Useful data for Noise Prototype Quad assembly

1. DESIGN MASS FOR ALL MASSES

Top mass:	22kg
UI mass:	22kg
Penultimate mass:	40kg
Test mass:	40kg

Once the mass of all the glass masses is known these numbers will be revised and the mass of the pen-re mass will be set as flows:

(TTM+PTM)-TRM=PRM

TTM = test mass
PTM = Penultimate test mass
TRM = Test reaction mass
PRM = Penultimate reaction mass

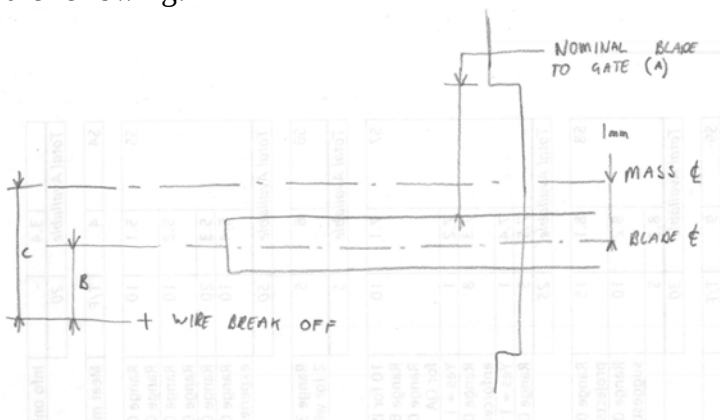
2. BLADE TIP POSITIONS

The blade tips in the TM and UIM should be central in the blade tip stop (5mm from either side).

The Height of the blade tips is more complex. It is belived that the correct blade top to blade gate mark dimensions (Final A) are as follows:

Top mass	6.6mm
UI mass	12mm

If these dimensions turn out to be incorrect then the correct values should be able to be derived from the following:



	A	B	C	Target C dimension *
Top Mass	5.0	1.28	2.28	3.9
UI Mass	4.6	-3.50 (no prism)	-2.5	4.12

*dimensions of target C come from T060042-01

So the target blade top to gate dimension (Final A) are derived as follows; Target C – C + A= Final A

3. MASSES REQUIRED TO DEFLECT BLADES

When the blades are loaded with a vertical mass to set the blade tip positions during mass assembly the mass needs to be adjusted to allow for the loading wire being vertical and the final wire angled.

	Angle form vertical (+ is toward blade root) theta	Mass that will ultimately be upon blade (M)	Vertical load required to deflect blade as masses will*
Top Wire	21.07°	62 kg 136.69lb	66.44kg
Mid Wire	26.99°	51 kg 112.43lb	57.23 kg
Btm Wire	6.09°	40kg 88.18lb	40.22kg

* = M/cos (theta)

4. WIRE TENSIONS

Frequency of a wire is defined by:

$$f = \frac{\sqrt{\frac{t}{m}}}{2l}$$

m = mass applying tension to wire

g = acceleration due to gravity

m_l = mass per unit length of wire

l = length of wire

f = natural frequency

The wires we have in the quad can have there natural frequency defined from this

	Top Wire	Mid Wire	Btm Wire	Final Wire	Units
Diameter	1.1	0.71	0.635	0.457	mm
Density	7900	7900	7900	7900	kg/m^3
mass per unit length	7.51E-03	3.13E-03	2.50E-03	1.30E-03	kg/m
Angle to vertical	22	27	8	0	degrees
Length	0.455	0.311	0.348	0.604	metres
Load in kg	66.9	28.6	20.2	10.0	kg
gravity	9.81	9.81	9.81	9.81	m/s^2
frequency	332	482	404	228	Hz

Even if the lengths deviate slightly from these frequencies should be used as a baseline with a ±2hz tolerance.

