Roadable Aircraft Project Hand-over Document

1. Introduction

The purpose of this document is to explain the decisions that have been made on the project over the last month whilst we have been working on the project. Hopefully it will be read prior to the Teleconference on Thursday 20th January. The report has been split up into two sections. The first explains the main decisions that have been taken and the state of the vehicle at present while the second summarises the work so far done in the various sub-groups.

2. Main Decisions taken

The main decision that we have had to take as a group is on the position and the number of ducted fans. As a group we decided that the two ducted fans positioned high on the sides of the vehicle posed a number of problems from an aerodynamic perspective and also a mechanical one. The current structure is already complex and heavy due to the wing storage and the necessary strengthening for the aircraft requirements and the automobile requirements. To include a structure out to the pods that includes a rapidly rotating shaft to power the fans would seriously over complicate the structure let alone the transmission from the engine to the pods. This would subsequently increase the cost of manufacture and also the maintenance costs over the life-cycle of the aircraft.

From an aerodynamic perspective the position of the fans would have caused a large nose down pitching moment due to the C of G position relative to the thrust line, which would have to be countered with the elevator that is not all that large and hence climbing could be difficult under full power. Likewise when the power is removed the nose will rise which could cause problems with stalling at low speed.

Our simpler suggestion is to use a single ducted fan at the rear of the vehicle. The transmission is far simpler and the thrust line is virtually on the longitudinal C of G which simplifies the control situation under sudden power changes and the structural considerations. This design will also make the vehicle more efficient as a car when it is driving on the road.

3. Progress in Subgroups

Below is a brief summary of the work that each of the sub groups has been looking into and any decisions that they are contemplating

3.1 Propulsion + Transmission

- Type of engine and transmission from engine to wheels and prop
- Gearboxes and additional systems

3.2 Stability and Control

- Stability Derivatives

3.3 Performance

- To be calculated later in the project

3.4 Human Factors

- Definition of a 3D crew space.
- Cockpit Display Technology, Glass Cockpit vs dials, Glass selected
- Seat Designs
- Excel cockpit model (see figures)
- Research into the applicability of JACK(rapid prototyping tool for vehicle interiors using computer models of various sized humans) for the cockpit design

3.5 CAD/Layout

- Latest GA drawing is attached to the back of this report
- Roughly 1:20 scale model of the vehicle (Pictures to follow ASAP)

3.6 Structures

- Currently trying to define a structure that includes an automatic wing-retracting device based on a screw mechanism. Wings are stored in the fuselage on top of one another
- Have researched a paper on telescoping wings and there effectiveness

3.7 Aerodynamics

- Prepared the constraint diagram and defined a minimum wing area
- Offset wing set-up to allow easy wing storage

3.8 Car

- Looked at initial stability whilst in road use
- Controls and displays necessary
- Research from car companies and lecturers regarding stability and structures
- Steering and Suspension

3.9 Manufacturing

- To be specified after the structure has been finalised
- Arranging a visit to Slingsby aviation to see aircraft manufacturing procedures

