time from beginning of turn maneuver until 360° of turn has been completed. These graphs shall be presented at four second intervals or less along the trajectory from the time of launch to the point where the vehicle is no longer capable of impacting on land or exceeding the planned impact area.

10.2.2.3.5 The turning data can be expressed in the form of maximum pitch and lateral acceleration as an alternative method of presentation. These calculations should assume that the vehicle is trimmed to the maximum airload that the structure can stand. Also required are the maximum turning rates that the guidance system and the autopilot can command.

10.2.2.3.6 A complete discussion of the methods used in calculating the turns shall be provided. This discussion should include: all assumptions made; types of malfunctions considered; forces producing the turns; and equations used.

10.2.2.4 Propulsion Characteristics. For vehicle with propulsion systems include the characteristics for each stage of propulsion:

10.2.2.4.1 Description and designation of propulsion unit.

10.2.2.4.2 Total propellant weight.

10.2.2.4.3 Type of propellant and hazard class.

10. PREPARATION INSTRUCTIONS (CONT'D)

10.2.2.4.4 Thrust versus time from ignition.

10.2.2.4.5 Total burn time.

10.2.2.4.6 Total impulse.

10.2.2.4.7 Maximum possible impact range for the vehicle burning to fuel exhaustion.

10.2.2.5 Guidance Characteristics: Include a description of the guidance system and its operating characteristics:

10.2.2.5.1 System description giving type of guidance, modes of operation, and theory of operation.

10.2.2.5.2 Operational frequency or band.

10.2.2.5.3 Acquisition or search procedures.

10.2.2.5.4 Maximum detection range and the target size associated with that range.

10.2.2.5.5 Sequence of events.

10.2.2.5.6 Biases including when and how they are applied.

10.2.2.5.7 Passive homing or home-on-jam capabilities.

10.2.2.6 Launch or Release Parameters: For each flight or group of similar flights the following information is required:

10.2.2.6.1 The desired launch point preferably in geodetic latitude, longitude, altitude, and launch/flight azimuth.

10.2.2.6.2 Launch elevation angle or aircraft flight path angle at launch.

10.2.2.6.3 For air launches, the type of launch aircraft to be used.

10.2.2.6.4 Launch velocity in feet or meters per second or Mach number.

10.2.2.6.5 Launch altitude in feet or meters.

10.2.2.6.6 For air launches in other than level flight, a description of how the aircraft flight path angle and the launch azimuth will be determined for vehicle launch or release.

10.2.2.7 Effects of Flight Termination:

10.2.2.7.1 Estimates of the coefficient of drag (C_D) vs Mach number specifying reference area (A), weight (W), and volume (V) for pieces resulting from flight

10. PREPARATION INSTRUCTIONS (CONT'D)

termination action. That piece(s) which in the absence of winds travels a maximum distance, and that major piece(s), which in the absence of winds travels a minimum distance, shall be included. If drag coefficient curves for vehicle pieces cannot be satisfactorily estimated, the subsonic and supersonic W/C_DA for each major piece may be provided instead. In either form, three-sigma tolerance limits for the drag coefficients given for the maximum distance piece shall be included. For major pieces which can possibly stabilize during free flight, drag coefficient curves shall be provided for the stability angle of attack. If the stability angle of attack is other than zero degrees, a lift coefficient (C_L) vs Mach number curve shall also be provided for the stability angle. In addition, drag coefficient estimates are required for vehicle pieces of minimum W/C_DA, such as skin or fuel tank sections. All C_D and C_L vs Mach number curves shall be provided in graphical form. Include equations for these curves if available.

10.2.2.7.2 Estimates of incremental velocities imparted to the vehicle pieces (for which drag data are required in paragraph 10.2.2.7.1).

10.2.2.7.3 Vehicle system time delays in the destruct path. This data is needed to determine the total destruct delay that must be accounted for in the range safety destruct calculations.

10.2.2.8 Theoretical Trajectory and Dispersion Information:

10.2.2.8.1 Various theoretical trajectory and dispersion information is required for each vehicle flight or group of similar flights. This information can be presented in various ways and any or all may be required, depending upon the type of system or the specific test involved.

10.2.2.8.2 The first method of presentation involves simulated nominal and dispersed trajectory data and theoretical dispersions calculations.

