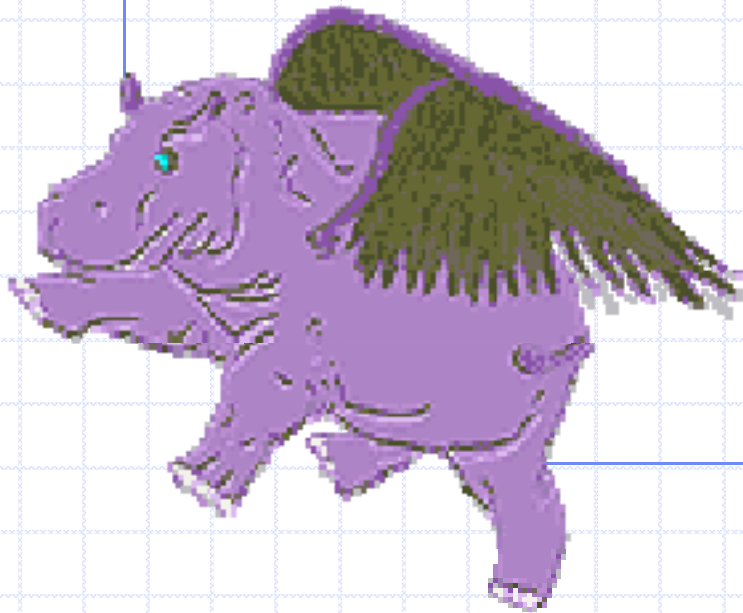


FLYING HIPPO:

Preliminary Design Review



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Objectives

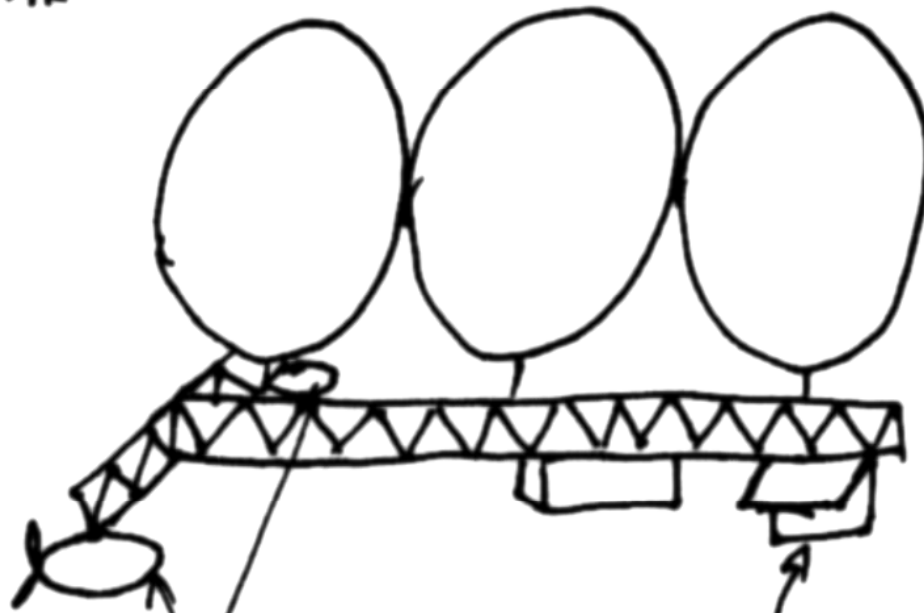
- ◆ To engineer a lighter-than-air vehicle, incorporating
 - Stability and Control
 - Maximum mass/time ratio
 - Durability
 - Elegance of design
- ◆ Design approach: simplicity