3.10 Cost

- Not yet considered seriously

3.11 Systems

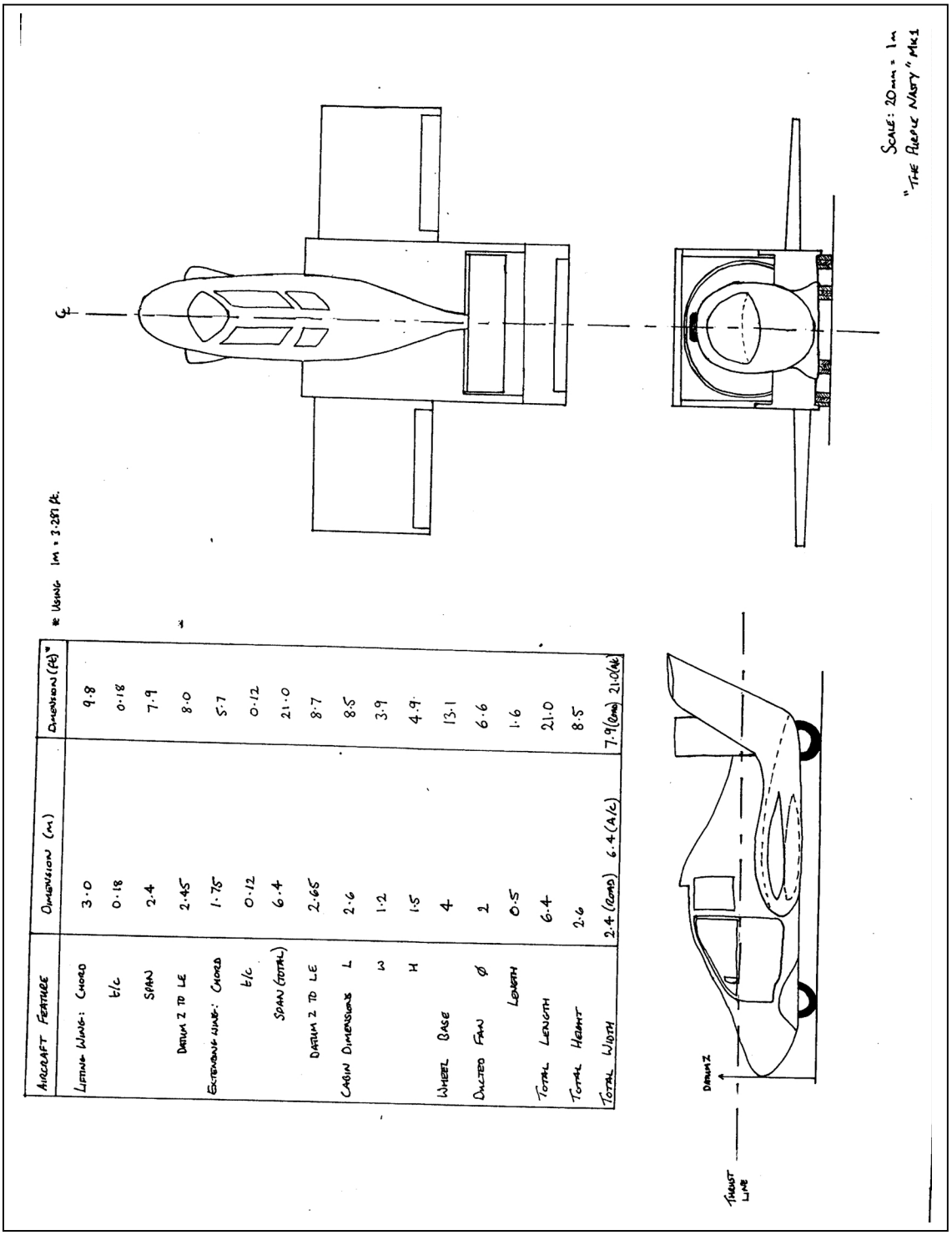
- Are researching the methods of supplying and generating AC and DC power for the vehicle (Using information from BAe and car manufacturers.
- Necessary Hydraulic and Cooling systems required
- Researched telescopic wing storage systems (SAE Paper No. 975602)

3.12 Weights

- Not known

Most of this work has been more thought about rather than seriously incorporated into the design although it is hoped that after the exams it will be possible to quickly progress with the details of the design.

Figure 1 GA Drawing



Aircraft Feature	Dimension (m)		Dimensions (ft)*
Lifting Wing: Chord	3.0		9.8
t/c	0.18		0.18
Span	2.4		7.9
Datum Z to LE	2.45		8.0
Elevonic Wing: Chord	1.75		5.7
t/c	0.12		0.12
Span (total)	6.4		21.0
Datum Z to LE	2.65		8.7
Cabin Dimensions L	2.6		8.5
W	1.2		3.9
H	1.5		4.9
Wheel Base	4		13.1
Ducted Fan Ø	2		6.6
Length	0.5		1.6
Total Length	6.4		21.0
Total Height	2.6		8.5
Total Width	2.4 (Rear)	6.4 (A/C)	7.9 (Rear) 21.0 (A/C)

