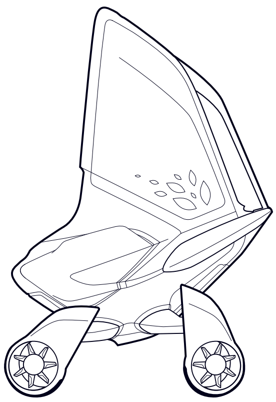


personal airship

ESCAPE

ROBBIE MCINTOSH

2011

ACKNOWLEDGEMENTS

This project could not have happened without the help of many great people I am fortunate to know and work with. Your dedication of time, your feedback, your wisdom and understanding is appreaciated beyond what words can express.

To lecturers Mark Richardson and Selby Coxon thankyou for all of your help, your feedback and guidance throughout this past year. At times it was tough but you were always optimistic whenever I was not, your enthusiasm and your encouraging words were instrumental in helping me achieve a great result.

To peers, it's been a great ride guys! You should all be proud of what you have accomplished, truly a great year for the university and design in general.

To Nigel Remedios and Raj Dafallah, your help and support during the digital sculpting process was incredible. You gave up your free time to produce truly top class results. You have both proven that you are good at what you do.

To Clemence, your love and support throughout this year has been amazing. You put up with the late nights and your partner being glued to the computer for hours on end. I'm doubtful I could have done this without you.

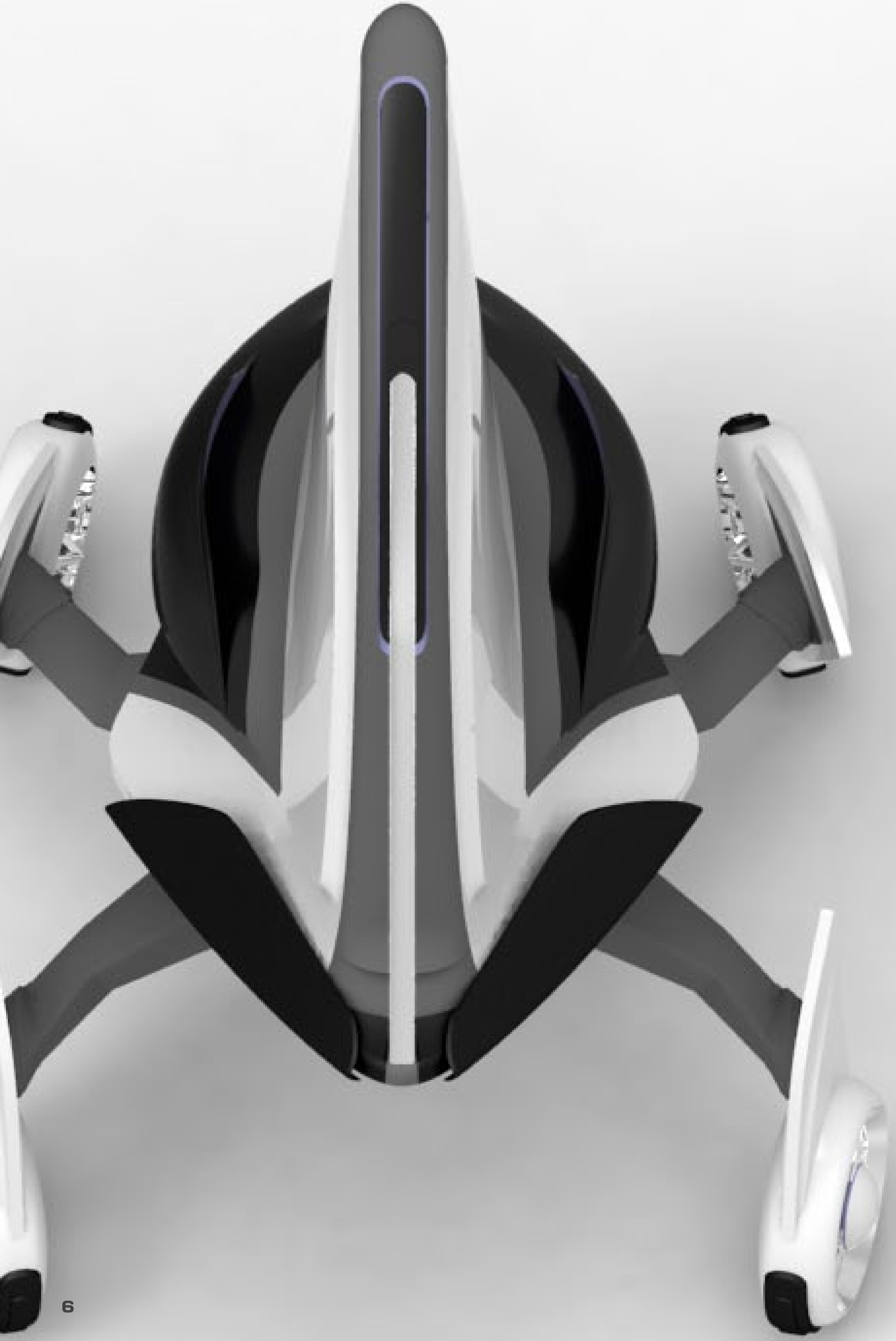
To my parents, Don and Lesley. You allowed me to leave home and pursue my dreams without asking for anything in return. Your love and support throughout these past five years has not only shaped me as designer but also as a person. This project is for you.

Thankyou!

Robbie McIntosh

“Nothing will ever equal that moment of exhilaration which filled my whole being when I felt myself flying away from the earth. It was not mere pleasure; it was perfect bliss..”

Prof. Jacques Alexandre Cesare Charles, on the first free flight in a manned hydrogen balloon, December 1, 1783



CONTENTS

1

INTRODUCTION

This project was born out of the designers imagination of a future in which the forms of transport used will be reflections of the individual, nature and humanity itself. The designer believes in a future in which these vehicles will have the capacity to truly move us on deep emotional levels and become more than objects born out of necessity.

1.1 PROJECT YEAR SCHEDULE

SEMESTER ONE

WEEK	DATE	ACTIVITY
0	21st February	Course introduction
1	1st March	Groundwork
2	8th March	Research planning
3	15th March	Ergonomic analysis
4	22nd March	Review of research material
5	29th March	Presentation of research material
6	5th April	Ideation
7	12th April	Concept development
8	19th April	Concept design presentation
Mid-semester break		
9	3rd May	Concept refinement
10	10th May	Concept refinement
11	17th May	Product design specification
12	24th May	Final concept presentation preparation
	6th June	Final concept presentation

SEMESTER TWO

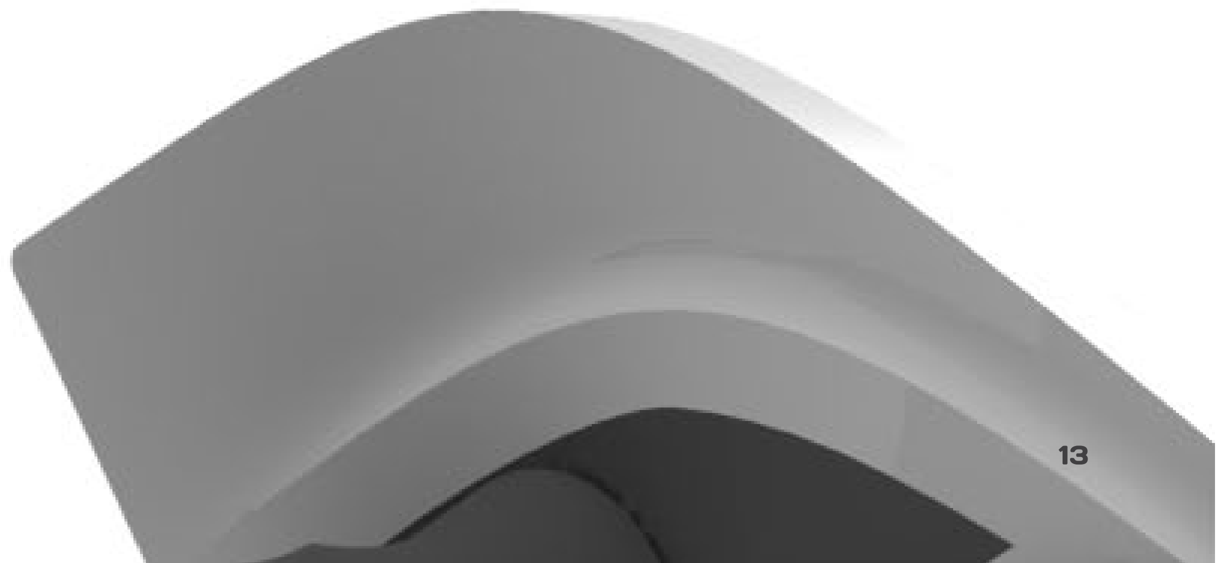
WEEK	DATE	ACTIVITY
1	26th July	Clay sculpting
2	2nd August	Clay sculpting
3	9th August	Clay sculpting
4	16th August	Clay sculpting refinement
5	23rd August	Digital sculpting
6	30th August	Digital sculpting
7	6th September	Digital sculpting refinement
8	13th September	Colour and trim presentation preparation
9	20th September	Colour and trim presentation
Mid-semester break		
10	4th October	Scale model prototyping
11	11th October	Scale model prototyping
12	18th October	Scale model prototyping
13	25th October	FInal submission preparation
14	1st Novemeber	Final submission preparation
15	8th Novemeber	Final submission

1.2 ABSTRACT

This project is motivated by a desire to create a modern, redefined airship design that will introduce new dimensions into air transport. Safety issues, together with the mass of construction materials intrinsic in past designs can be overcome using modern design and manufacturing techniques. The focus on the personal experience of flight in this project arrives from the demonstrated gap in the market availability for such a craft.

This paper details the conceptualisation, design development processes, options, considerations and design standard applied to the design of a small, multipurpose, personalised, low emission airship and compares these results with other published concepts.

The result is not only a redefined airship, rather a completely new mode of air and ground transport. The “big idea” was in response to peoples perceived ideas as to what an airship is. The concept essentially challenges these ideas.



1.3 PROJECT INTRODUCTION

Airships of the past have left their modern decedents with a bad image. The so called Golden Age of air travel ended in catastrophe. The Hindenburg disaster of 1937 all but destroyed the reputation of the Airship coupled with the emergence of modern fixed winged aircraft, Airships like those of the past simply disappeared.

Modern Airships are a far cry from their relatives. Generally much smaller in size and numbers, they fill niche applications such as sightseeing vessels, advertising and aerial surveillance.

Recently there has been a growth in interest around bringing back Airships as a form of commercial air transport. They have the potential to replace or at least compliment existing aircraft in the coming years. They hold several advantages over existing craft, including their ability to operate with zero emissions, their manoeuvrability, being able to navigate and land in a relatively small area means that they require less infrastructure than existing air craft, their sheer size would provide a good platform for solar energy capture.

Several companies, including Boeing and Lockheed Martin have developed or are in the process of developing new generations of Airships. However, most have been slated for roles as cargo carriers. Their potential to sustain flight indefinitely without the need for landing to refuel and their ability to carry large loads give them plenty of promise in long haul type transport applications.

Numerous commercial passenger carrying concepts are also “floating” around in mainstream media. Notable examples include UK based design group Seymourpowell’s hydrogen based floating cruise ship subsequently called Aircruise and US based company Aeros with their ML866 Airship. A number of student based concepts are also in widespread circulation. In a similar vein, much like the aforementioned cargo carrying Airships the commercial passenger Airships would be used by the masses and would be generally large in size, if not gigantic.

Few concepts have focused on the personal experience of flight. Upon researching into privately owned airships it was found that there were very few available on the market and none were in development. Those that were available did not utilize any modern methods of production and were essentially hot air balloons with a directional fan attached. Furthermore the commercially available Airships also lacked in style and functionality, which is in no way a reflection of their heritage.

1.4 DESIGN OBJECTIVES

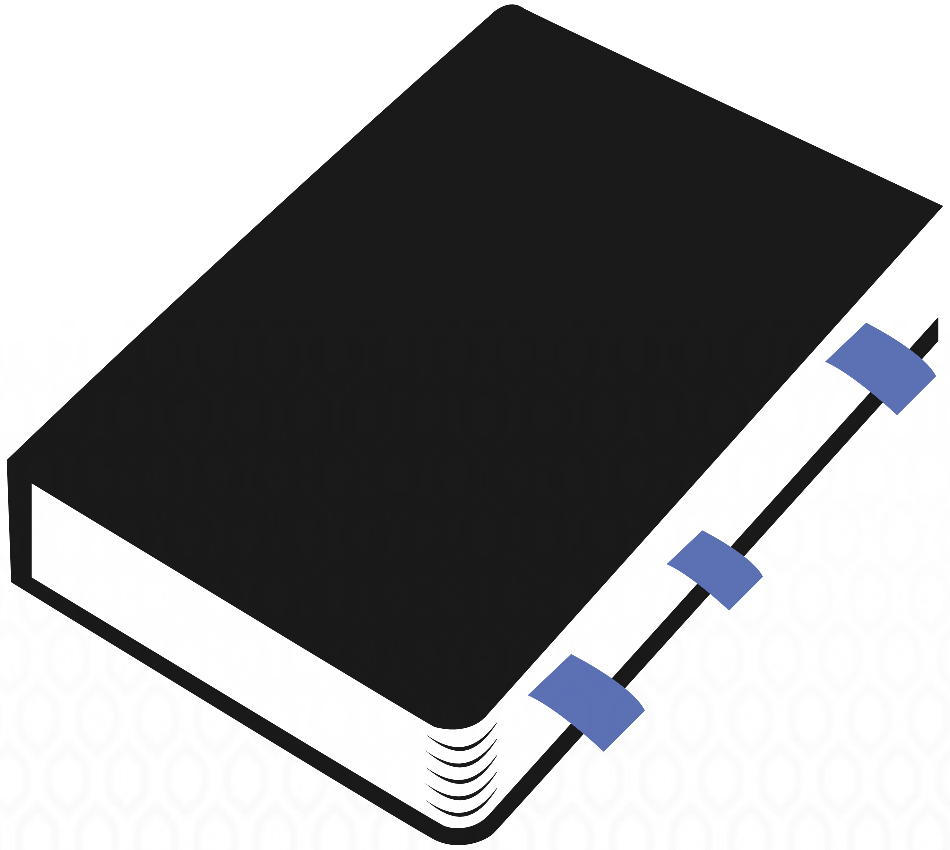
To create a new form of personal air transport.

To restore confidence in perceived airship safety.

Push functionality and styling boundaries.

Create an approachable, humanistic mode of transport.

Redefine the airship.