Preliminary Proposed Designs

DESIGN A

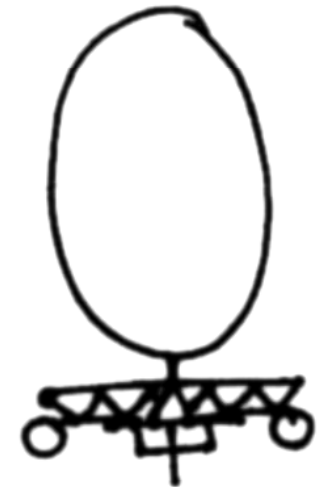
REAR

FRONT



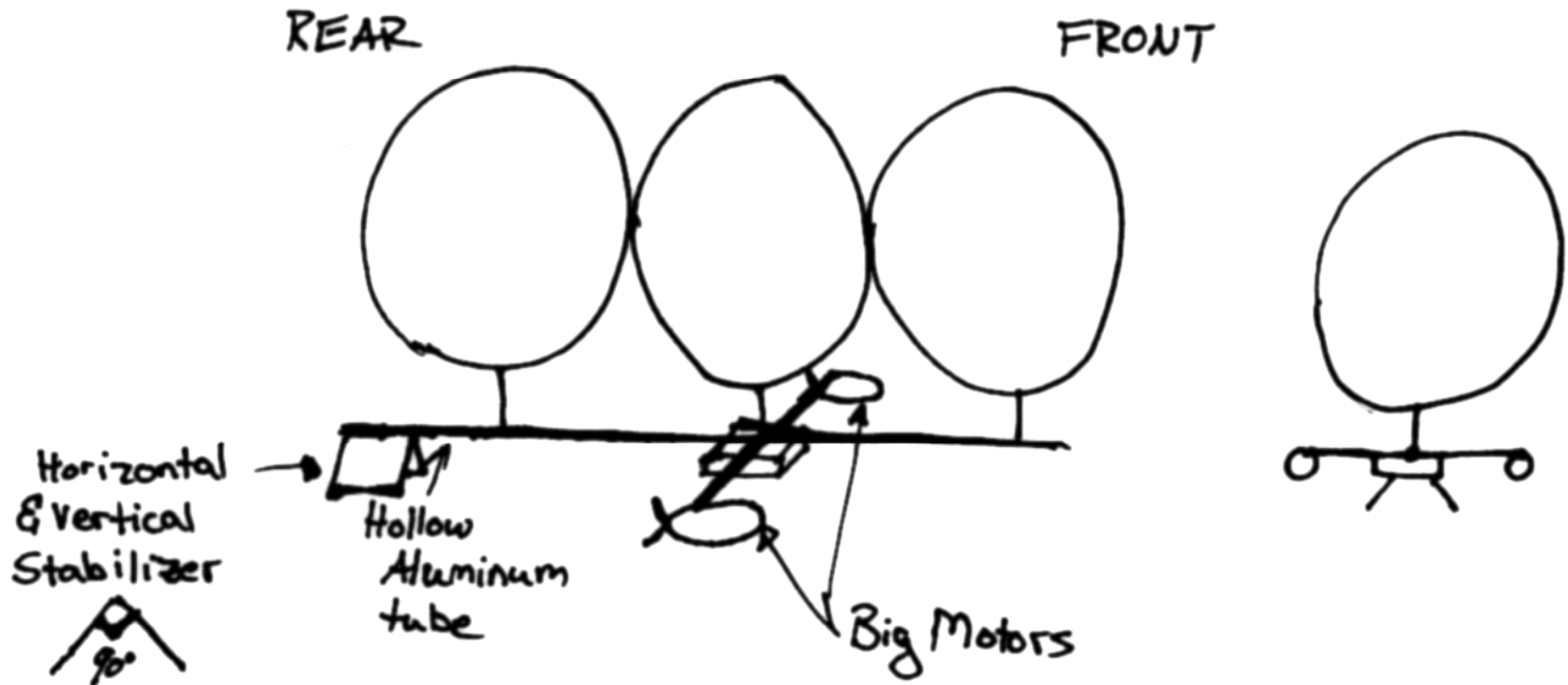
Big motors

Horizontal &
Vertical
Stabilizers



Preliminary Proposed Designs

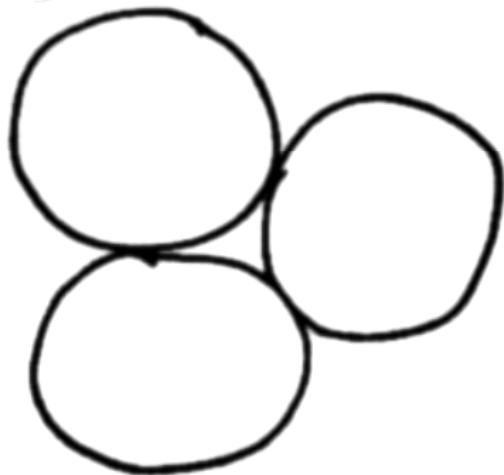
DESIGN B



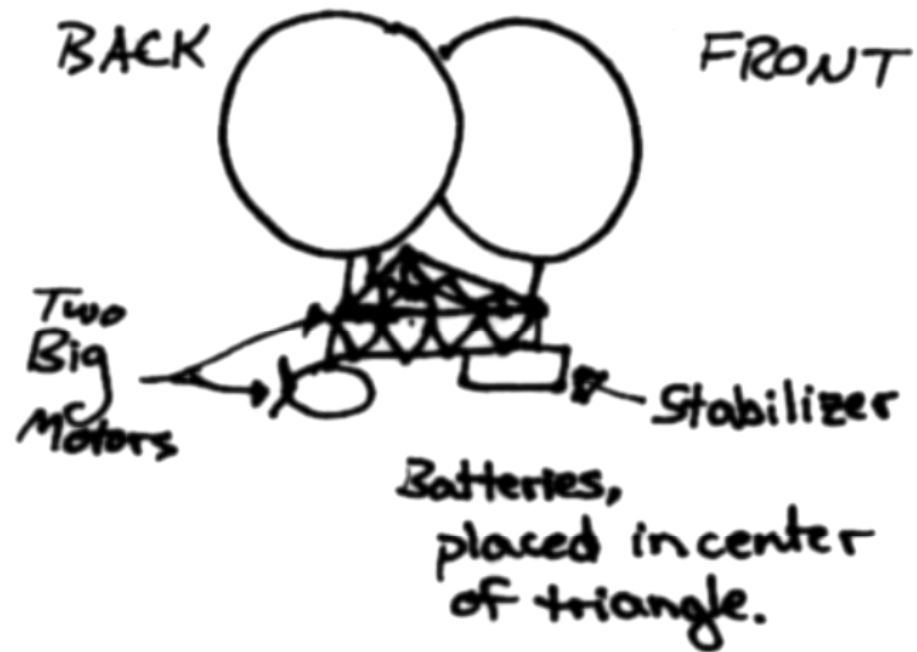
Preliminary Proposed Designs

DESIGN C

TOP VIEW



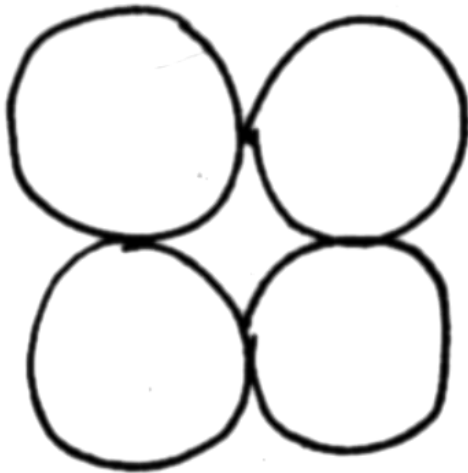
SIDE VIEW



Preliminary Proposed Designs

DESIGN D

TOP VIEW



SIDE VIEW



Product Design Matrix

Requirement	Importance	A	B	C	D
		Linear, Rear Propulsion	Linear, Center Propulsion	Triangle	Square
speed	8	0	0	0	-
weight	10	0	0	-	-
stability	7	0	0	+	+
control	7	0	+	+	0
endurance	4	0	0	-	-
strength	6	0	+	+	+
simplicity	6	0	0	0	0
aesthetic	2	0	+	+	-
total		0	15	8	-11

