APPENDIX A

The NASA Med-Lite Expendable Launch Vehicle

This Appendix presents data on the NASA Med-Lite Expendable Launch Vehicle (ELV), particularly those characteristics that either affect or constrain the payload. Proposed payloads must be compatible with the data contained in this Appendix.

1. LAUNCH VEHICLE DESCRIPTION

Med-Lite is currently in the procurement cycle. Since the actual launch vehicle(s) and Contractor have not been selected, the launch vehicle will be referred to as "Med-Lite" throughout this Appendix. The selected Contractor will use the Med-Lite ELV to provide launch services for the MIDEX missions to be selected and confirmed from proposals received in response to this AO. Med-Lite will be a multistage solid- or liquid-propellant vehicle, launched from a U.S. launch site.

The Med-Lite Contractor will use launch vehicles appropriate for the proposed payloads. Proposals responding to this AO are limited to missions that can be achieved within the capability of a vehicle from this mixed fleet. This constraint is appropriate for the fiscal, scientific, and technical scope of the MIDEX program. Moreover, limiting the required launch-vehicle performance also reduces the launch-vehicle cost to NASA.

2. PAYLOAD/VEHICLE INTEGRATION AND LAUNCH

Integration of the payload to the Med-Lite vehicle will be accomplished at the yet-to-be-determined U.S. launch site. The Med-Lite Contractor will manage the mission integration of the payload flight and ground systems with the launch vehicle and its associated ground support equipment (GSE).

3. PAYLOAD MASS

Separated payload mass capability for the Med-Lite service varies with orbit altitude, inclination, and fairing configuration. The Med-Lite RFP specifies performance requirements for a number of missions, as shown in Table A-1. A parametric set of orbit performance curves will be available when the Med-Lite vehicle has been selected. Those proposers who have a question about a specific payload to a specific orbit may use the questionnaire in Figure A-3 at the back of this Appendix to determine feasibility.

4. ORBIT INJECTION ACCURACY

Orbit injection accuracies vary with the mission orbit. For low Earth circular orbits (<1000 km), the 3s altitude errors are about ±10 km, and the 3 s inclination error is about ±0.04 degrees.

5. FAIRING ENVELOPE AND PAYLOAD ATTACH FITTINGS

The payload, consisting of the spacecraft and instrument(s), must fit within the static envelope of the Med-Lite vehicle. The vehicle selected for the Med-Lite service may offer several fairings. The performance requirements in Table A-1 are associated with the fairing sizes as defined in Figure A-1. Generally, the larger payload envelopes are required by higher mass payloads. For instance, a payload envelope configuration no larger than 3A, in Figure A-1, is specified for the 450 kg payload mass capability to a 500 km, 5 degree inclination orbit noted in Table A-1. For a given mission in Table A-1, the use of a larger fairing will reduce the mass capability and may be unacceptable for upper stage accommodation or vehicle stability reasons.

The standard mechanical interface specified in the Med-Lite RFP is a 985.77 mm (38.810 inch) bolt circle at the top of a payload attach/separation system provided by the vehicle. Since the mass of the payload attach fitting has already been factored into the capabilities of the launch vehicle, the total mass capabilities listed in Table A-1 are available for the payload.

6. ENVIRONMENTS

Environment specifications from the Med-Lite RFP are shown in Figure A-2.

7. ELECTRICAL INTERFACE

The electrical interface between the launch vehicle and the payload will provide a minimum of 42 pins. It will provide the capability for battery trickle charge and payload monitoring prior to launch, for passing a minimum of three discrete signals to the payload during flight, and for confirming separation.

8. SPIN

The Med-Lite vehicle will be capable of separating the payload in either a spinning or nonspinning mode. The Med-Lite RFP specifies that the vehicle shall provide a spin rate up to at least 15 rpm.

TABLE A-1 MED-LITE RFP PERFORMANCE REQUIREMENTS

Earth Orbit Missions	**Perigee Alt (km)**	**Apogee Alt (km)**	**Inclination (deg)**	**Payload Mass (kg)**	**Fairing Configuration (Figure A-1)**
1	800	800	25	1,360	1
2	600	600	75	450	4
3	870	870	98.9	1,397	1
4	500	500	5	450	3A
5	1,400	1,400	75	1,000	3
6	185	45,000	90	440	4
7	704	704	94	1,000	3
Earth Escape Missions	**Perigee Alt (km)**	**C_3 (km^2/sec^2)**	**Declination of Launch Asymptote (deg)**	**Payload Mass (kg)**	**Fairing Configuration (Figure A-1)**
8	185	11	Launch Date Dependent	450	2
9	185	20	<28.5	300	1A
10	185	0	<28.5	580	2

Notes:
1. Mission 6 has an argument of perigee requirement of 270∞.
2. Escape missions require specific values of C_3, right ascension and declination of the launch asymptote for each day of the 20-day launch window. Parking orbit coast times for these missions may be up to a complete orbit period.
3. Fairings must accommodate payload static envelope diameters as specified in Figure A-1.
4. Payload mass does not include vehicle-provided attach hardware.
5. Altitudes specified are relative to the equatorial radius of the Earth.