2 TASK CLARIFICATION

The Task Clarification component of this project focuses on initial investigation and research findings. It provides an overview of the products history, the current state of the art and emerging and predicted trends for future products. It also examines the current state of art in like products and explores potential users that a new product could be geared toward.

2.1 DESIGN AND PROJECT RESEARCH METHODOLOGY

The methodology for this project provides an overview of the design process and the basic method/s employed to generate the final design.

RESEARCH	Research the history of Airships Analyse current and emerging products Research/identify emerging technolo-gies	Internet research Books Library databases	Task clarification
FORMULATE	Identify and analyse a potential market Create user scenarios based on market Benchmark against competing products	Market research Product websites Product reviews	Concept creation
DESIGN	Body storming Create a package Mock ups and or proportion models CAD	Tape drawings Product dimension study Alias volume study Clay sketch model	Prototype/Scale model

2.2 PROJECT RESEARCH INTRODUCTION

All forms of transport - Air, rail, road and sea contribute to an estimated total of 13% of global greenhouse emissions. Civil Aviation, Domestic and international account for 2% of those global emissions.

In Australia, of the total 100% of aviation emissions 45% is produced by domestic aviation and 55% is produced by international aviation. Source: National Aviation Policy Green Paper, http://www.infrastructure.gov.au/aviation/nap/files/Aviation_Green_Paper.pdf

The image of Australian aviation is changing. In light of looming global warming fears the aviation industry has progressively been making changes in an attempt to improve its overall carbon footprint. The aviation industry has been introducing fuel saving measures which, so far have delivered efficiency gains of approximately 2% per year. Consequently, the carbon footprint of the industry has been growing at a rate of approximately 3% per year. The introduction of cleaner forms of fuel, improved efficiency and aerodynamics of aircraft and the implementation of a Carbon Pollution Reduction scheme by the Australian government are beginning to show signs of improving this carbon footprint.

Appropriate measures are underway to reduce overall carbon emissions from the aviation industry, however more can be done. Most of the research undertaken in this project has suggested improving existing aircraft, but little has pointed to introducing an alternative form of aircraft.

2.3 AIRSHIP HISTORY

Airships were instrumental in a number of humanities significant historical achievements; They were humanities first real flying machines, they gave birth to air travel as we know it today. Their enormous and at times overwhelming size inspired and effected the masses. Because of this they were a true representation of design for emotion.

The origins of the modern airship date back to France in 1784. In this year Jean-Pierre Blanchard became the first person to be carried aloft by a powered balloon. Originally the balloon was operated using a simple hand cranked propeller, later Blanchard would go on to fit a more elaborate bird like flapping wings to the balloon. The addition of wings was in response to humanities understanding of aviation at the time. Indeed the concept of human flight was a new one and humanity looked to the masters of flight to gain a better understanding in order to improve operation. This was the first of what would become modern Airships.

In the pioneering age of airships only the elite of the scientific community were directly exposed to them. The general public were met with intrigue and fascination

The year 1900 would go on to be heralded as the beginning of the Golden Age of airships; it is the year in which the first German airship the Zeppelin LZ would take flight. The LZ was the first incarnation of what would become the most famous airship in the world's history. These majestic giants would go on to rule the skies for decades to come serving as the primary means of air transport before coming crashing back to earth in an event that would forever shape their future.

'Zeppelins are intended as weapons of moral suasion..
The Zeppelin has been built with the idea of spreading panic over as wide an inhabitant area as possible.
It has been devised as the terror of the air, the very quintessence of frightfulness…'
Evening Standard and St. James's Gazette, 1 June 1915, p. 6.

During periods of war airships were used as long range bombing and scouting platforms. Their sheer size together with their potential to unleash massive amounts of destruction was used as a means of striking psychological terror into the minds of the enemy. Alas their actual use as an attack craft was minimal due to the fact of their inaccuracy when bombing coupled with the development by the enemy of incendiary bullets.

"You do not travel on an airship, you voyage." Dr. Hugo Eckener, commander of the airship Graf Zeppelin, the first commercial passenger carrying aircraft to cross the Atlantic Ocean.

During the inter war periods airships were seen gently floating over city scapes. At the time airships symbolized a means of luxurious air travel to those who were wealthy enough to afford the experience. Through advertising airships offered flights to far off exotic locations, an opportunity to experience the thrill of wining and dining whilst floating amongst the clouds. The interiors of these airships were akin to luxury hotels and boasted all the same creature comforts including an on board restaurant, bars, observation decks and even an on board smoking area.

On Thursday May 6, 1937 the fantasy of airship travel would turn into that of a nightmare for many. The event took place as the German airship Hindenburg was returning from a successful voyage and was in the process of landing at an airfield in Lakehurst New Jersey. In front of a large crowd of onlookers the Hindenburg burst into flames. The disaster was caught on film by radio news reporter Herbert Morrison, the footage of the event along with the chilling audio sound track that accompanied it would go on to become one of the defining pieces of situational journalism in history.

The emotional distress of Morrison is clear as he frantically calls the events taking place in front of him.

"It burst into flames! Get out of the way!...
It's crashing terrible! Oh, my! Get out of the way, please!
It's burning, bursting into flames and is falling...
This is the worst of the worst catastrophes in the world!...
Oh, the humanity, all the passengers screaming around here! (Morrison begins sobbing)...
It's just laying there, a mass of smoking wreckage, and everybody can hardly breathe and talk...
This is the worst thing I've ever witnessed."
Herbert Morrison Radio News presenter May 6, 1937 Lakehurst, New Jersey.

The widely documented Hindenburg disaster all but destroyed people's personal confidence in airships, the psychological effects of the disaster reciprocated throughout the world. The catastrophe signified the end of the Golden Age of airships. In the years following the disaster airships would no longer be used to carry passengers, instead they were destined to serve out the remainder of their lives operating in military applications. The coup de grace for airships was the introduction of modern fixed wing aircraft that would eventually go on to dominate the skies for the coming decades and by the 1960's airships had all but disappeared.

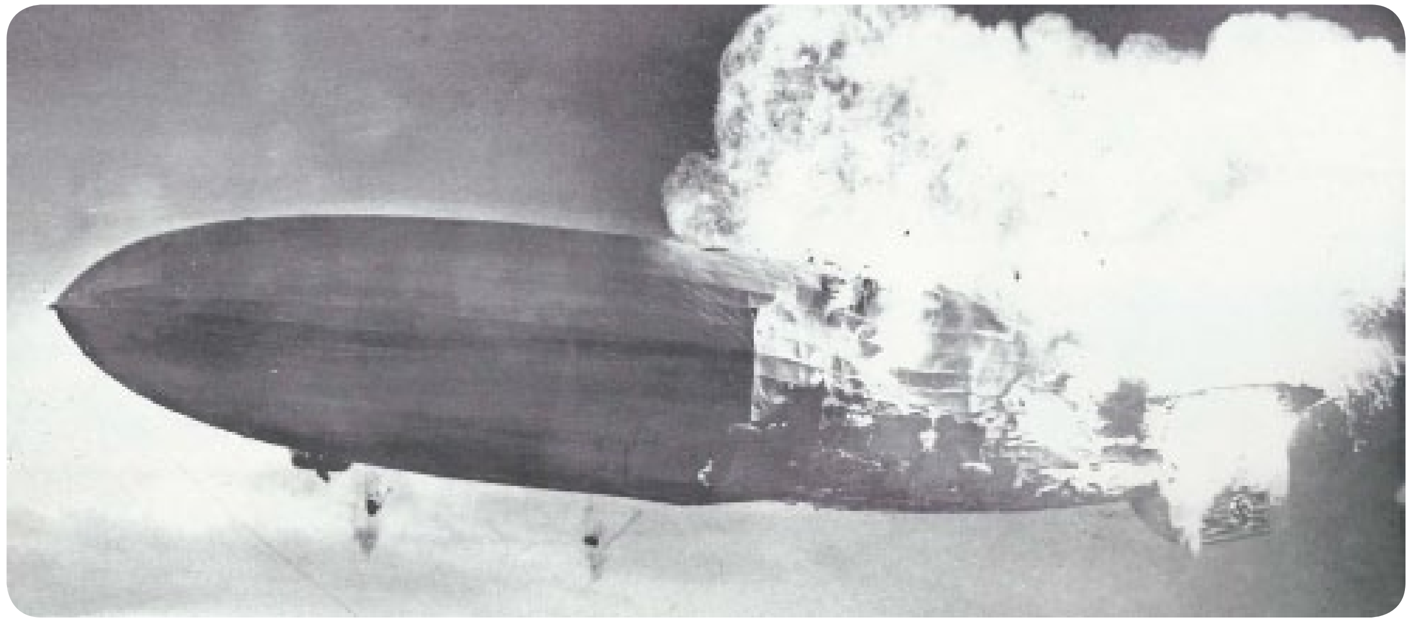
The emotional impact airships had on a generation seems to have all but been lost. Today the airships of yesterday serve as a distant memory for the old and a fantasy for the young. Whilst there are airships in operation today they are a far cry from their ancestors, much smaller in size and much fewer in numbers they serve mainly as sightseeing craft and in other niche applications such as advertising and aerial photography. Modern airships have lost their grandiose presence and their allure of luxury that they once had during their Golden Age.

Airships at present are a far cry from their origins. Unlike their rigid ancestors, most modern airships in use today are of semi-rigid or non-rigid design meaning they do not rely on a core framework for support rather relying on internal air pressure to maintain their shape. Another fundamental difference is the type of gas used for buoyancy. Hydrogen gas was typically employed by the giant alrships of the past. Its unpredictable nature (proven during by the Hindenburg disaster) saw Helium, an inert non-combustible alternative become the staple in modern airships. Coincidentally modern airships are generally much smaller in size compared to their ancestors in part due to the extremely high cost of Helium gas which is up to 30 times more expensive than a hydrogen substitute.

The current application of airships is varied. They perform vital roles within the militaries of the world acting as surveillance and reconnaissance platforms. They are also used within the scientific community in the gathering of meteorological and other atmospheric data. Commercial applications include high impact advertising. "Advertising blimps", commonly used at large public events and provide an excellent platforms to advertise. They also perform as sightseeing craft in particular niche tourism markets.

In recent years interest has build around the possible revival of airships for mainstream commercial use. Major companies are beginning to recognise their potential across a much broader range of applications than those they currently operate in. airships offer lower operation costs in contrast to current aircraft, they produce low or no carbon dioxide emissions, low noise emissions and also provide a unique platform from which to promote business.

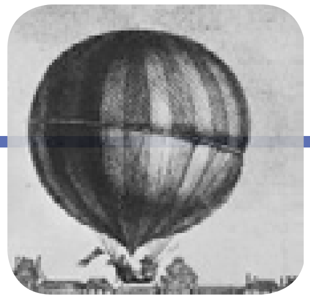
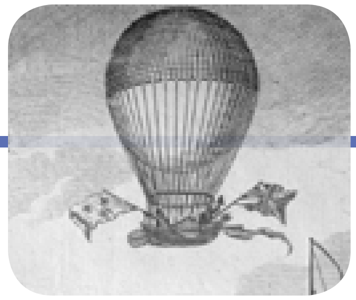
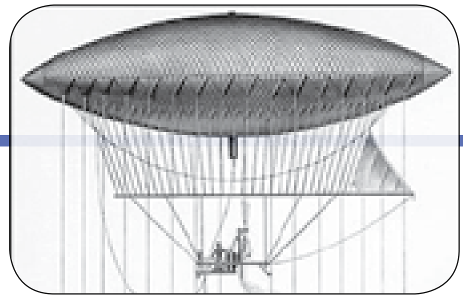
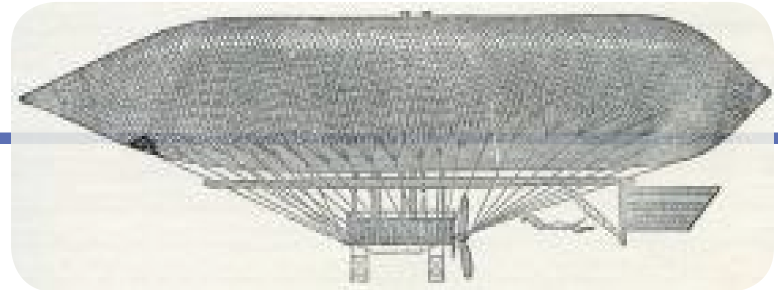
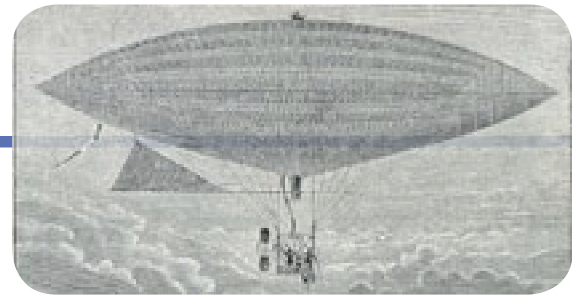
Source: Archbold, Hindenburg: An Illustrated History. 1994.
Beaubois, Airships An Illustrated History: drawings by Carlo Demand; translated {from French} and adapted by Michael and Angela Kelley. 1974.



2.4 SUNRISE SUNSET

A brief overview of historically significant airships.

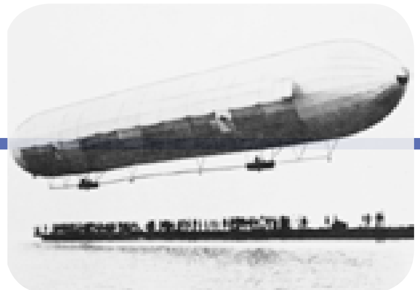
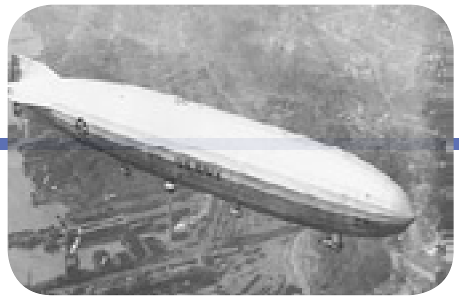
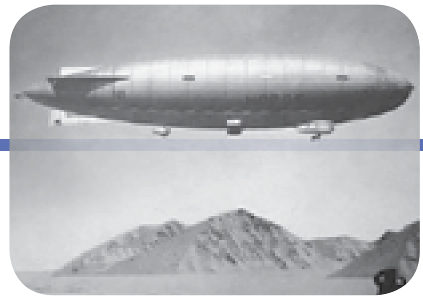
P I O N E E R I N G A G E

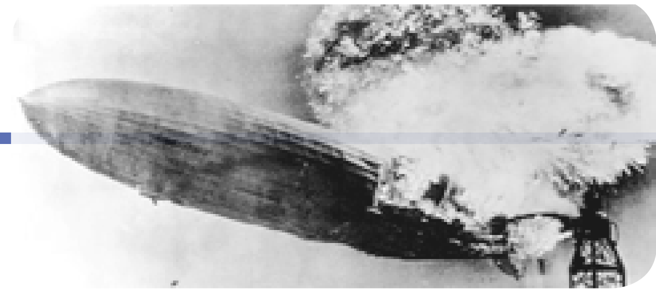






1783 France, Prof. Jacques Alexandre Cesare Charles becomes the first man to be carried alot in a Hydrogen balloon.
1784 France, Jean Pierre Blanchard fits a hand powered propellor to a Hydrogen balloon making it the worlds first airship
1852 France, South American born inventor Henri Giffard attaches the first engine to an airship. His propulsion.. Steam.

