



Statement of Work Fabrication of Arm Cavity Baffle (Machined Parts) for Advanced LIGO

The following documents are incorporated into and made a part this purchase order. Click on the following LIGO Document Control Center (DCC) links to access these documents or go on line to the LIGO Public DCC at <https://dcc.ligo.org/> to access the DCC#.

1.0 Terms:

<u>DCC #</u>	<u>Description</u>
C080185-v1	Laser Interferometer Gravitational Wave Observatory (LIGO) Commercial Items or Services Contract General Provisions California Institute of Technology "Institute", LIGO Rev 11/12/08
F0810001-v4	Technical Direction Memorandum.

2.0 Quality Control:

<u>DCC #</u>	<u>Description</u>
Q0900001-v4	Advanced LIGO Supplier Quality Requirements, dated 2/10/10, describes following contractor/supplier QA/QC actions for this procurement:
<input checked="" type="checkbox"/> 3.1 Pre-Award Inspection	<input checked="" type="checkbox"/> 3.9 Discrepant Material Storage
<input checked="" type="checkbox"/> 3.2 Supplier In Process Quality Control	<input checked="" type="checkbox"/> 3.10 Quality Records
<input checked="" type="checkbox"/> 3.3 In Process Inspection	<input checked="" type="checkbox"/> 3.11 Drawing and Specification Change Control
<input checked="" type="checkbox"/> 3.4 Pre-Ship Inspection	<input type="checkbox"/> 3.12 Welding Certification
<input checked="" type="checkbox"/> 3.5 Receiving Inspection	<input checked="" type="checkbox"/> 3.13 End Item Data Package (including Certifications of Compliance)
<input checked="" type="checkbox"/> 3.6 Discrepant Material	<input type="checkbox"/> 4.1 Design Verification
<input checked="" type="checkbox"/> 3.7 Material Review Action	<input checked="" type="checkbox"/> 4.2 Raw Material Procurement
<input checked="" type="checkbox"/> 3.8 Material Review Actions at Contractor	<input checked="" type="checkbox"/> 4.3 Traceability of Materials
	<input checked="" type="checkbox"/> 4.4 Calibration Program
	<input type="checkbox"/> 4.5 Critical Interface
	<input checked="" type="checkbox"/> 4.6 Cleanliness
	<input checked="" type="checkbox"/> 4.7 Packaging
	<input checked="" type="checkbox"/> 4.8 Storage
	<input checked="" type="checkbox"/> 4.9 Transport
	<input type="checkbox"/> 4.10 Customs

For the above list the Supplier shall: 1) Identify the corresponding sections/paragraphs in their existing QA/QC system 2) meet or exceed the design requirements contained in the attached engineering documents for each area called out.

LIGO prefers to utilize the vendors existing QA/QC programs to the fullest extent possible consistent with the LIGO QA and QC requirements. All bidders are requested to submit a written description/plan of their existing QA/QC system with their quotes. The bidder must also submit QA/QC plans for managing subcontractor work and materials.

In the event that a prospective contractor lacks an existing quality system, the contractor/vendor shall develop and implement a quality assurance program in compliance with requirements negotiated at contract/PO award.

3.0 End Item Data Package:

At the time of delivery of the parts, the Supplier shall also provide the following data, as a minimum:

- Any as-built modifications (with approval of the LIGO Contracting Officer) as mark-ups to the drawings
- Material certifications
- Dimensional & QC inspection reports—this shall include a report showing that parts have been inspected and fall within specified tolerances.
- Certificate or statement of compliance with all contract and drawing process restrictions.

4.0 Included Documents:

Arm Cavity Baffles: Metal Mechanical Parts and Quantities, see Section 9.0. In addition to the drawings, the contractor will be provided with CAD solid models of the parts (SolidWorks Professional 2009, SP5.0) CAD files will be supplied in the format preference of vendor.