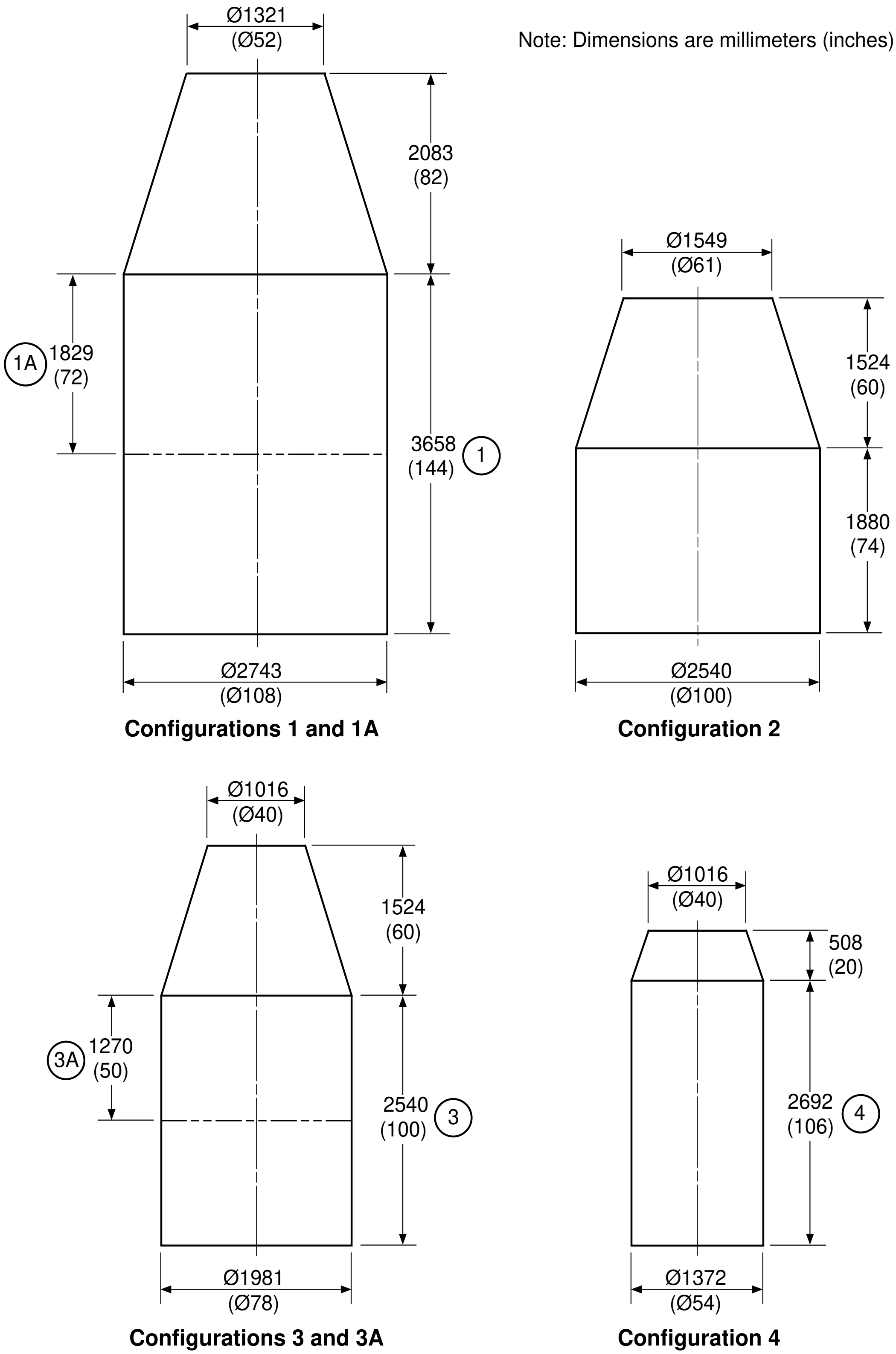
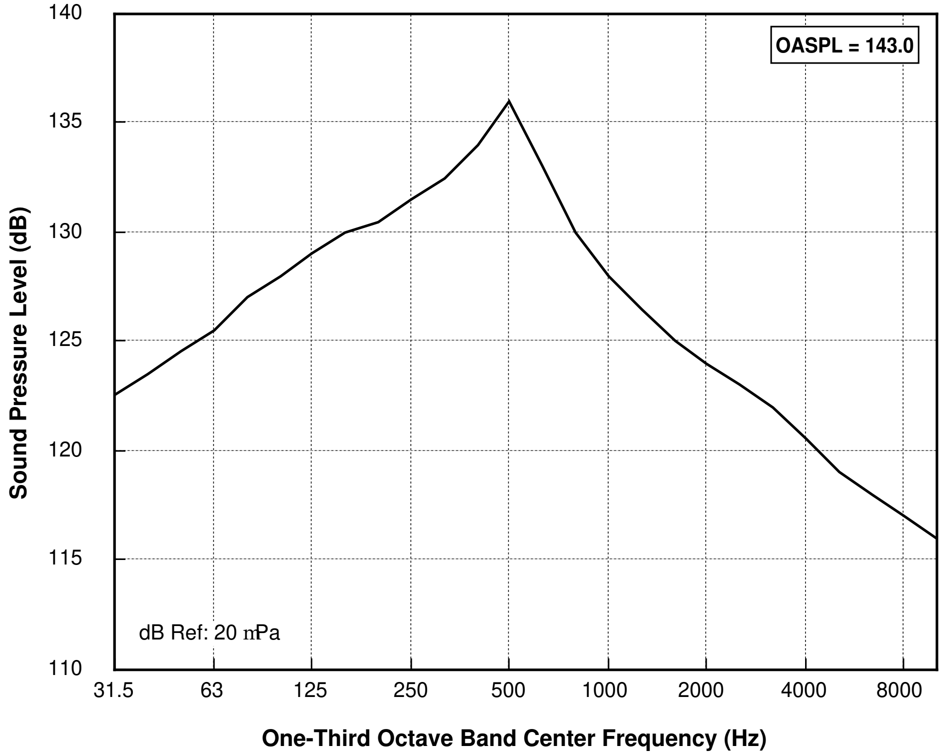