1872 Germany, Paul Haelein is the first to use an internal combustion engine in an airship design.
1883 France, Gaston Tissandier uses an electric engine to power his experimental airship.

T H E G O L D E N A G E



1900 Germany. Herald as the beginning of the Golden Age of airships the first of the iconic Zeppelins the LZ1 is launched.
1922 USA. USS Shenandoah is the first airship to use Helium for buoyancy instead of Hydrogen.
1926 Arctic Circle, Italian airship Norge is the first aircraft to fly over the North Pole.

1928 Germany. The German Airship LZ127 Graf Zeppelin is the first aircraft to circumnavigate the globe.
1937 USA. The German airship The Hindenburg explodes upon routine landing. Ending the Golden Age of airships.

P R E S E N T D A Y



1963 USA. Goodyear launches the first of their iconic airships to advertise their tyres.
1980 United Kingdom. Per Lindstrand technologies introduces fly by wire technology to their GA-42 airship.
1997 Germany. German airship makers Zeppelin introduce their NT model.

2006 USA. Airships are re-introduced into the US Navy after a 44 year Hiatus.
2006 USA, Lockheed Martin produces experimental aircraft a hybrid airship the P-791.

2.5 TREND ANALYSIS - AIRSHIPS

As of 2011 Australia's own Skylifter are proposing an airship concept that would be used as a mass cargo/ infrastructure transporter. With the specific intent of producing a craft capable of carrying large prefabricated structures to disaster struck or remote areas where it may be costly or impossible to build structures on site. Source: Skylifter. http://skylifter.com.au/

US based company Lockheed Martin are experimenting with Hybrid airships technology. Technically "heavier than air" these airships combine the buoyant lift of traditional airships with aerodynamic lift used by winged aircraft to achieve flight. The P-791 craft is a working example of the concept. Source: Lockheed Martin http://www.lockheedmartin.com/products/p-791/

In 2010 Prominent British Product Design consultancy Seymourpowell released details of their visionary transportation concept "Aircruise" (opposite page). The concept is a hotel for the sky with low passenger numbers and huge internal spaces offering room for living, dining relaxing, as well as scope for dramatic and inspirational public spaces. The design proposes a bar/lounge zone, four duplex apartments, a penthouse and five smaller apartments. The Aircruise concept presents an alternative take on future air travel suggesting "slow is the new fast". Source: Seymourpowell http://www.seymourpowell.com/aircruise/aircruise-press-release.html

In July 2008 work on a heavy-lift airship was announced by Boeing and SkyHook International Inc. "A teaming agreement to develop the JHL-40 (Jess Heavy Lifter), a new commercial heavy-lift rotor craft designed to address the limitations and expense of transporting equipment and materials in remote regions. Boeing has received the first increment of a multiyear contract from SkyHook to develop the new aircraft. The neutrally buoyant feature allows SkyHook to safely carry payloads unmatched by any rotor craft in existence today. The helium-filled envelope is sized to support the weight of the vehicle and fuel without payload. With the empty weight of the aircraft supported by the envelope, the lift generated by four rotors is dedicated solely to lifting the payload, leaving the aircraft neutrally buoyant. The SkyHook JHL-40 aircraft will be capable of lifting a 40 tonne sling load and transporting it up to 200 miles without refuelling in harsh environments such as the Canadian Arctic and Alaska." Source: Boeing. http://www.boeing.com/news/releases/2008/q3/080708c2_pr.html

Millennium airships Sky freighter is another cargo carrying airship currently in development In a similar fashion to Skyhook Millennium's Sky freighter uses four fans operating independently to carry the weight of the cargo. "This advanced (patent pending) airship propulsion and control system consists of four engines (Ultra High Efficiency Turbofan) housed within the body of Sky Freighter in separate engine rooms which provide both protection and in-flight serviceability, and drive four variable pitch fan assemblies which are mounted perpendicular to the body of the airship at each Thrust Wing base." Source: Millennium Airships. http://www.millenniumairship.com

Seymourpowell's Aircruise concept 2010

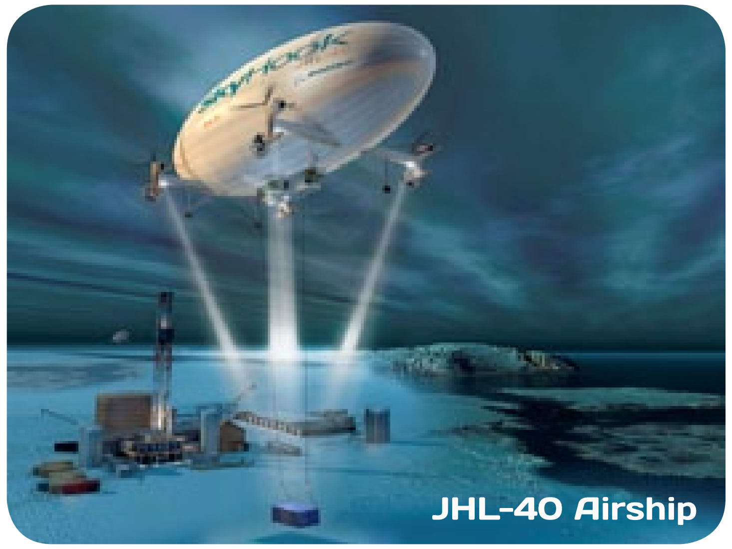
Aeros a US based company are promoting their ML866 concept for use across a wide range of applications including the possibility of luxury passenger transports akin to the airships of the past. Source: Aeros. http://www.aerosml.com/

Discovery Air and Hybrid Air Vehicles of Canada have announced plans to launch a commercial Heavy Lift Air Vehicle to serve mining camps and secluded villages in the countries north using airships originally developed for long-term reconnaissance by the US military. These hybrid aircraft use both the lift from non-flammable helium and the aerodynamics of the ship to stay aloft. The airships will be able to carry up to 500 tons of cargo and be able to travel up to 185 km/h and will have the ability to take off and land unlike existing aircraft. Source: Gizmodo.http://gizmodo.com/discovery-air/

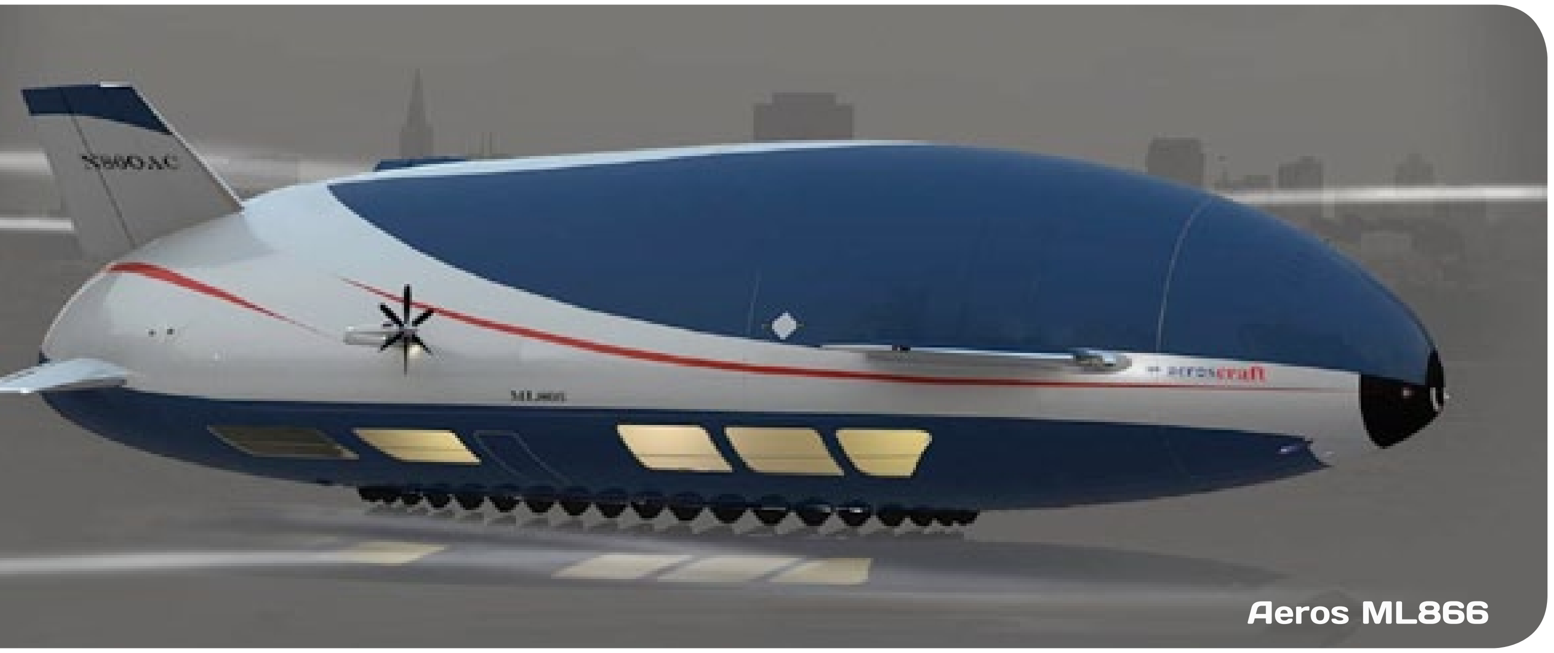
Festo a US based company is experimenting with animalistic forms using cues from marine life including manta rays and fish in the design of their airships. The airships themselves are self propelled meaning that they do not rely on

Australia's own Skylifter


Festo


JHL-40 Airship


Millennium Sky Freighter


Aeros ML866

Discovery Air Airship

2.6 TREND ANALYSIS – OTHER AIRCRAFT

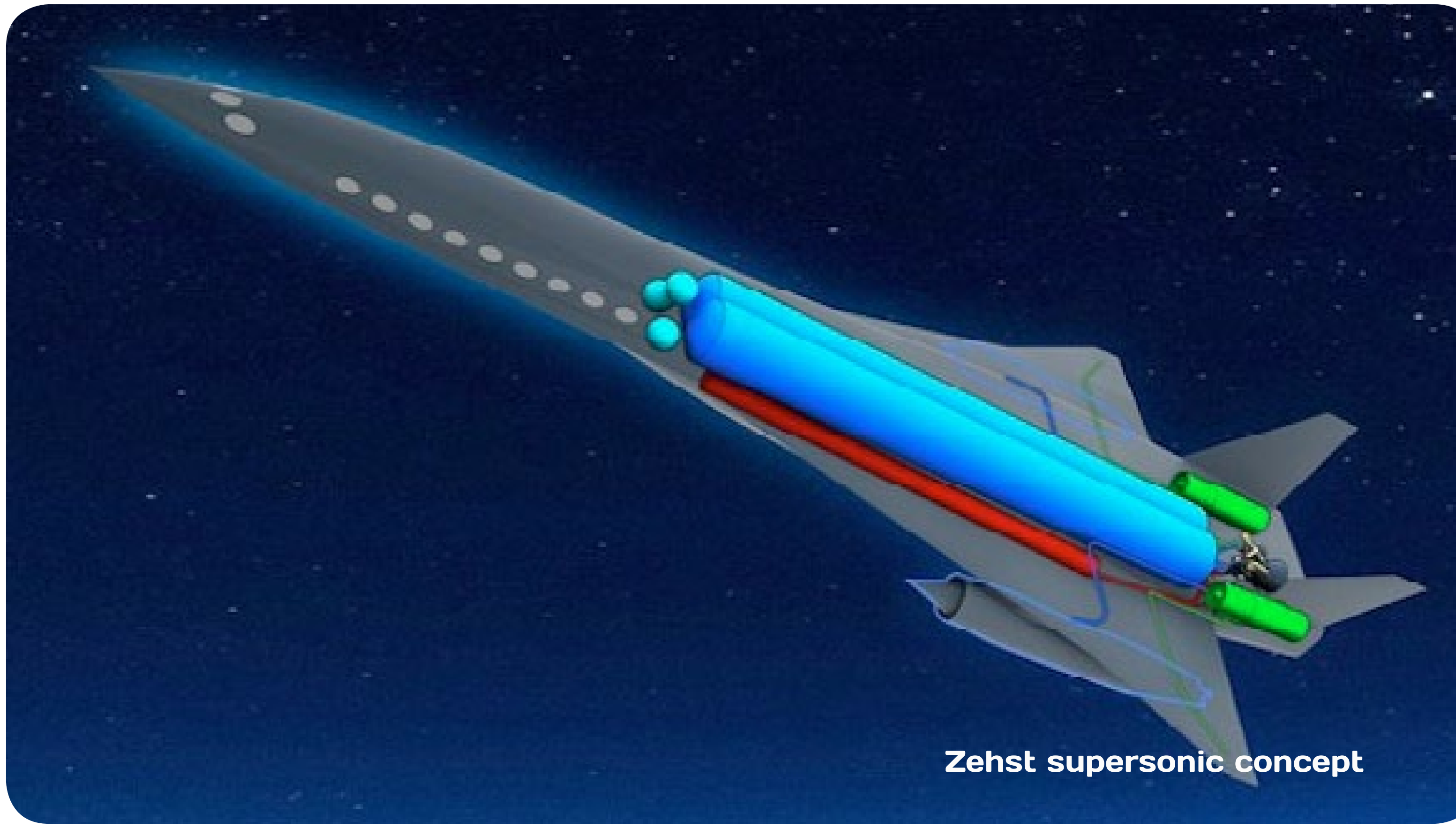
EADS The European Aeronautic Defence and Space Company in 2011 announced their zero-emission airliner "VoltAir" concept. VoltAir utilises a pusher-prop ducted fan and electric motors over conventional jet engines. The prop's design is a twin coaxial contra-rotating design, delivering excellent propelling power very efficiently. Interestingly the engine would be bathed in liquid nitrogen. A chilled engine allows the superconductive wiring to work more effectively delivering the maximum power transfer. Super conducting motors waste almost no electrical energy when operated properly. Source: EADS. http://www.eads.com/eads/int/en/news/press.dd6d47cf-8edf-4a8f-b043-a5adaaf238b6.4eb07896-3e59-4301-a243-e00d762cdb20.html

Zehst, another concept from EADS is a zero-emission supersonic jet. The concept utilises seven engines. Two of the engines operate in a similar manner to conventional aircraft burning biofuel. These would be used in normal flight, takeoff and landing. Two giant ramjets and three rocket engines burning liquid hydrogen and oxygen would propel the aircraft into the upper stratosphere, travelling at mach 4.5 the aircraft would take approximately 2.5 hrs to travel from Paris to Tokyo. Source: EADS. http://www.eads.com/eads/int/en/news/press.92323d58-24e5-4b71-aa1e-438e8c1289b0.4eb07896-3e59-4301-a243-e00d762cdb20.html

NASA revealed its electric powered personal flight concept called the Puffin in 2010. The concepts takes off like a helicopter and flies like a plane and is apparently capable of travelling at speeds of over 200 km/h. The tilt-rotor system used on the Puffin is similar to that of the V-22 Osprey helicopter. Weighing less than 180 kg the concept is able to travel distances of up to 80km on a charge. Source: NASA. http://www.nasa.gov/topics/technology/features/puffin.html


VoltAir concept


NASA's "Puffin"


Zehst supersonic concept

2.7 RESEARCH CONCLUSION

Airships of the past have given their modern descendents a bad image. The so called Golden Age of airships ended in disastrous event that shook public opinion of airships. The Hindenburg disaster coupled with the emergence of modern aircraft saw airships enter early retirement.