<u>DCC #</u>	<u>Description</u>
E0900364-v7	LIGO Metal in Vacuum Specification
E0900023-v10	Process for Manufacturing Cantilever Spring Blades for AdvLIGO
Q1100003-v1	Acceptable Quality Level (AQL) for Inspection of LIGO Components

5.0 Scope:

- 5.1 This SOW is for the fabrication of various individual piece parts of sheet metal and machined parts per the thirty-seven (37) unique drawings listed in **Table 1: Parts List, Delivery Quantities and Schedule**.
- 5.2 Acceptance Test: A First Article Assembly will be fabricated, assembled and approved at the vendor site for fit check prior to fabrication of complete order. Assembly instructions and fasteners will be supplied by LIGO.
- 5.3 Inspect using AQL Level 1.0.
- 5.4 Some piece parts will require electro-polish processing, as specified in drawing. These parts must be handled with clean gloves after electro-polish process. See parts denoted by “*” in **Table 1: Parts List, Delivery Quantities and Schedule**.
- 5.5 For part number D1002608 - SLC ACB Suspension Blade, heat treatment and nickel plate process will be the responsibility of LIGO.
- 5.6 ALIGO will supply material required to fabricate piece parts made of 18 GA Enamel Steel A424 Type I and Maraging Steel C250.

Return unused materials to: LIGO Laboratory
California Institute of Technology
Attn: Michael Smith
MS 100-36
391 S. Holliston Ave.
Pasadena, CA 91125

- 5.7 Upon acceptance, all piece parts fabricated from 18 GA Enamel Steel A424 Type I will be satisfactorily packaged and shipped to vendor specified by ALIGO for porcelain coating, as specified in Section 9.0. Part numbers D1000973 and D1002357-0X must be packaged in a manner which maintains the 'accordion' configuration. Shipping containers will be constructed for multiple use.
- 5.8 All other piece parts will be shipped as specified in Section 9.0. Shipping containers will be constructed for multiple use.

6.0 Quantity Requirements

See Table 1 for required quantities.

7.0 Delivery Requirements

The deliveries are FOB at these destinations, i.e. the contractor has responsibility for shipping title and control of goods until they are delivered and the transportation has been completed. The contractor selects the carrier and is responsible for the risk of transportation and for filing claims for loss or damage.

7.1 Packaging

All packaged items shall have appropriate labels attached to properly identify the following:

- Destination Site
- LIGO Assembly – ARM CAVITY BAFFLE
- LIGO Contact person and information
- Part ID, serial number or other identifying data
- Shipping manifest with long text description of enclosed items

7.2 Shipping Containers

The contractor is responsible for providing shipping containers and transportation which protects these parts from damage from the transportation environment (weather, handling, accidents, etc.). Mating edges of parts should be especially protected from damage during shipping.

7.3 Shipping Locations:

7.3.1 LIGO Livingston Observatory (LLO)

Attn: Chris Guido
19100 LIGO Lane
Livingston, LA 70754

7.3.2 LIGO Hanford Observatory (LHO)

Attn: Gerardo Moreno
127124 North Route 10
Richland, WA 99354

7.3.3 LIGO Specified Vendor – to be provided at acceptance of bid.

8.0 Manufacturing Requirements

8.1 Precedence

The Statement of Work (SOW) sections below regarding processing or fabrication of the parts are meant to convey the scope and nature of the requested work. The parts are to be produced using the CAD models which will be provided to the contractor upon award.

8.2 Additional Restrictions

- Machine all surfaces to remove oxides and mill finish, unless otherwise stated. Abrasive removal techniques are not acceptable. No sanding of any type. No use of Scotch-Brite (tm) or similar abrasive products.
- All machining fluids must be fully synthetic, water soluble (not simply water miscible) and free of sulfur, chlorine, and silicone.
- Thoroughly clean part to remove all oil, grease, dirt, and chips with soap and water. Follow with solvent (acetone) wipe. Pay close attention to tapped holes.
- No repairs shall be made unless approved in advance, and in writing, by LIGO Laboratory.

8.3 Materials

Material is specified on the drawings. Use domestic materials only. All materials specified by drawings or SOW have been approved for use in the UHV environment in LIGO. No materials may be substituted or added without prior knowledge and testing by LIGO. Cast tooling plate is not permitted.

8.4 Machining

All parts are to be machined. No grinding or lapping with abrasive wheels, cloth or stones is permitted. No sanding of any type. No use of Scotch-Brite (tm) or similar abrasive products. No parts shall be cast or molded. Water soluble (not just water miscible) cutting fluid (lubrication) is to be used for all machining operations. The use of cutting fluids or lubricants, which contain sulfur, chlorine or silicone compounds is prohibited.

8.5 Finishing

Any required surface finish is defined in the drawings. Localized scratches, digs and blemishes should be minimized.

8.6 Marking

Parts shall be marked per drawing notes.

9.0 Delivery Schedule

Refer to Table 1 for delivery schedule. Early and/or partial deliveries are welcome. If this schedule cannot be accommodated, please provide an alternative delivery schedule for consideration with your bid package.