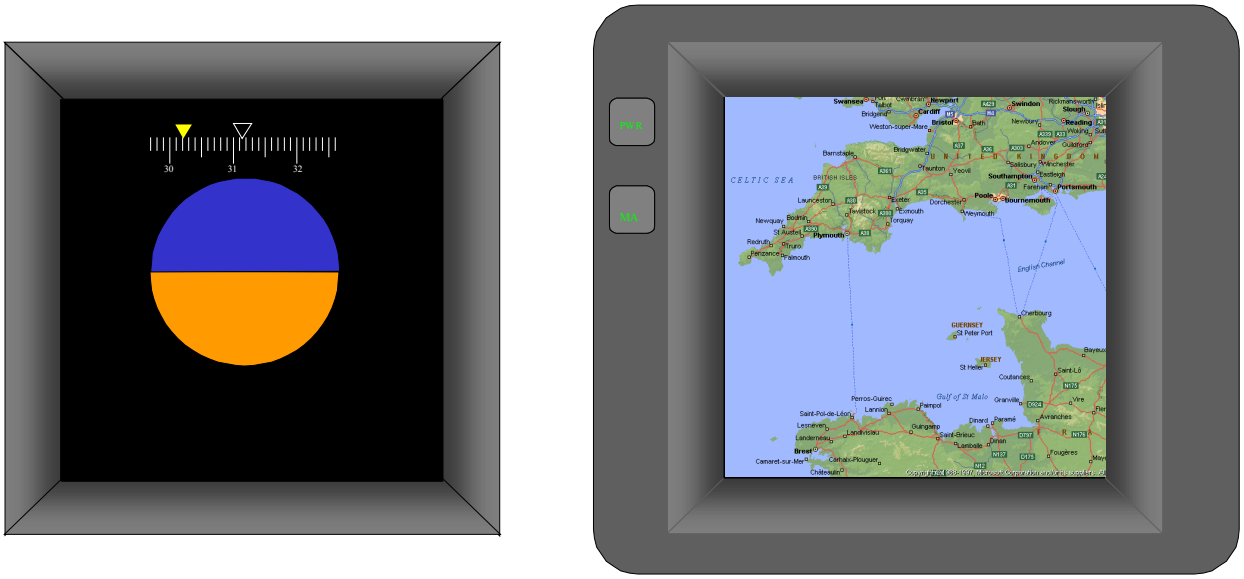


Figure 2 Excel screen-shots: Aircraft Mode example

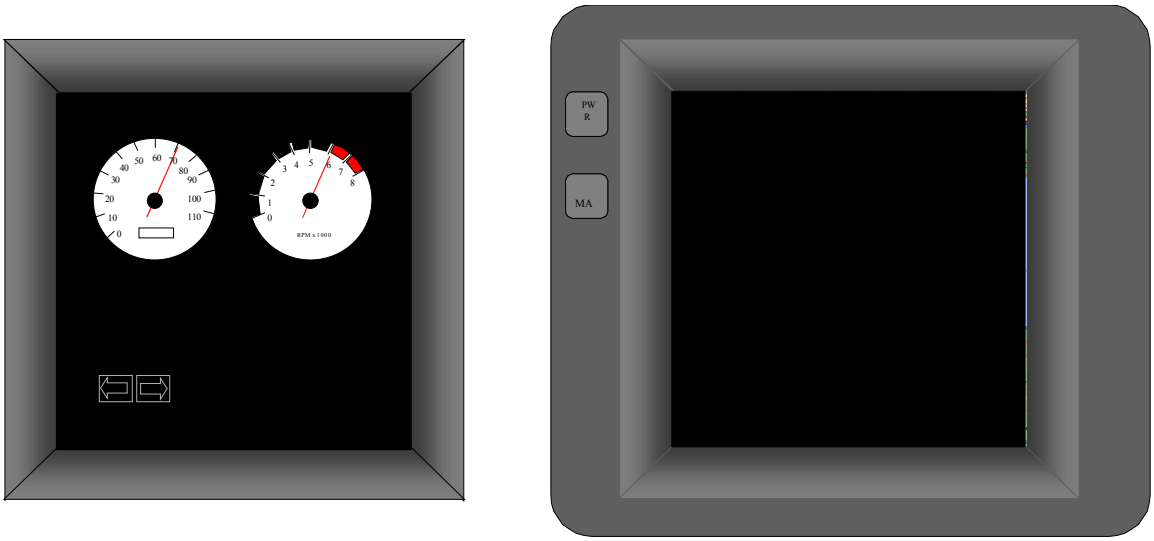


Figure 3 Excel screen-shot: Car Mode example