The Image of aviation is changing. A “greener” future is in the making as a result of human kinds changing ideals and ways of thinking about the world we live in. Improvements are being made throughout all fields of aviation including the introduction of increasingly more environmentally friendly aircraft, infrastructure and operating procedures. The benefits of this change not only safeguard environment but also as the green aviation industry matures there is likely to be several financial benefits for both producers and consumers.

Congestion problems at ports, highways and airports coupled with evidence of climate change is forcing nations to reconsider airships as a form of primary transport. Airships offer a range of advantages over existing air transport.
An airship is able to operate whilst producing zero or practically zero $CO2$ emissions compared to that of a modern plane of the same carrying capacity. Airships are able to maintain flight without refuelling much longer periods of time than existing aircraft. They are as versatile as most existing aircraft in almost all of the same applications.

AIrships are in fact safer than existing aircraft. Helium, not hydrogen is the lifting gas used in modern airships. Unlike Hydrogen Helium is inert and noncombustible therefore an event like the Hindenburg disaster would likely to never be repeated.

Modern airship design incorporating the advanced technology materials into lighter, stronger composite frame materials and thrust-vectoring, fuel efficient solar assisted engines running on biofuels have progressed to the prototype stage and beyond thereby demonstrating feasibility. Less dense internal frameworks allow for a higher percentage of lifting gas in the envelope. Modern navigation technology, Fly-by-light avionics and light-weight control systems provide simplicity of operation and safety for the user.

2.8 PRODUCT DESIGN RATIONALE

Design and construction of an airship that is safe, reliable, cost efficient and environmentally sustainable as a means of transport is regarded as practical when using technologically advanced materials and design techniques.

This design process may be applied to the development of a range of vehicle sizes and capabilities with specialised features.

The process is equally relevant to commercial or recreational vehicle applications.

2.9 PRODUCT PERCEPTION

The below imagery is indicative of where would like Escape to fall within the current market. The benchmarking and research indicating that there is reasonable scope for Escape to retail as a niche product for those who have above average wealth. Escape as indicated previously is all about the personal flight experience therefore the physical size of the product is also taken into consideration when placing it amongst potential competitors.

LUXURIOUS / EXPENSIVE

SMALLER

LARGER

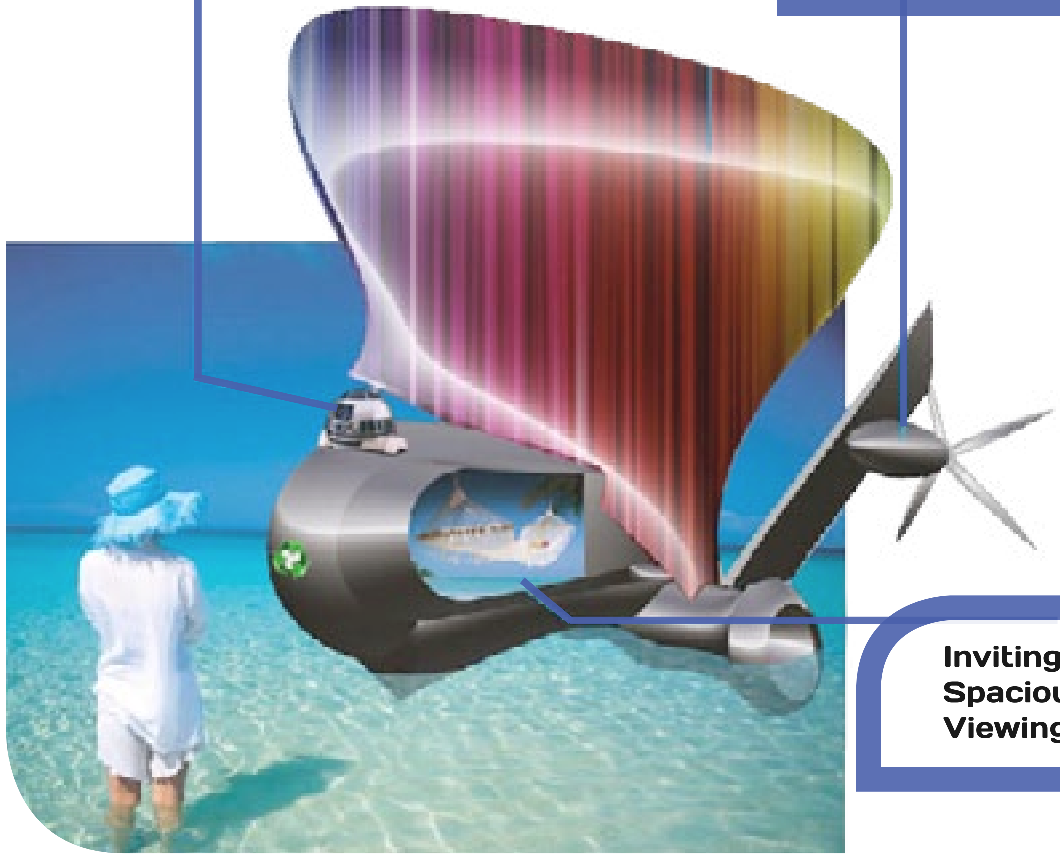
MASSCLUSIVE / INEXPENSIVE

2.10 PRODUCT FEATURES/QUALITIES MAPPING

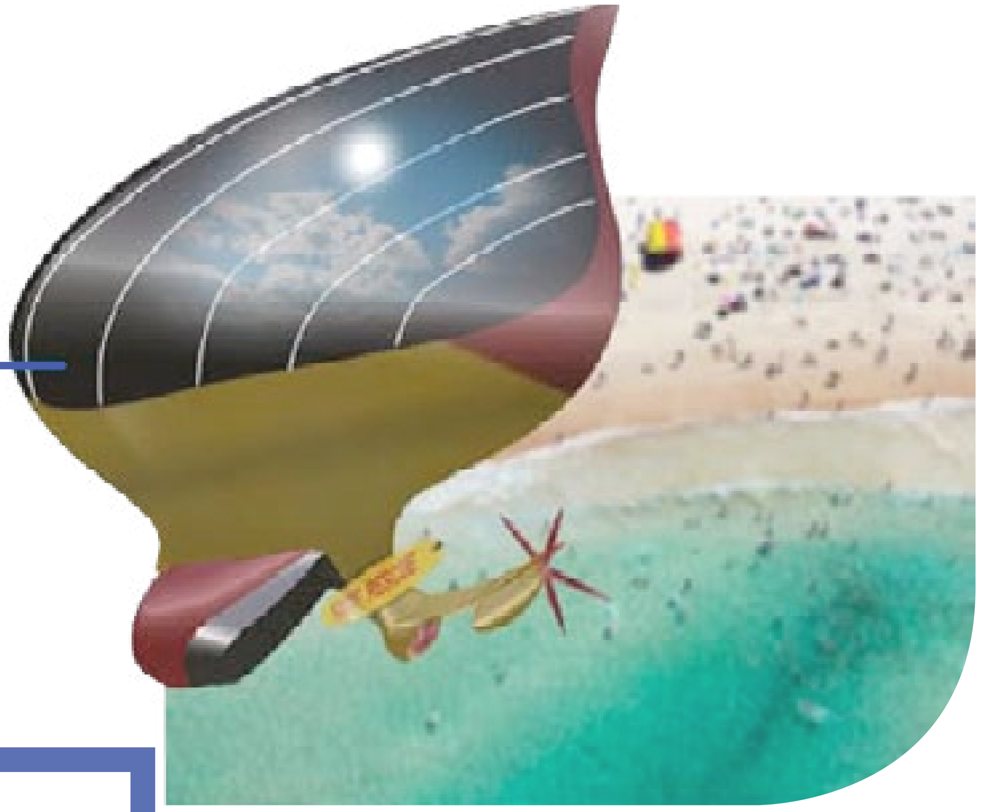
The images on the following pages represent in a stylistic way some of the elements the designer originally wanted to incorporate into the design of the Airship Escape. They were used as a draft design benchmark throughout the project.

Non threatening design
A Literal vehicle personality
Autonomous functionality

Sustainable
Zero emission
Environmentally friendly



Inviting interior
Spaciousness
Viewing platform



Customised
"Smart" material technology

Unlimited possibilities
- go anywhere

2.11 PRODUCT BENCHMARKING OVERVIEW

The following series of pages provide an insight into Escape's potential competitor products that are already available. These current products were graded on a set of 8 criteria, each criteria in some way reflective of original project objectives. The data obtained was then plotted on a graph in a manner that graphically shows potential gaps or opportunities in the market.

Portability: The Escape airship in order to operate as a privately owned craft would need to be portable. It would need the ability to be transported and stored with ease.

Storage: To be a true adventure craft Escape would need to provide some on-board storage for equipment.

Airspeed: Airships are typically slow moving craft. A slower airspeed gives the vehicle occupants the opportunity to simply enjoy the ride.

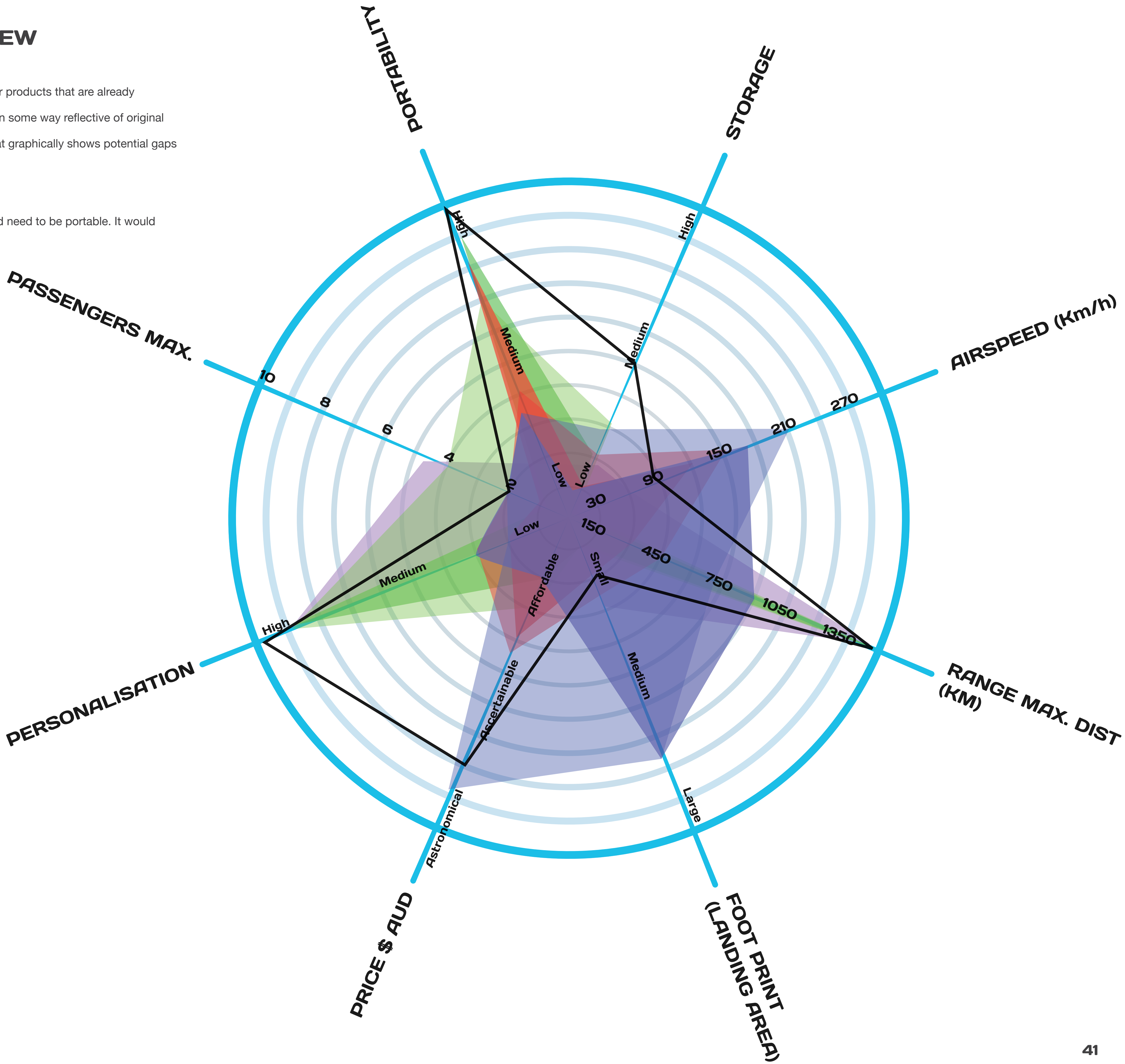
Range: Airships are renowned for their ability to travel long distances before there is the need to refuel. This ability allows for more time spent in the air.

Foot print (landing area): Escape would need to have the ability to land in small area.