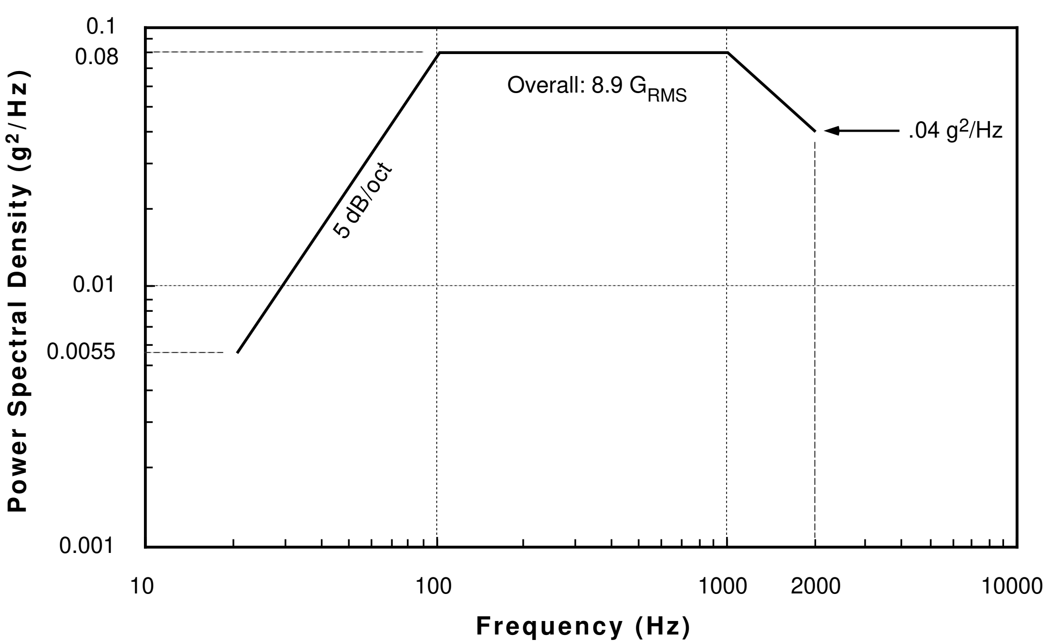