Justification of Selected Design

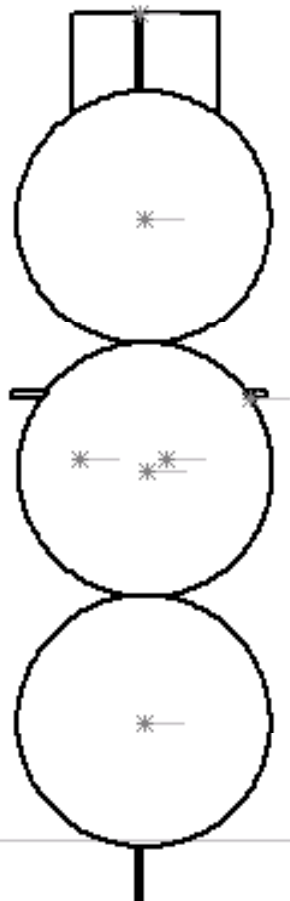
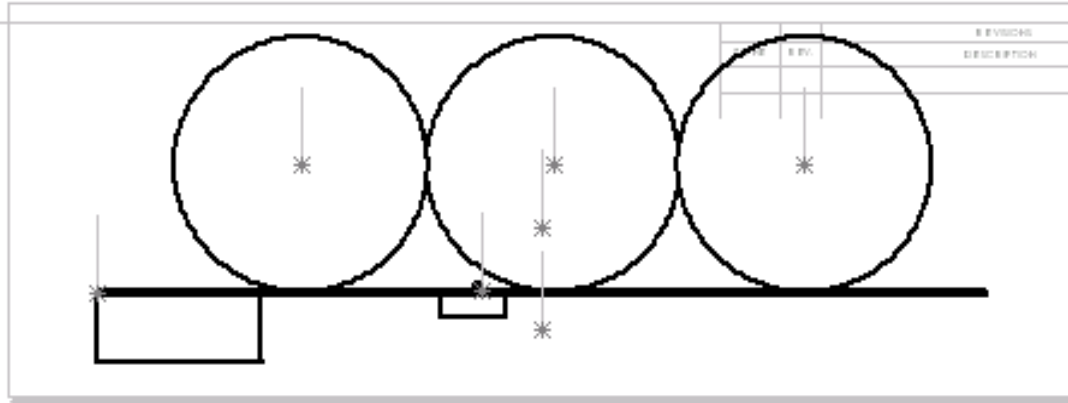
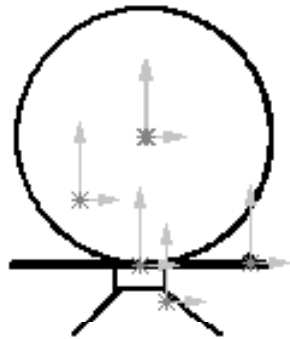
- ◆ Selected Design B