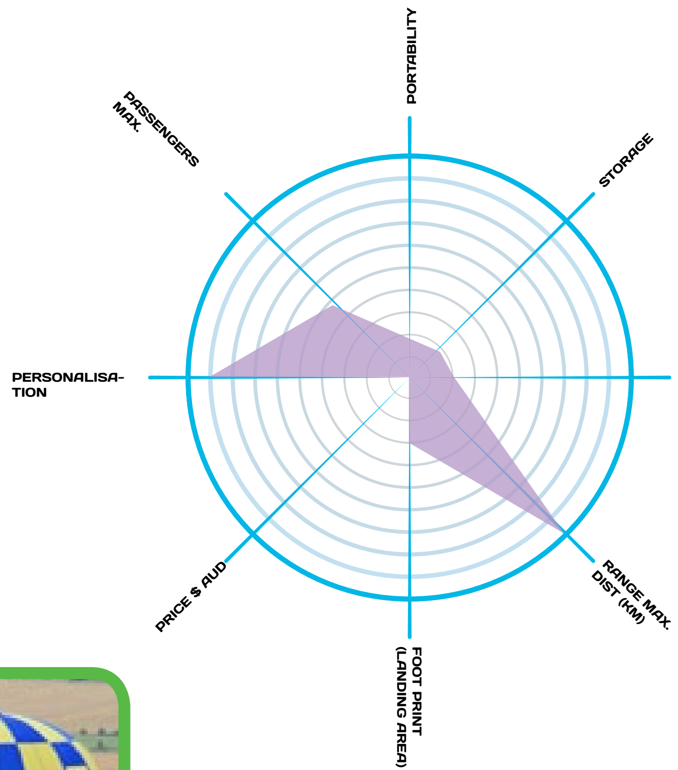
Price: The price of a product is an important one, though it is sometime hard to calculate accurately the final retail and operating costs of a vehicle, it is hoped that Escape could fall under the category of ascertainable meaning it would be available to those with above average wealth.

Personalization: Escape will have the ability to be personalised by the individual to a high degree.

Passengers: Escape will carry a maximum of two occupants a pilot and copilot.



The following products were chosen based on their availability to the consumer. Information is sourced from their respective companies.

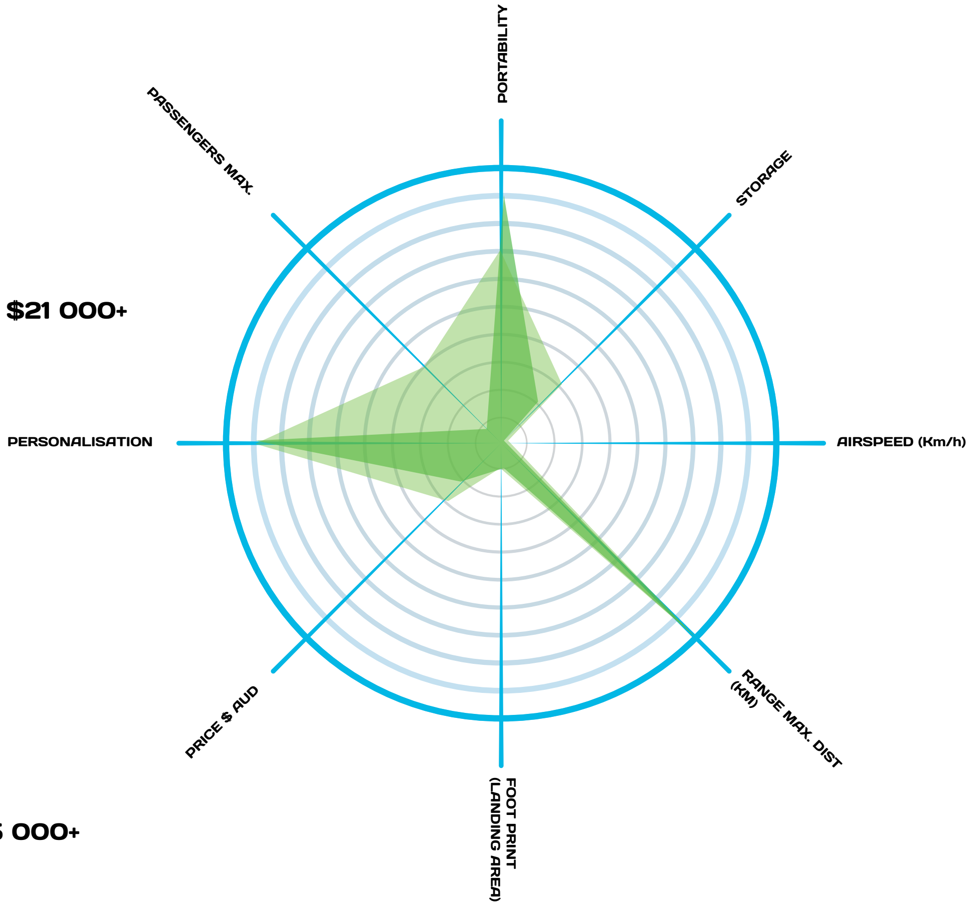


Lindstrand airship $POA

Cameron AS-105GD $POA

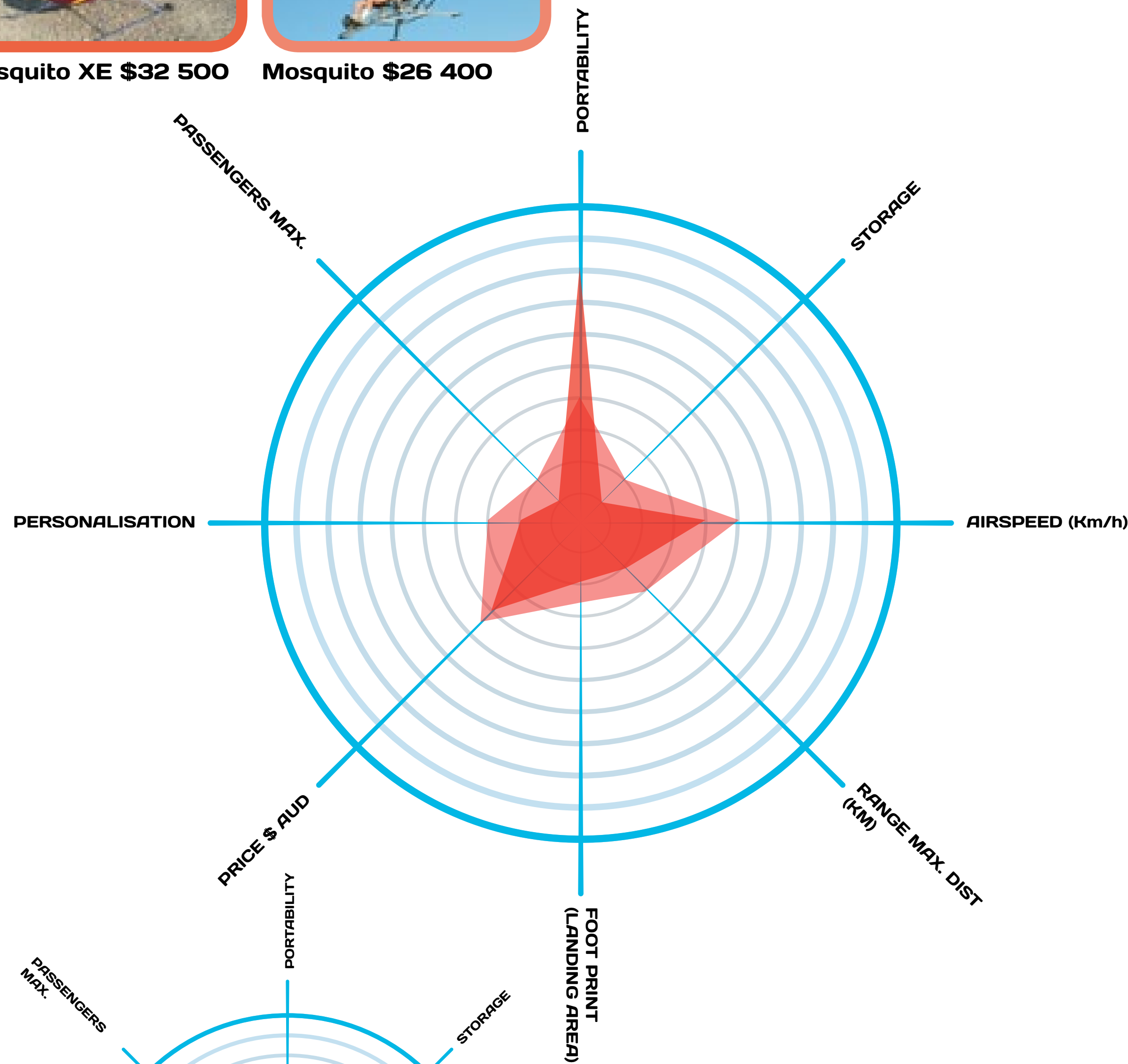
Lindstrand Cloudhopper $21 000+

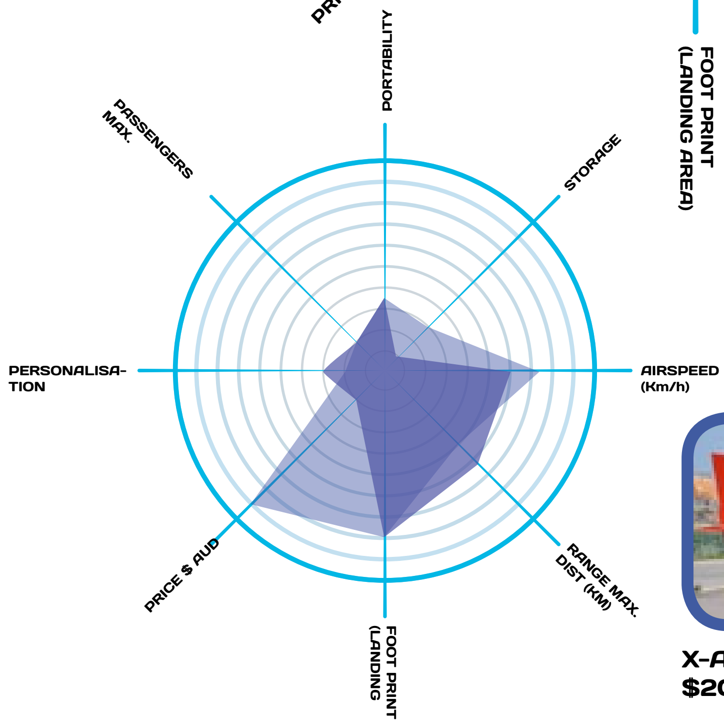
Lindstrand X-Series $25 000+



Mosquito XE $32 500

Mosquito $26 400





X-Air Hunuman $20 000

Foxbat A22L $96 500

2.12 TARGET CONSUMER

From the outset of the project a particular target group of consumers has never been specified. The designer seeks to create a product that could satisfy the needs of a large, diverse audience of people. The designer desires that Escape retains a feeling of versatility without falling into a current vehicle stereotype.

S C E N A R I O 1

Nathan and Shelly Smith

Age: 45 and 44

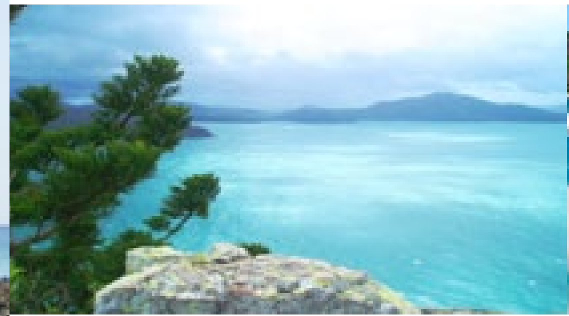
Occupation: Engineering Manager and Surgeon

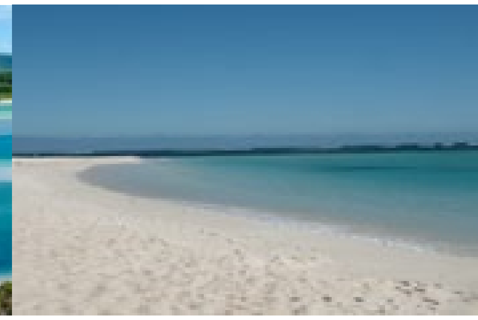
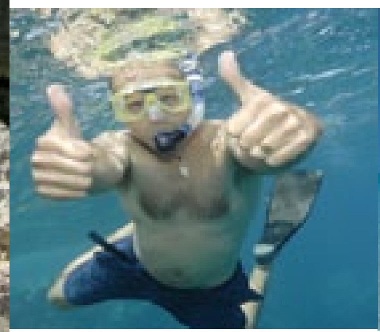
Background: Nathan and Shelly met and married in their early twenties. They both work full time in their respected professions.

Their wealth is a measure of their success. Nathan and Shelly have above average wealth. They own a number of investment properties both residential and commercial which they rent. They are happily married without children.

Nathan and Shelly are keen adventurers and share a passion for travel. Their most recent vacation took them to Whitsundays they were attracted to the Island group because of its seemingly untouched natural beauty. Being environmentally conscious travellers they booked their holiday through a local Eco-travel agent to ensure that any carbon emissions produced whilst they travelled would be offset.

Once they arrived Nathan and Shelley spent two weeks island hopping, exploring individual islands and their surrounding reefs. For the most part they travelled by chartered boat with other Eco-tourists. Unfortunately they weren't allowed to see everything they had come to see as some places were inaccessible by boat in other cases they would have liked to have stayed longer on particular islands but were restricted by the boat operator. They left wishing there was a way they could have explored more.



S C E N A R I O 2

Jack Launders

Age: 70

Occupation: Grazier

Background: Jack owns and operates a 100 000 square kilometre property in Queensland. He is one of the primary beef suppliers to the country. His property has been passed down through the generations, Jack himself was born on the property.

Jack has worked hard all his life

Age is unfortunately catching up on Jack which has seen him become less and less involved with the running of his property. He still lends a hand on a daily basis performing routine checks and any necessary maintenance on the properties fences, water pumps and livestock housing. Thankfully Jack has a large family, most of which work on the property along side him.

Jack requires a flexible mode of transport that will allow him to overview his vast holdings and to maintain the condition of his pastures and his stock dispersal as well as transport essential supplies to his field staff.






S C E N A R I O 3

Jane Hoggart

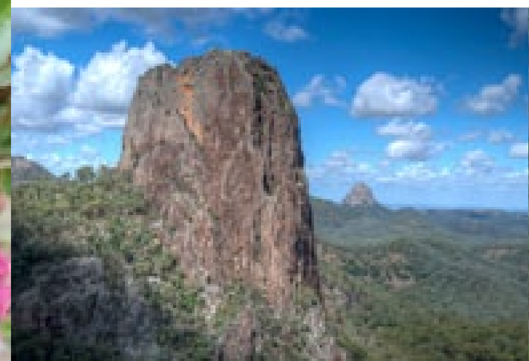
Age: 35

Occupation: National Parks Manager

Jane's management responsibilities cover large areas of National Park in remote National Parks. These areas have difficult access due to the absence of roads combined with steep rocky and sandy terrain.