FIGURE A-1 FAIRING STATIC ENVELOPES SPECIFIED BY THE MED-LITE RFP



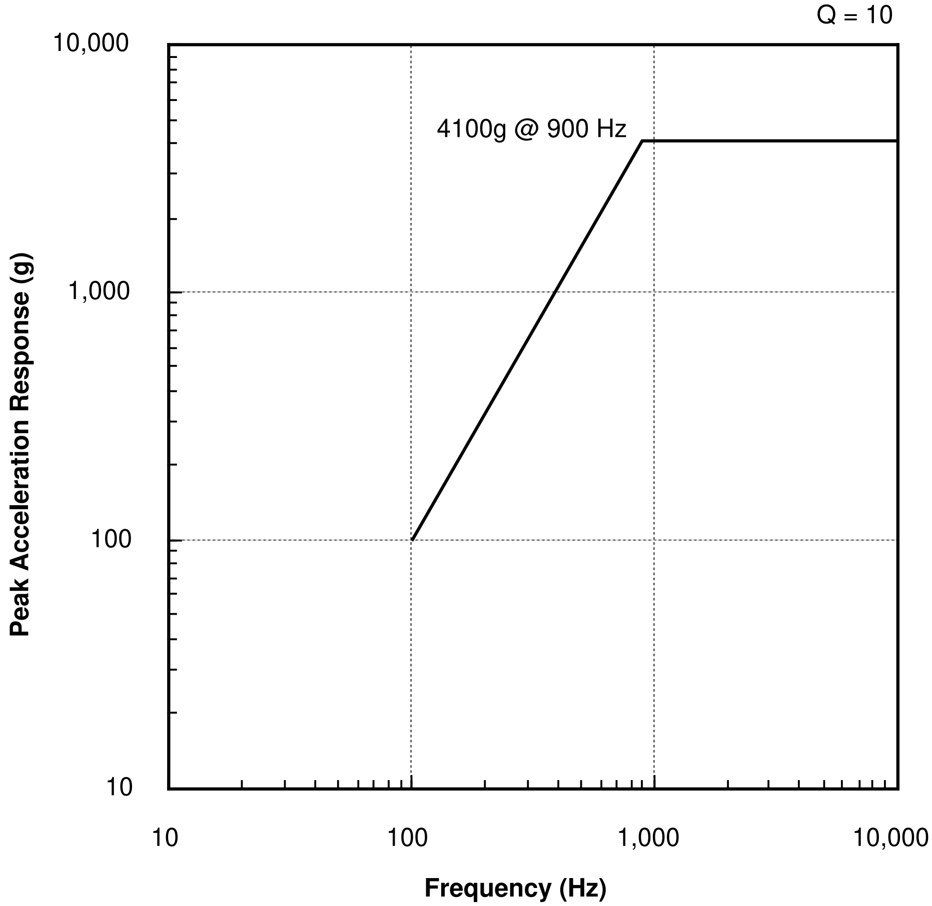
One-Third Octave Center Frequency (Hz)	Maximum Flight Levels (dB)
31.5	122.5
40	123.5
50	124.5
63	125.5
80	127.0
100	128.0
125	129.0
160	130.0
200	130.5
250	131.5
315	132.5
400	134.0
500	136.0
630	133.0
800	130.0
1000	128.0
1250	126.5
1600	125.0
2000	124.0
2500	123.0
3150	122.0
4000	120.5
5000	119.0
6300	118.0
8000	117.0
10000	116.0
OASPL	143.0

(a) Spacecraft Acoustic Environment - Maximum Flight Level



(b) Spacecraft Interface Random Vibration Environment

FIGURE A-2 MAXIMUM SPACECRAFT ENVIRONMENTS FOR THE MED-LITE VEHICLE



(c) Spacecraft Interface Shock Environment - Maximum Flight Levels

Axis	Acceleration (g's)
Max Axial	+11.0/–2.0
Max Lateral	± 3.5

Notes: Axial tension is designated with a negative sign.

Accelerations are simultaneous.

(d) Spacecraft Design CG Limit Load Factors

FIGURE A-2 (CONT.) MAXIMUM SPACECRAFT ENVIRONMENTS FOR THE MED-LITE VEHICLE

Request for clarification of a specific payload to orbit

Provide the following information to determine if the mission orbit is achievable.

Apogee (km)	______________
Perigee (km)	______________
Inclination (deg)	______________
C_3 (km^2/sec^2)	______________
Argument of Perigee (deg)	______________
Payload Mass (kg)	______________
Fairing Configuration	______________

Send the above information to the following:

Name: Mr. Bruce Milam

FAX: (301) 344-4925

E-Mail: Bruce_Milam@ccmail.gsfc.nasa.gov

FIGURE A-3 PAYLOAD QUESTIONNAIRE