Table 1: Parts List, Delivery Quantities and Schedule

ITEM NO.	DRWG NUMBER	REV	DESCRIPTION	Total Order QTY	DELIVERY LOCATIONS -				
					LIGO Specified Vendor		LIGO Hanford, WA		LIGO Livingston, LA
					First Article 4/26/11	6/17/11	First Article 4/26/11	6/17/11	6/17/11
1	D1000684	V1	SLC TUBE LOWER MTG PLATE	11			1	6	4
2	D1000909	V1	SLC COPPER PLATE	11			1	6	4
3	D1000929	V1	SLC COPPER SUPPORT PLATE	11			1	6	4
4	D1000930	V1	SLC MAGNET HOLDER STEEL PLATE	11			1	6	4
5	D1000973	V1	ARM CAVITY BAFFLE SKIN	5	1	4			
6	D1000974	V1	ARM CAVITY BAFFLE TOP SKIN	11	1	10			
7	D1000975	V1	ARM CAVITY BAFFLE BTM SKIN	11	1	10			
8	D1000976	V1	ARM CAVITY BAFFLE CTR SKIN	11	1	10			
9	D1001009	V1	ARM CAVITY BAFFLE LO TUBE *	11			1	6	4
10	D1001026	V1	ARM CAVITY BAFFLE UP LEAF	11	1	10			
11	D1001027	V1	ARM CAVITY BAFFLE LOWER LEAF	11	1	10			
12	D1001120	V1	SLC EARTHQUAKE STOP RING	22			2	12	8
13	D1001138	V1	SLC ACB INTERFACE MTG PLATE	11			1	6	4
14	D1001186	V1	SCREW #3/4-10 X 4	15			2	8	5
15	D1001363	V1	ACB SIDE REINFORCING HATSECTION	22	2	20			
16	D1001365	V1	ARM BAFFLE MIDDLE REINFORCING PLATE	22	2	20			
17	D1001621	V1	ARM CAVITY BAFFLE UPPER MOUNTING HINGE	11			1	6	4
18	D1001622	V1	ARM CAVITY BAFFLE LOWER MTG HINGE	11			1	6	4
19	D1001700	V1	SLC INTERFACE MOUNTING CLAMP	66			6	36	24
20	D1001826	V1	SLC ACB BALANCING WEIGHT	44			4	24	16
21	D1002340	V1	SLC ACB SUSPENSION ROD	15			2	8	5
22	D1002357-01	V1	ARM CAVITY BAFFLE 1 HOLE SKIN - RIGHT QPD	2		2			
23	D1002357-02	V1	ARM CAVITY BAFFLE 1 HOLE SKIN - LEFT QPD	2		2			
24	D1002357-03	V1	ARM CAVITY BAFFLE 1 HOLE SKIN - RIGHT NO QPD	1		1			
25	D1002357-04	V1	ARM CAVITY BAFFLE 1 HOLE SKIN - LEFT NO QPD	1		1			
26	D1002560	V1	SLC DAMPING TUBE TOP PLATE	11			1	6	4
27	D1002561	V1	SLC DAMPING 8 DIA TUBE *	11			1	6	4

ITEM NO.	DRWG NUMBER	REV	DESCRIPTION	Total Order QTY	DELIVERY LOCATIONS -				
					LIGO Specified Vendor		LIGO Hanford, WA		LIGO Livingston, LA
					First Article 4/26/11	6/17/11	First Article 4/26/11	6/17/11	6/17/11
28	D1002581	V1	SLC SUSPENSION ROD SUPPORT	11			1	6	4
29	D1002608	V1	SLC ACB SUSPENSION BLADE *	15	1	14			
30	D1002609	V1	SLC BLADE MOUNTING BRACKET	11			1	6	4
31	D1002610	V1	SLC TUBE UP CONNECTOR PLATE	11			1	6	4
32	D1002612	V1	SLC UPPER TUBE *	11			1	6	4
33	D1002617	V1	SLC DAMPING TUBE LOWER PLATE	11			1	6	4
34	D1002618	V1	SLC TUBE LOWER CONNECTOR PLATE	11			1	6	4
35	D1002844	V1	SLC ACB BLADE CLAMP	11			1	6	4
36	D1003025	V1	QPD HOUSING	53	8	45			
37	D1100243	V1	SLC ACB 3 DEGREE SHIM	11			1	6	4