Management of areas such as this require close monitoring of flora and fauna species population as well as maintaining watch for invasive pest species.

A quiet means of transport, capable of low altitude flight and little local distubance could provide the access required together with a platform for photographic and mapping projects.



2.13 AIRSHIP DESIGN REQUIREMENTS

The Following information is from the U.S. Department of Transport, Federal Aviation Administration Airship Design Criteria document 1995. Source, Civil Aviation Authority: www.caa.gov.tw/big5/download/fsd/FAA-P-8110-2chg2.doc

For each pilot compartment

+ The compartment and its equipment must allow each pilot to perform his duties without unreasonable concentration or fatigue;

+ Where the flight crew are separated from the passengers by a partition, an opening or operable window or door must be provided to facilitate communication between flight crew and the passengers; and

+ The aerodynamic controls listed in § 4.32, excluding cables and control rods, must be located with respect to the propellers so that no part of the pilot or the controls lies in the region between the plane of rotation of any inboard propeller and the surface generated by a line passing through the centre of the propeller hub making an angle of 5 degrees forward or aft of the plane of rotation of the propeller.

Pilot compartment view

+ Each pilot compartment must be free from glare and reflections that could interfere with the pilot's vision, and designed so that -

(1) The pilot's view is sufficiently extensive, clear, and undisturbed, for safe operation;

(2) Each pilot is protected from the elements so that moderate rain conditions do not unduly impair his view of the flight path in normal flight and while landing; and

(3) Internal fogging of the windows covered under subparagraph (a)(1) of this section can be easily cleared by each pilot unless means are provided to prevent fogging.

+ If certification for night operation is requested, compliance with paragraph (a) of this section must be shown in night-flight tests.

+ Windshields and windows

+ The windshield and windows forward of the pilot's back when seated in the normal flight position must have a luminous transmittance value of not less than 70 percent.

Cockpit controls

+ Each cockpit control must be located and (except where its function is obvious) identified to provide convenient operation and to prevent confusion and inadvertent operation.

+ The controls must be located and arranged so that the pilot, when seated, has full and unrestricted movement of each control without interference from either his clothing or the cockpit structure.

+ Identical power plant controls for each engine must be located to prevent confusion as to the engines they control, and must be arranged from left to right in the following order:

(1) Throttles or power levers

(2) Propeller pitch controls

(3) Mixtures of fuel control/cutoff

+ The landing gear control must be located to the left of the throttle centerline or pedestal centerline.

+ Each fuel feed selector control must be located and arranged so that the pilot can see and reach it without moving any seat or primary flight control when his seat is at any position in which it can be placed.

Motion and effect of cockpit controls

+ Cockpit controls must be designed so that they operate as follows:

Controls	*Motion and effect*
Aerodynamic:	
Elevator	Rearward for nose up
Rudder	Right pedal forward for nose right, or, for wheel control, right (clockwise) for right rudder.

Doors

+ Each closed cabin with passenger accommodations must have at least one adequate and easily accessible external door.

+ No passenger door may be located with respect to any propeller disc so as to endanger persons using that door.

Seats, berths, and safety belts

+ Each seat, berth, and its supporting structure must be designed for occupants weighing at least 170 pounds and for the maximum load factors corresponding to the specified flight and ground load conditions, including emergency landing conditions.

+ Each seat, berth, and safety belt must be approved.

+ Each pilot seat must be designed for the reactions resulting from the application of pilot forces to the primary flight controls.

+ Each berth installed parallel to the longitudinal axis of the airship must be designed so that the forward part has a padded end-board, canvas diaphragm, or equivalent means that can withstand the static load reaction of the occupant when the occupant is subjected to the forward inertia forces prescribed in § 3.26. In addition --

+ Each berth must have an approved safety belt and may not have corners or other parts likely to cause serious injury to a person occupying it during emergency conditions; and

+ Safety belt attachments for the berth must be designed to withstand the critical loads resulting from relevant flight and ground load conditions and from the emergency landing conditions, with the exception of the forward load.

+ Proof of compliance with the strength and deformation requirements of this section for seats, berths, and safety belts, approved as part of the type design and for their installation, may be shown by --

1) Structural analysis, if the structure conforms to conventional aircraft types for which existing methods of analysis are known to be reliable;
2) A combination of structural analysis and static load tests to limit loads; or
3) Static load tests to ultimate loads.

+ Each occupant must be protected from serious injury when he experiences the inertia forces prescribed in § 3.26 by a safety belt for each seat.

+ There must be a means to secure each safety belt, when not in use, so as to prevent interference with the operation of the airship and with rapid egress in an emergency.

+ The cabin area surrounding each seat, including the structure, interior walls, instrument panel, control wheel, pedals, and seats, within striking distance of the occupant's head or torso (with the safety belt fastened), must be free of potentially injurious objects, sharp edges, protuberances, and hard surfaces. If energy absorbing designs or devices are used to meet this requirement, they must protect the occupant from serious injury when the occupant experiences the ultimate inertia forces prescribed in § 3.26.

+ Each seat track must be fitted with stops to prevent the seat from sliding off the track.

Cargo compartments.

+ Must be designed for its placarded maximum weight of contents and for the critical load distributions at the appropriate maximum-load-factors corresponding to the flight and ground load conditions of these requirements.

+ Must contain provisions to prevent the contents of any cargo becoming a hazard by shifting and to protect any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operations.

+ Must be constructed of materials which are at least flare resistant.

+ Designed to provide for cargo to be carried in the same compartment or adjacent to the compartment with the occupants, must have means to protect the occupants from injury under the ultimate inertia forces specified in § 3.26.

+ Where lamps are installed, each lamp must be installed so as to prevent contact between lamp bulb and cargo.

+ Not accessible to the crew while in flight must have provisions to contain a fire to allow continued safe flight and landing.

Emergency exits

+ Number and location. Emergency exits must be located to allow escape without crowding in any probable crash attitude. The airship must have at least the following emergency exits:

+ For all Airships, except those with all engines mounted on the approximate centerline of the car that have a seating capacity of five or less, at least one emergency exit on the opposite side of the cabin f ran the main door specified in § 4.33.

+ If the pilot compartment is separated from the passenger compartment with a door that is likely to block the pilot's escape in a minor crash, there must be an exit in the pilot's compartment. The number of exits required by subparagraph (1) must then be separately determined for the passenger compartment, using the seating capacity of that compartment.

+ Type and operation. Emergency exits must be moveable windows, panels, or external doors, that provide a clear and unobstructed opening large enough to admit a 19-by-26-inch ellipse. In addition, each emergency exit must --

1) Be readily accessible, requiring no exceptional agility when used in emergencies;
2) Have a method of opening that is simple and obvious;
3) Be arranged and marked for easy location and operation, even in darkness; and
4) Have reasonable provisions against jamming by car deformation.

+ The proper function of each emergency exit must be shown by tests.

For each compartment to be used by the crew or passengers, the following apply:

+ The materials must be at least flame-resistant.

+ Provide at least one approved and appropriately placarded handheld fire extinguisher.

+ Lines, tanks, or equipment containing fuel, oil, or other flammable fluids may not be installed in such compartments unless adequately shielded, isolated, or otherwise protected so that any breakage or failure of such an item would not create a hazard.

+ Materials located on the cabin side of the fire wall must be self-extinguishing or be located at such a distance from the fire wall, or otherwise protected so that ignition will not occur if the fire wall is subject to a flame temperature of not less than 2,000 degrees F for 15 minutes. For self-extinguishing materials (except electrical wire and cable insulation and small parts that the Administrator finds would not contribute significantly to the propagation of a fire), a vertical self-extinguishing test must be conducted in accordance with Appendix F of Part 23 of the FAR or an equivalent method approved by the Administrator. The average burn length of the material may not exceed 6 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the material test specimen may not continue to flame for more than an average of 3 seconds after falling.

Conclusion

On reviewing the required design standards the designer has gained greater knowledge into what is needed to be covered in the interior component of this project. It has also broadened knowlege on specific components/items that need to be placed within the interior compartment and the basic structure/organisation requirements needed for the cabin package.

Key requirements:

+ Unobstructed cabin space free from clutter.

+ The pilots view should be extensive, clear and undisturbed.

+ The pilot should be sufficiently protected from the elements.

+ Windshield and windows should always be clear and be made from non-splintering material.

+ Cockpit controls should be labelled when function is not obvious.

+ The controls must be located and arranged so that the pilot has full and unrestricted movement of each control without interference from clothing or cockpit structure.

+ Multiple power plant controls must be labelled to prevent confusion as to which engine they control.

+ The landing gear control must be located to the left of the throttle centerline.

+ Closed cabins must have easily accessible doors and not be located near any propeller disc.

+ Seat belts must be included in the design.

+ The cargo area must contain provisions to prevent cargo moving during flight.

+ The cargo area must be constructed from at least flare resistant materials.

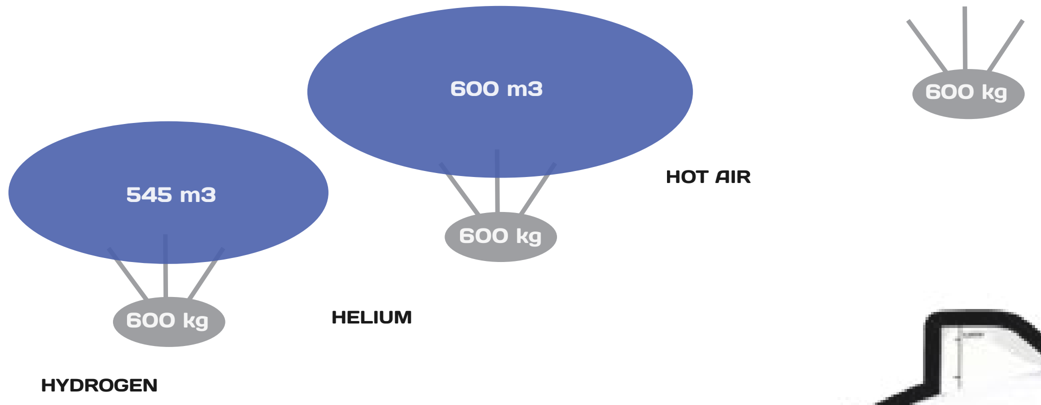
+ An emergency exit.

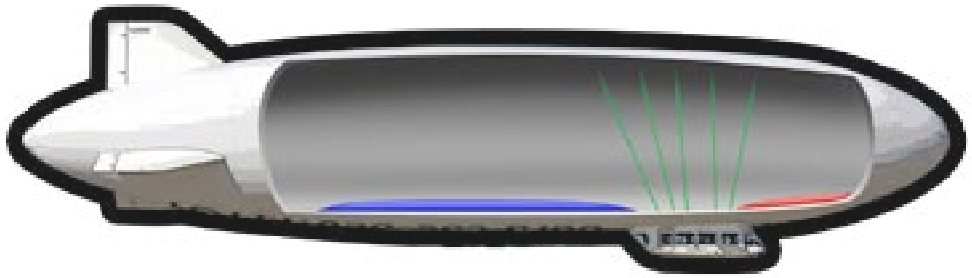
+ Interior compartment/s used by crew or passengers must be made out of at least flame resistant material.

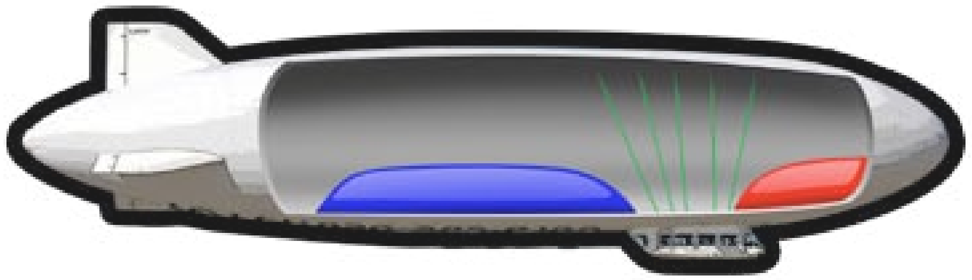
+ Fire extinguisher/s.

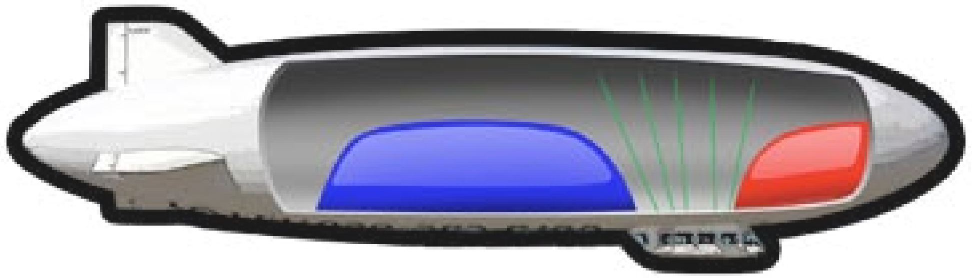
2.14 HOW AIRSHIPS WORK

As a rule of thumb 1 cubic meter of Hydrogen gas is capable of lifting approximately 1.1 kilograms, 1 m3 of Helium gas is able to lift 1 kg and 1 m3 of hot air lifts 300 grams.