5. FLEXURE DISTANCES

Effective flexure lengths vary depending upon the connection method between the wire clamp and what it is attached to. In the quad the flexure lengths have been demonstrated to be as follows:

	fl with static clamp	Fl on blade
Top Wire	5.1	n/a
Mid Wire	3.2	3.9
Btm Wire	2.9	4.12
Final Wire	2.0	n/a

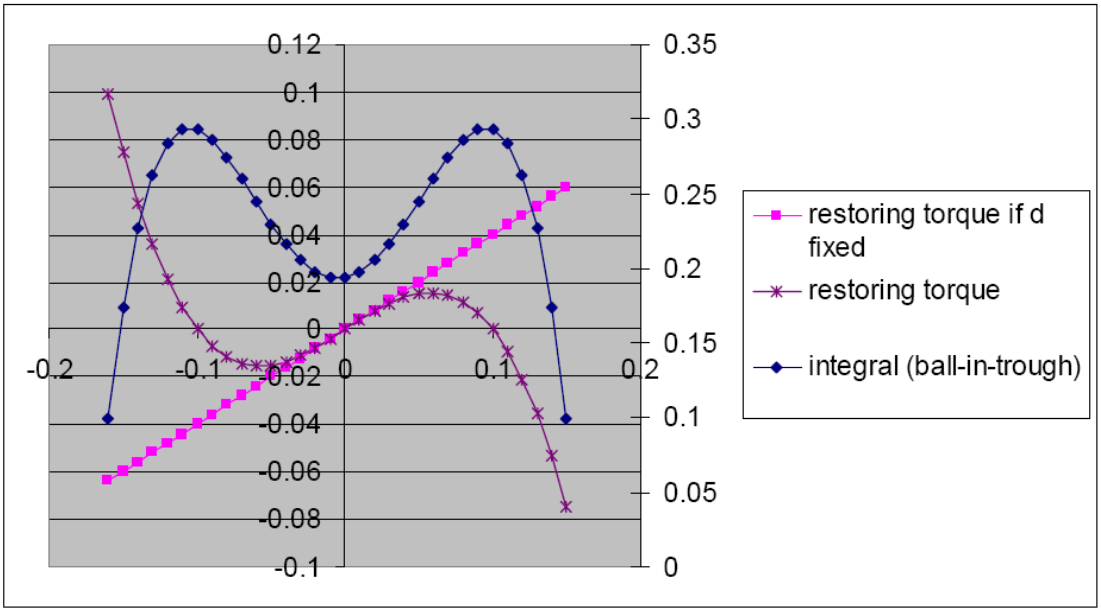
6. LENGTH OF WIRES

The wire lengths are as follows:

	Nominal Length (no d's)	Real length excluding flexure
Top	445	455.2
Mid	308.5	315.6
Btm	341	348.02
final	600	604

7. SUSPENSION STABILITY

Reference T070073



This is illustrative of mass stability, it can be seen that at approximately 10 degrees the mass will topple. This was shown to be true

8. APPENDIX A, CONDENSED ESSENTIAL DATA

Target mass weights (nominal including wire clamps)

Top mass:	22kg
UI mass:	22kg
Penultimate mass:	40kg
Test mass:	40kg

Target blade wire clamp underside positions

Top Stage	41mm	from stiff back
	104mm	from optics table
Top mass	6.6mm	from gate notch
UI mass	12mm	from gate notch

Vertical load requited to deflect blade to correct position (load resolved to wire angle)

Top Wire	66.44kg
Mid Wire	57.23 kg
Btm Wire	40.22kg

Pitches, lengths and diameters of wires in wire jig

	Diameter	Target Length*	Natural Frequency	Jig length (inc 2x 10mm slip)	Slip gauge sum (mm)
Top Wire	1.1mm	455.2	332	445	20 (0.787”)
Mid Wire	0.71mm	311	482	310.5	20 (0.787”)
Btm Wire	0.635mm	348.02	404	347.4	20 (0.787”)
Final Wire	0.35mm	604	228	602	22 (0.866”)

* Copied from dirty quad at RAL

Ian’s contact details:
Lab phone numbers: CAD 1235 44 6972
Office 1235 44 5864
Personal: Home 1635 578237
Mobile 07917 173137
Feel free