- ◆ Most durable

- ◆ Most controllable

- ◆ Least weight

- ◆ Legacy of success



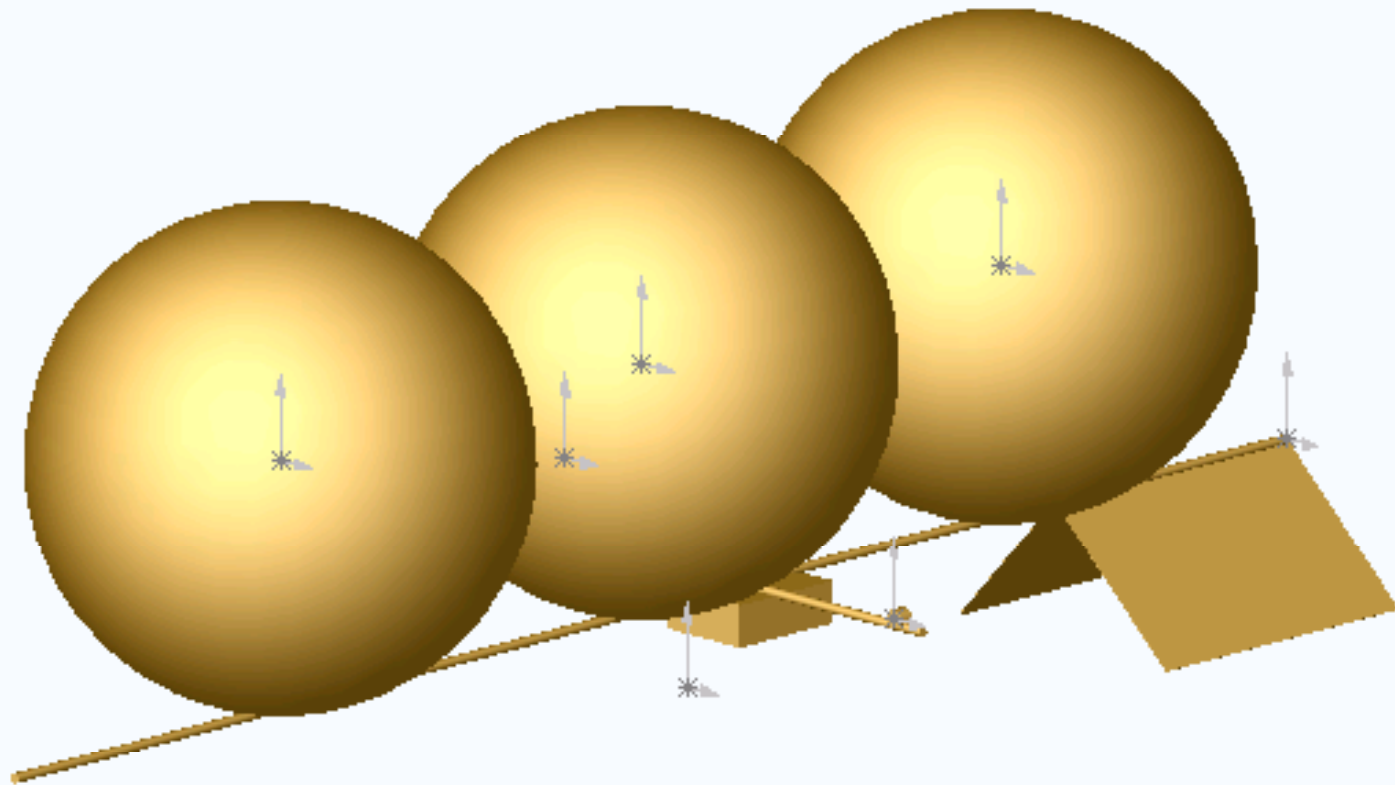
Schematic of Selected Design

PROPRIETARY AND CONFIDENTIAL
 THE INFORMATION CONTAINED IN THIS
 DRAWING IS THE SOLE PROPERTY OF
 <INSERT COMPANY NAME HERE>. ANY
 REPRODUCTION IN PART OR AS A WHOLE
 WITHOUT THE WRITTEN PERMISSION OF
 <INSERT COMPANY NAME HERE> IS
 PROHIBITED.