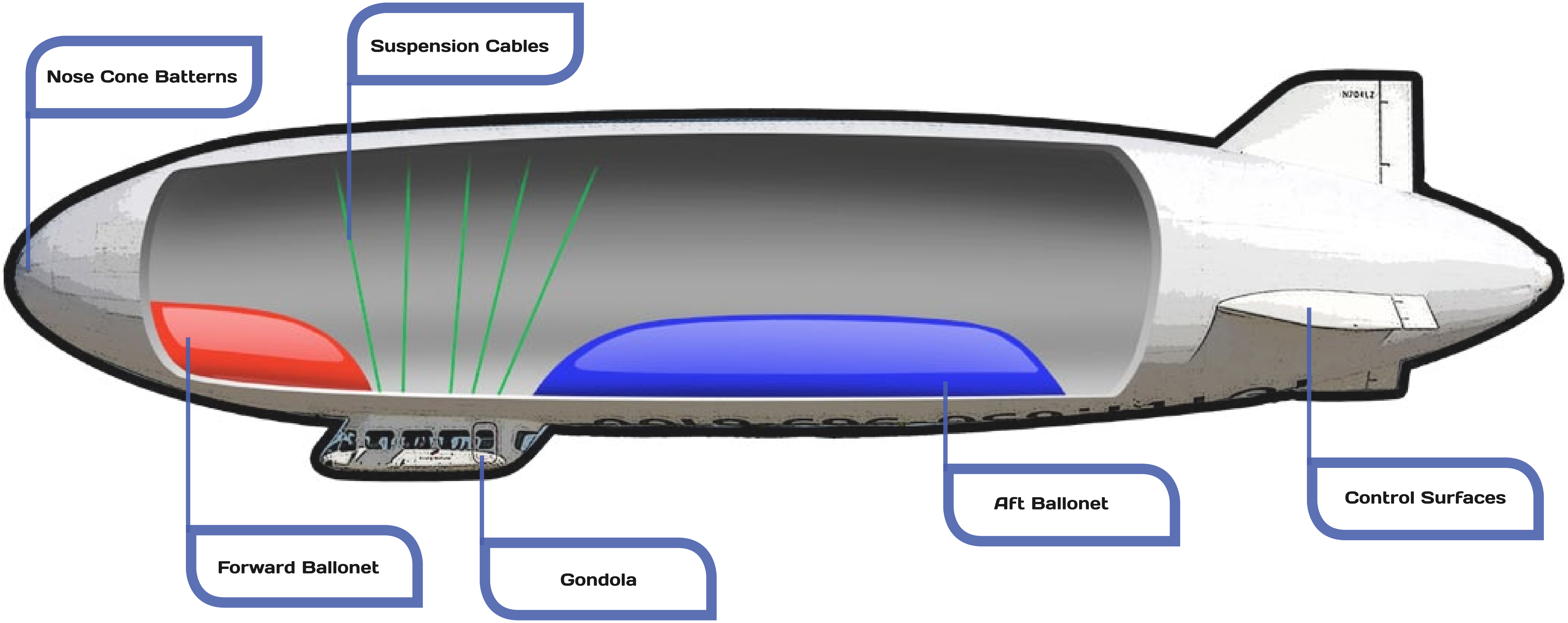


An Airship controls its buoyancy in the air much like a submarine does in the water. The ballonets act like ballast tanks holding “heavy” air. When the blimp takes off, the pilot vents air from the ballonets through the air valves. The helium makes the blimp positively buoyant in the surrounding air, so the blimp rises.

As the blimp rises, outside air pressure decreases and the helium in the envelope expands. The pilots then pump air into the ballonets to maintain pressure against the helium. Adding air makes the blimp heavier, so to maintain a steady cruising altitude, the pilots must balance the air-pressure with the helium-pressure to create neutral buoyancy.

2.15 ANATOMY OF AN AIRSHIP

The below imagery provides an overview of the basic components that make up an airship.



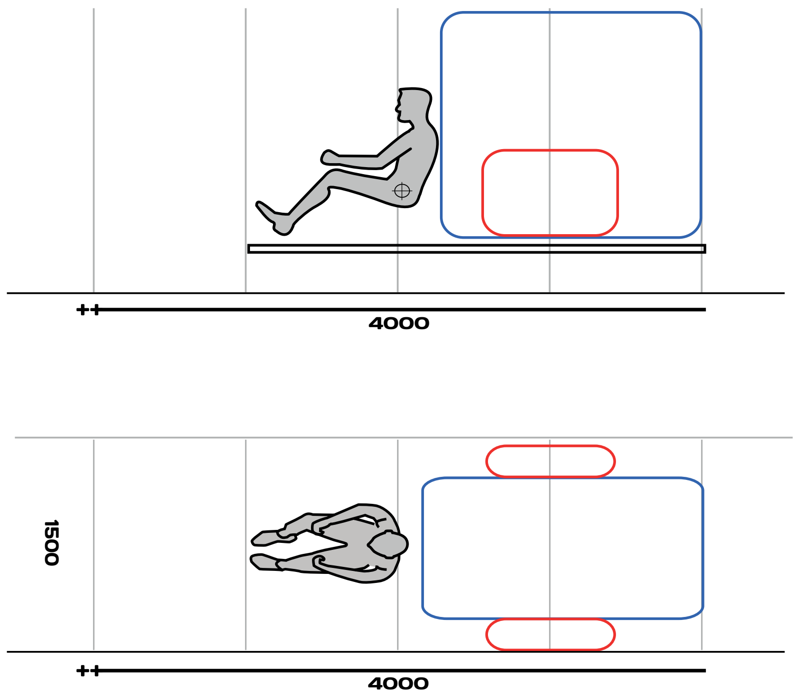
An Airship controls its elevation by increasing and decreasing the amount of air in the internal ballonets. Air is sucked in via external airscoops (left) when descending and vented via valves (right) when ascending. Fans provide forward motion.

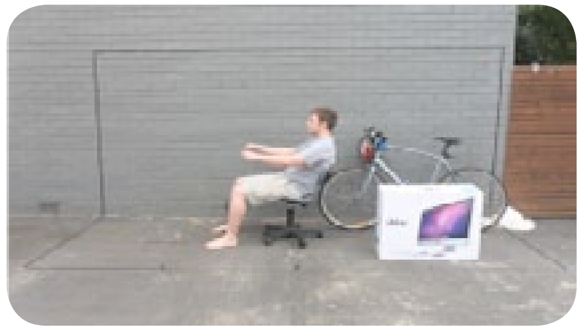
2.16 BODY STORMING

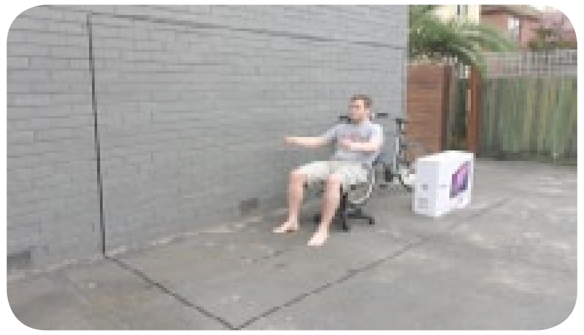
The below imagery is from an exercise used to generate vehicle packing ideas. Using a previously determined footprint and everyday items one is able gain a general idea on where components and passengers alike could be placed.