10.2.2.8.3 Five separate and distinct trajectories must be defined as described below.

10.2.2.8.3.1 Nominal or expected trajectory. This is the trajectory that the vehicle would fly if all vehicle parameters were exactly as expected, all vehicle systems performed exactly as planned, and there were no external perturbing influences.

10.2.2.8.3.2 Three-sigma maximum altitude trajectory.

10.2.2.8.3.3 Three-sigma minimum altitude trajectory.

10.2.2.8.3.4 Three-sigma lateral trajectory.

10.2.2.8.3.5 Three-sigma high performance trajectory.

10. PREPARATION INSTRUCTIONS (CONT'D)

NOTE: The three-sigma trajectories define vehicle performance. In other words, approximately 99.7% of all normal vehicles will have trajectories which are dispersed no more than the three-sigma trajectory. Any deviation outside these limits indicates that the vehicle is behaving in an abnormal, though not necessarily dangerous, manner. However, the Range Destruct Officer may terminate such a vehicle's flight if it is approaching a land mass threatening to get outside or below the command/flight termination coverage area, or another condition exists which may, in the judgement of the Range Destruct Officer, cause a hazardous sitaution to be created.

10.2.2.8.4 The simulated trajectory data shall be provided in tabular form with the independent variable, time, appearing on every sheet. A definition of all symbols shall be provided. All data is required from lift-off to impact at a sampling rate of one second or at other rates as approved by the government.

10.2.2.8.4.1 The time 00 seconds must correspond to first motion for pad or ground launched vehicles and to the instant of release, first motion of the ejection mechanism or first motion of the missile on a rail launcher for air launched vehicles.

10.2.2.8.4.2 A right-handed launch point fixed coordinate system referenced to the local tangent plane at the launch point should be used. Positive downrange distance X should be along the launch azimuth, and positive altitude Z should be up or away from the earth. Crossrange distance Y should be positive to the left.

10.2.2.8.4.3 Present position coordinates X, Y, Z in feet or meters vs time of flight. These data shall be presented to the nearest foot or meter.

10.2.2.8.4.4 Present velocity components X, Y, Z in feet or meters per second vs time of flight. These data shall be presented to the nearest one-tenth of a foot or decimeter per second.

10.2.2.8.5 Dispersion Information:

10.2.2.8.5.1 Those vehicle parameters having a significant effect upon trajectory dispersion, such as thrust, specific impulse, weight, staging variations, guidance errors, and tolerances in biases, shall be combined by a statistical method to produce reasonable results, although evaluation by varying each parameter independently is acceptable. A brief discussion of the statistical method used shall be included. Wind effects shall also be included in this combination.

10.2.2.8.5.2 The expected impact dispersion data for each stage or jettisoned body is required.

10.2.2.8.6 An alternative method of presentation which for some weapons systems provides significant information on vehicle performance capabilities is the generation of impact areas for the various launch parameters. These areas shall be generated considering both normally operating and malfunctioning vehicles. The various malfunction modes shall be identified and a probability of occurrence

10. PREPARATION INSTRUCTIONS (CONT'D)

indicated. A complete discussion of the assumptions and the method of calculation used for generating these areas shall be provided. The launch parameters used for generating the hazard areas shall encompass all possible launch conditions of the weapons system.

10.2.2.8.7 A description of the trajectory deviations (or any other conditions) beyond which the requesting agency is no longer interested in the vehicle flight and, thus, would be willing to accept premature flight termination, even though the vehicle may not have reached a dangerous position or attitude.

10.2.2.9 Explosive Warhead Data: A description of the effects of explosive warhead detonation is required. This description shall include location and altitude of the point where vehicle detonates (dispersion of the vehicle and vehicle pieces) and warhead fragments disperse. Also required is the circuitry showing how the warhead is armed, exploded, and locked out. All system time delays are to be noted.

10.2.2.10 Test Related Information:

10.2.2.10.1 To preclude the issuance of overly restrictive safety limitations, general mission and test related information shall be discussed. This information shall include the purpose and objectives of the mission or of each flight, the number of launches planned, and the expected maximum variation in launch parameters to achieve mission objectives.

10.2.2.10.2 Description of the vehicle's flight path over the earth, including the launch aircraft's flight plan to the launch area, if applicable, preferably by providing a map showing launch point, maneuvers (as required), impact, or recovery locations. Times at regular intervals shall be indicated along the flight path.

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