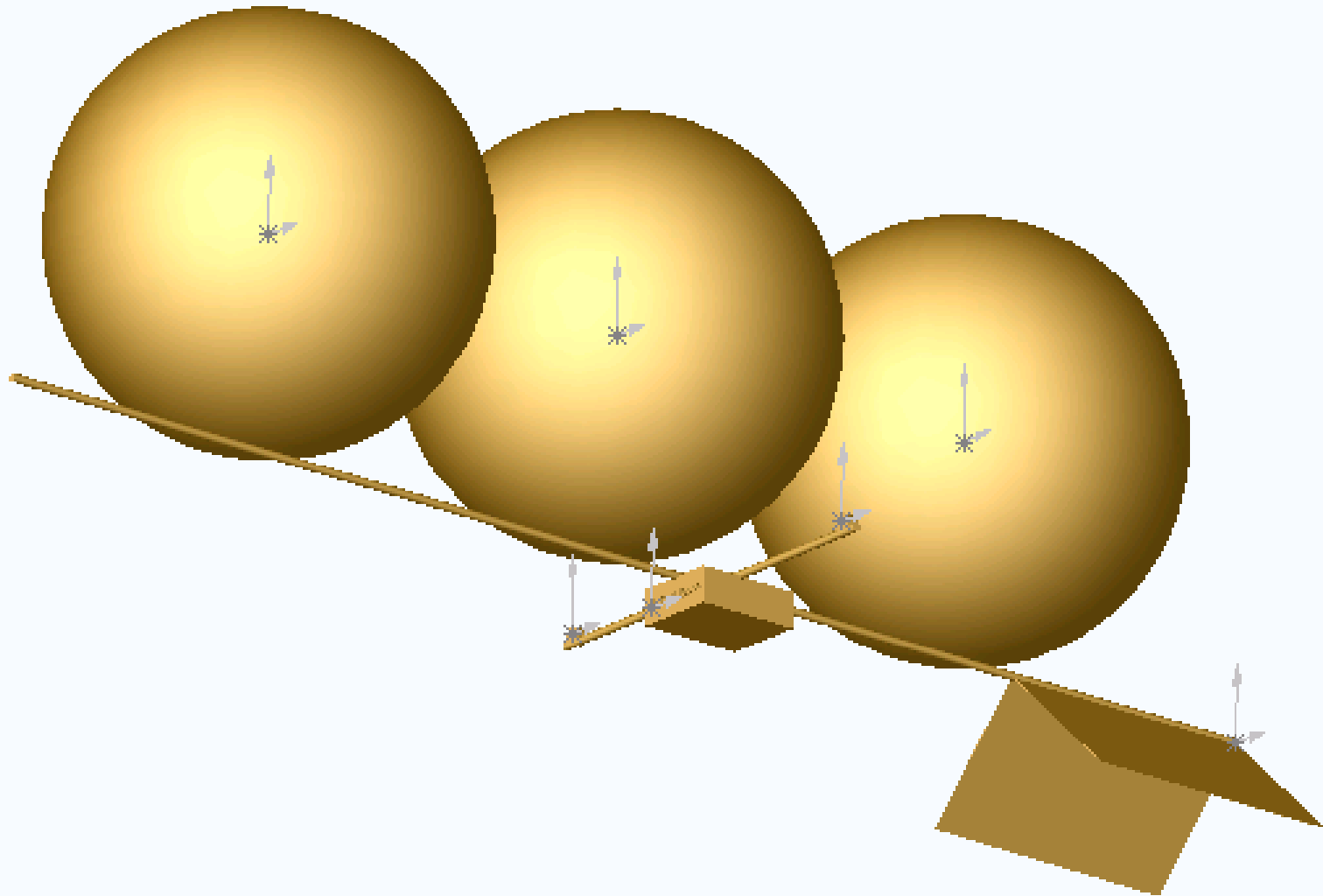
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL $\frac{1}{16}$ ANGULAR $\pm 0.030^\circ$ BEND $\pm 0.030^\circ$ TWO PLACE DECIMAL ± 0.005 THREE PLACE DECIMAL ± 0.0005	NAME DATE	<COMPANY NAME>
		DE SIGN CHECKED ENG APPR. MFG APPR. D.S.A. CUSTOMER		
NEXT ASSY	USED ON	FINISH		DTM: <DRAWING NO.> A SCALE: <SCALE> WEIGHT: <WEIGHT> SHEET 1 OF 1
APPLICATION	DO NOT SCALE DRAWING			

REV.	DESCRIPTION	DATE	APPROVED

Solid Model of Selected Design



Solid Model of Selected Design



Technical Analysis – Lift

◆ Three Balloons = 1.6 m³ of helium
(fixed)

◆ Maximum Mass

$$\begin{aligned} &= \text{Lift/g} = (\rho_{\text{air}} - \rho_{\text{helium}}) * V \\ &= \mathbf{1600 \text{ g}} \end{aligned}$$

Technical Analysis – Steady State

◆ Thrust from two large engines =
 $2 * 1.80 \text{ N} = \mathbf{3.60 \text{ N}}$
[Assuming batteries run for 5 sec.]

◆ $T = D = 0.5 * \rho_{\text{air}} * v^2 * S * C_D$
Let $C_D = 0.9$,
Then $v = [2 * T / (\rho_{\text{air}} * S * C_D)]^{1/2}$
 $= \mathbf{2.9 \text{ m/s}}$

Technical Analysis – Vehicle Mass

◆ Batteries (8 cell)	160 g
◆ Engines (two)	420 g
◆ Propellers (two)	10. g
◆ Balloons (three)	210 g
◆ Electronics (total)	290 g
◆ Structures (estimate)	320 g
<hr/>	
◆ Total Estimate	1410 g
◆ Payload Estimate	<190 g

Requested Additional Materials

Aluminum rod (for main cross structure):

- ◆ 3/8 in. diameter, hollow, 1 mm thickness

- ◆ Lighter

 - Estimated weight of balsa wood structure: **490 g**

 - Estimated weight of aluminum rod: **320 g**

- ◆ Strength

 - Balsa wood yield strength: **20 MPa**

 - Aluminum yield strength: **410 MPa**

- ◆ Durability

- ◆ Price: **\$2.11**