POWER SOURCE **STORAGE AREA**

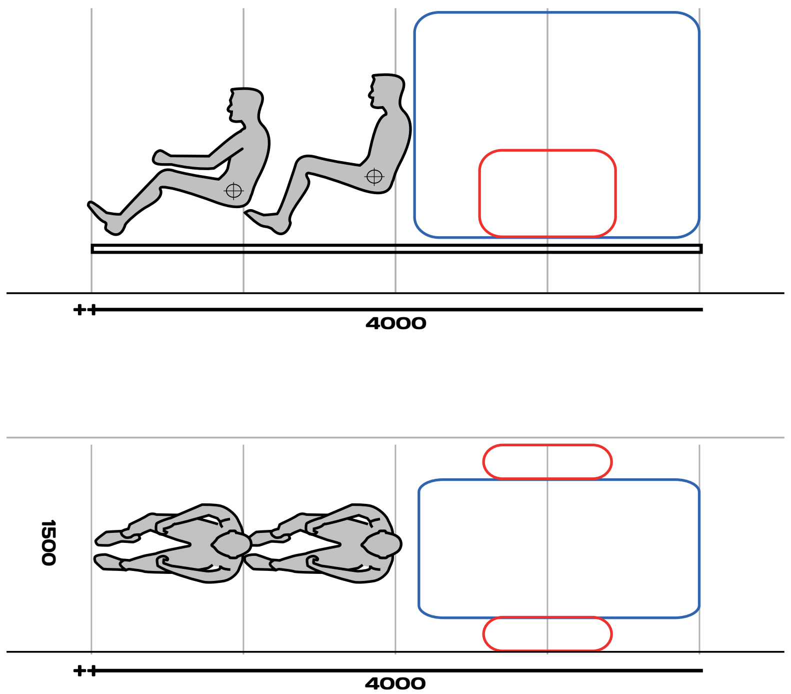
SINGLE OCCUPANT

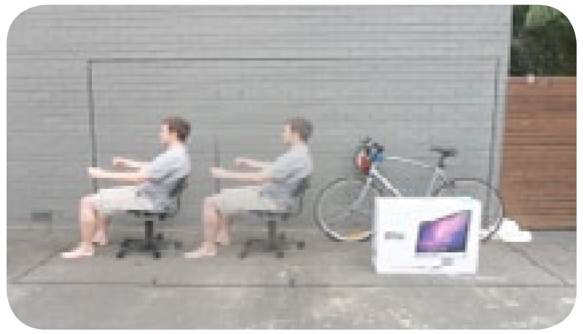


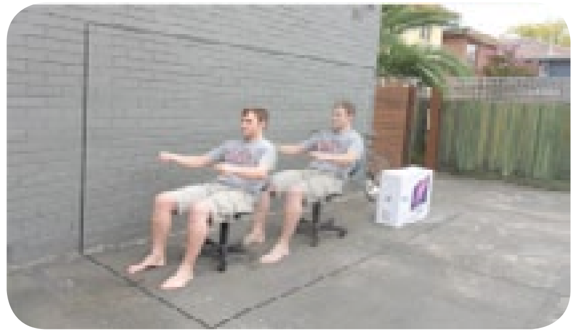




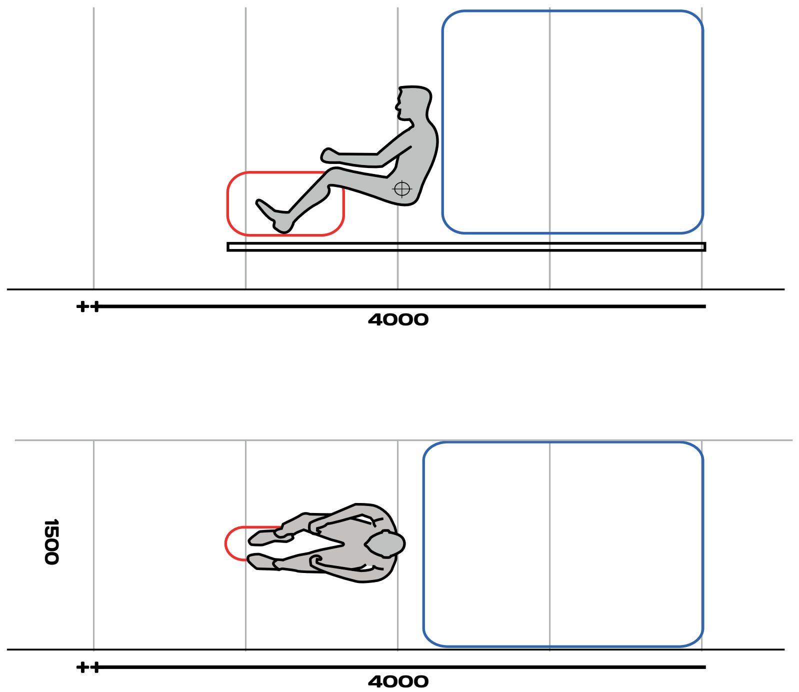
TWO OCCUPANTS

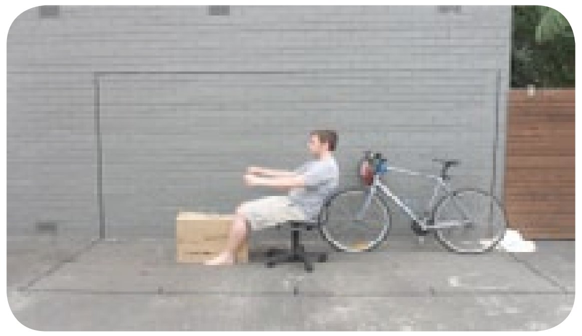




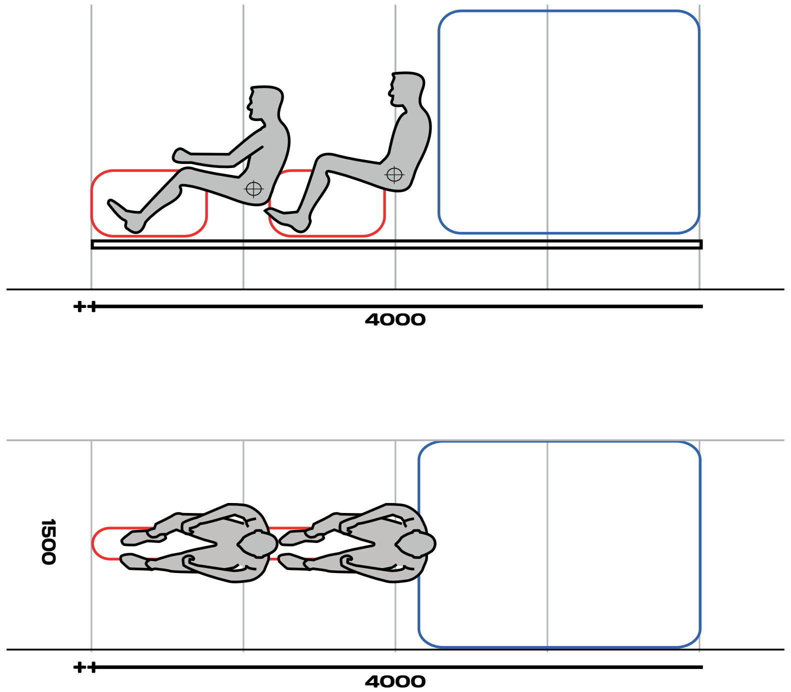


SINGLE OCCUPANT ALT. POWER SOURCE





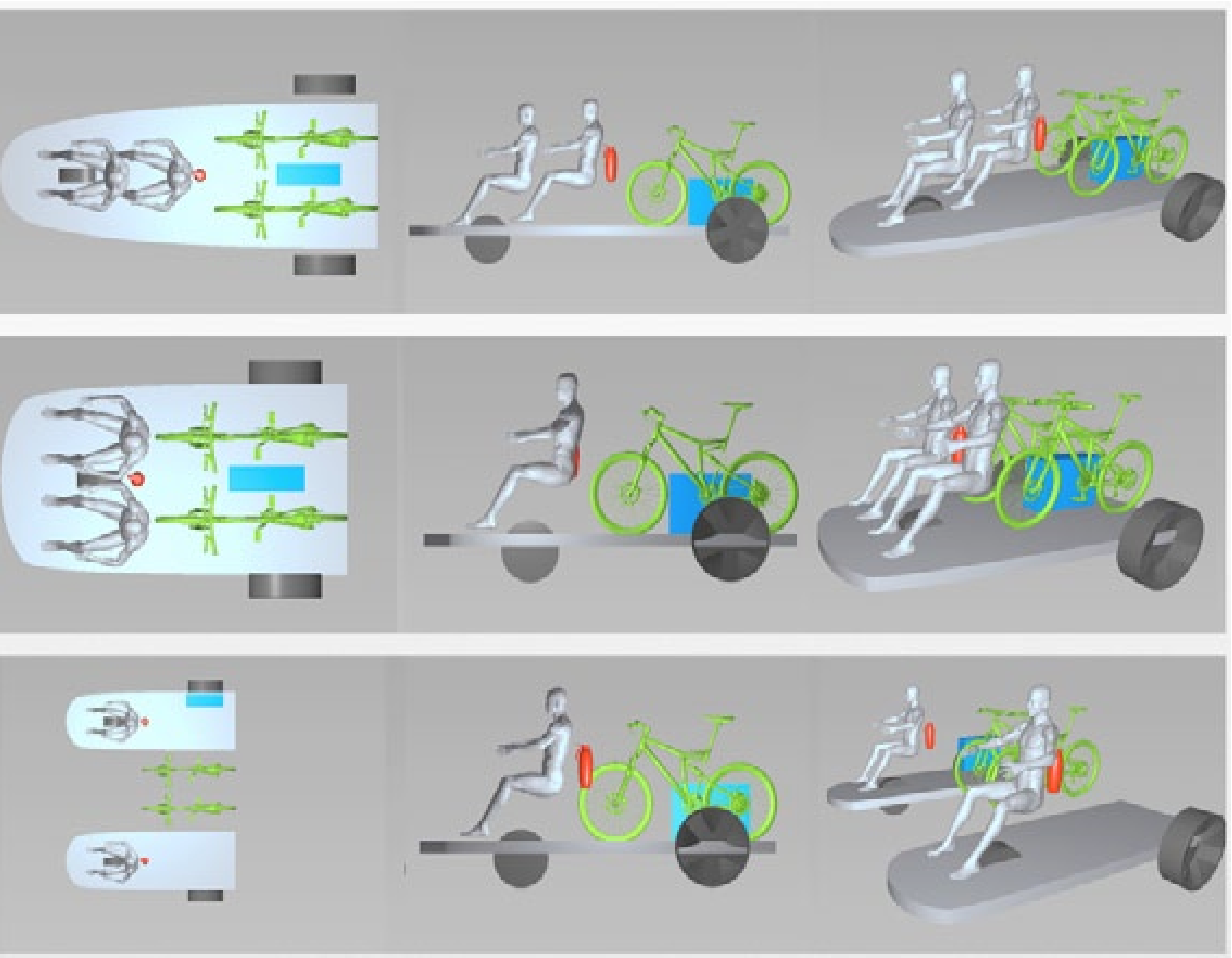
TWO OCCUPANTS ALT. POWER SOURCE

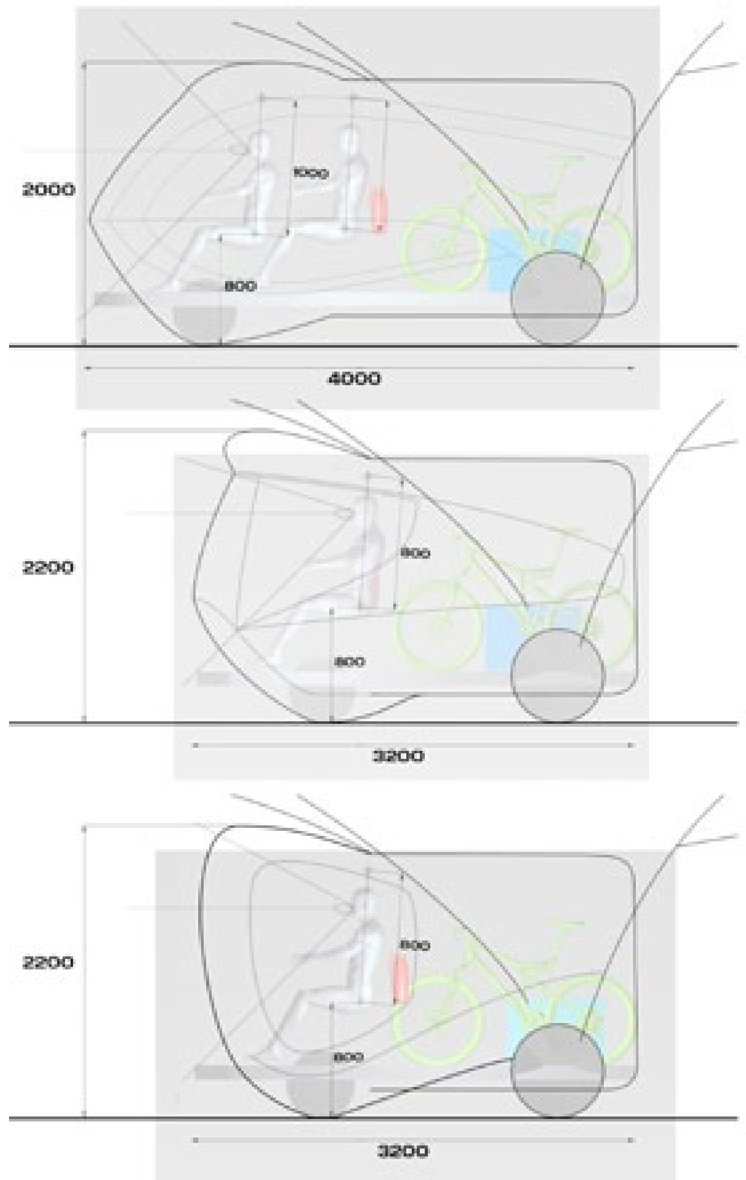


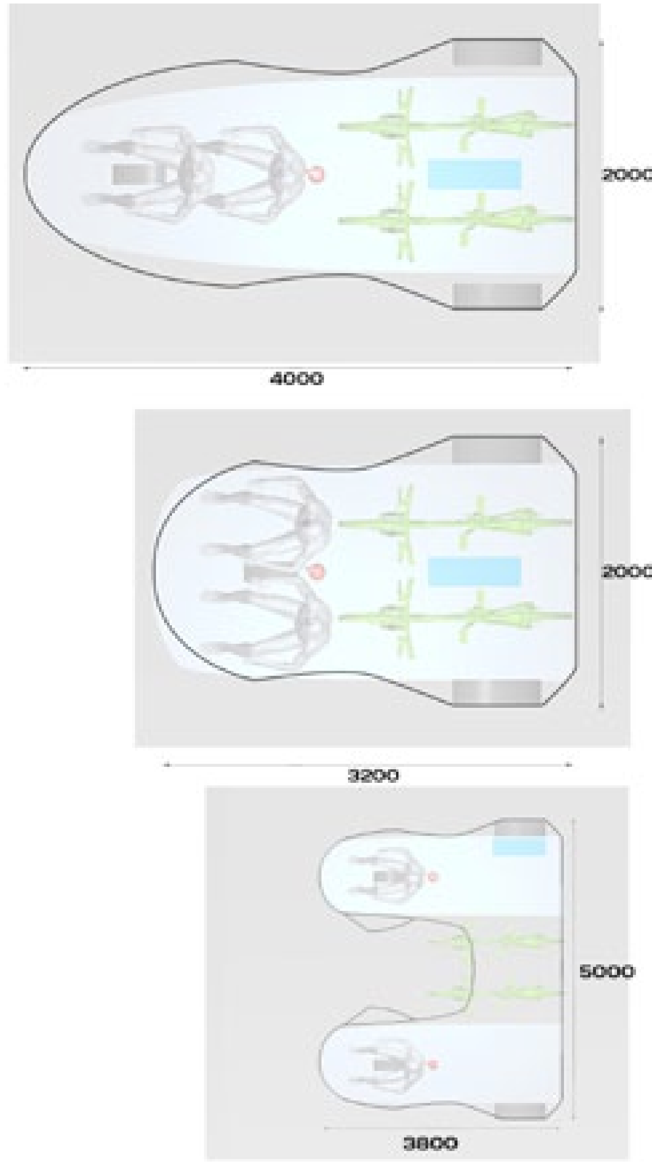
2.17 PACKAGE IDEATION

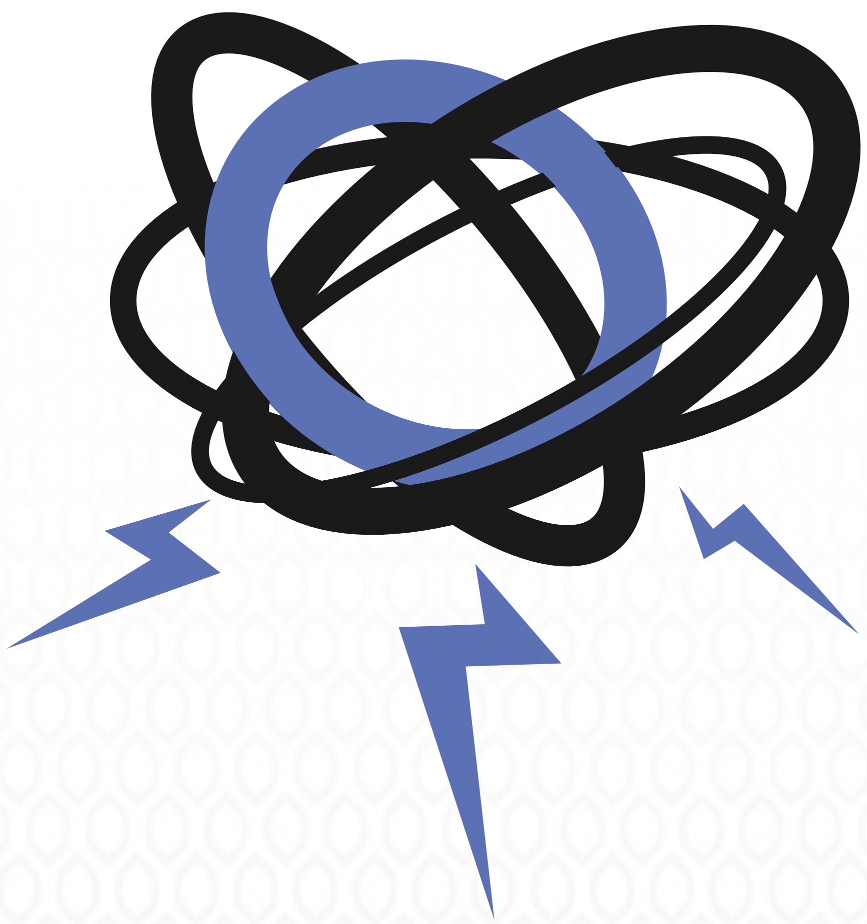
WIth information gathered from the body storming exercise packages were then realised in CAD. CAD offers flexibility in the process as it allows for components to be arranged to any liking within a 3D space. More concepts can be generated (and faster) through this medium as one does not need to deal with physical space restrictions and environmental hazards!

Post process three packages were selected to be used in the concept design phase of the project. Eventually one of these packages would grow and evolve to form the basis of the final design concept.









3

CONCEPT CREATION

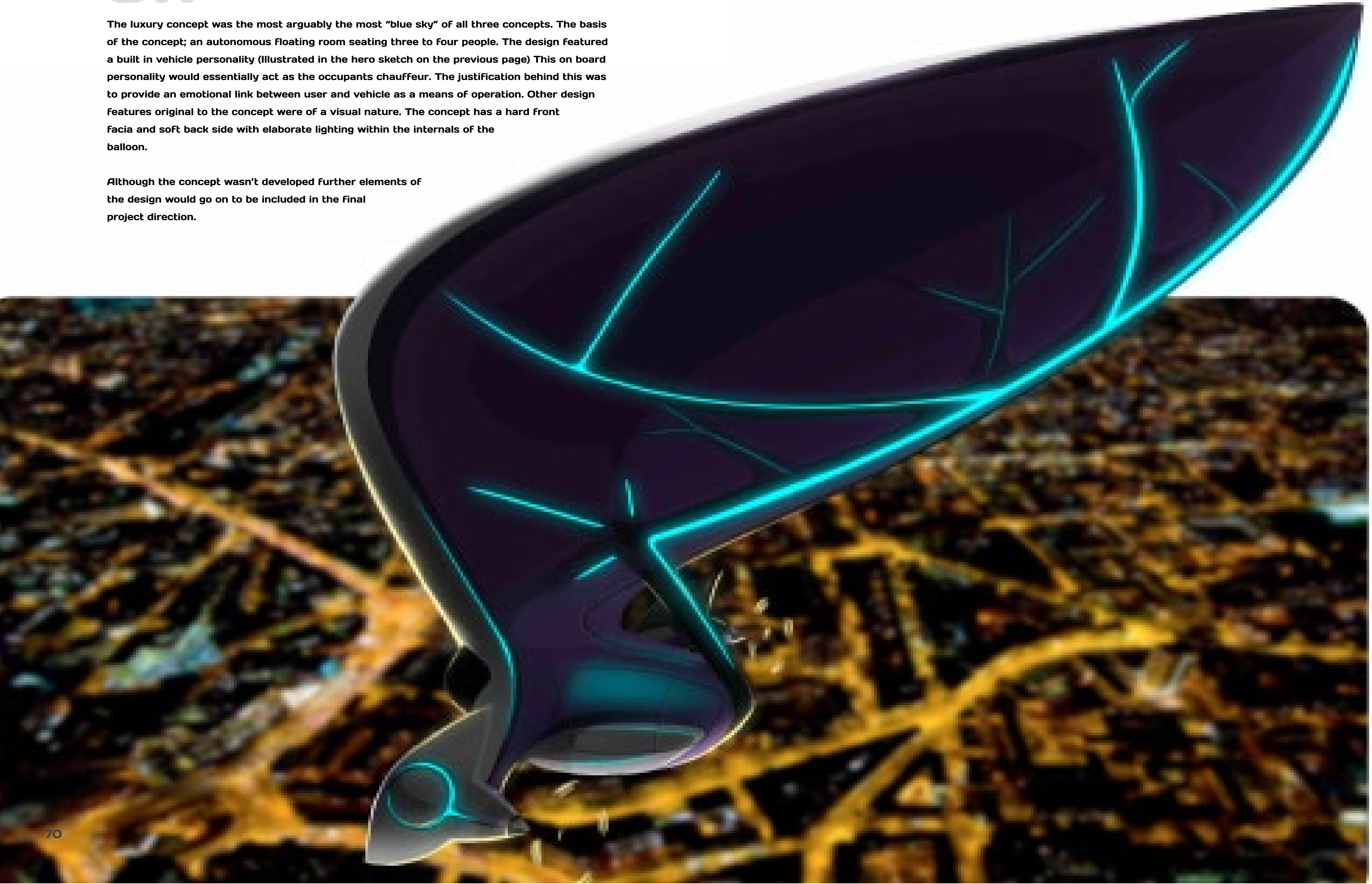
The concept design phase of the project called on designers to take what they had learned in their critical justification research and apply it to three distinct concepts. The three concepts produced in essence applied what was learnt, however the concepts failed to wow and, in hindsight lacked definition and originality. A fourth concept was then created. This concept, which was intentionally against the grain would go on to provide the design basis for Escape. Incidentally “Concept 4” as it is sometimes affectionately referred to would go on to be much better received by lecturers and peers than the originals.

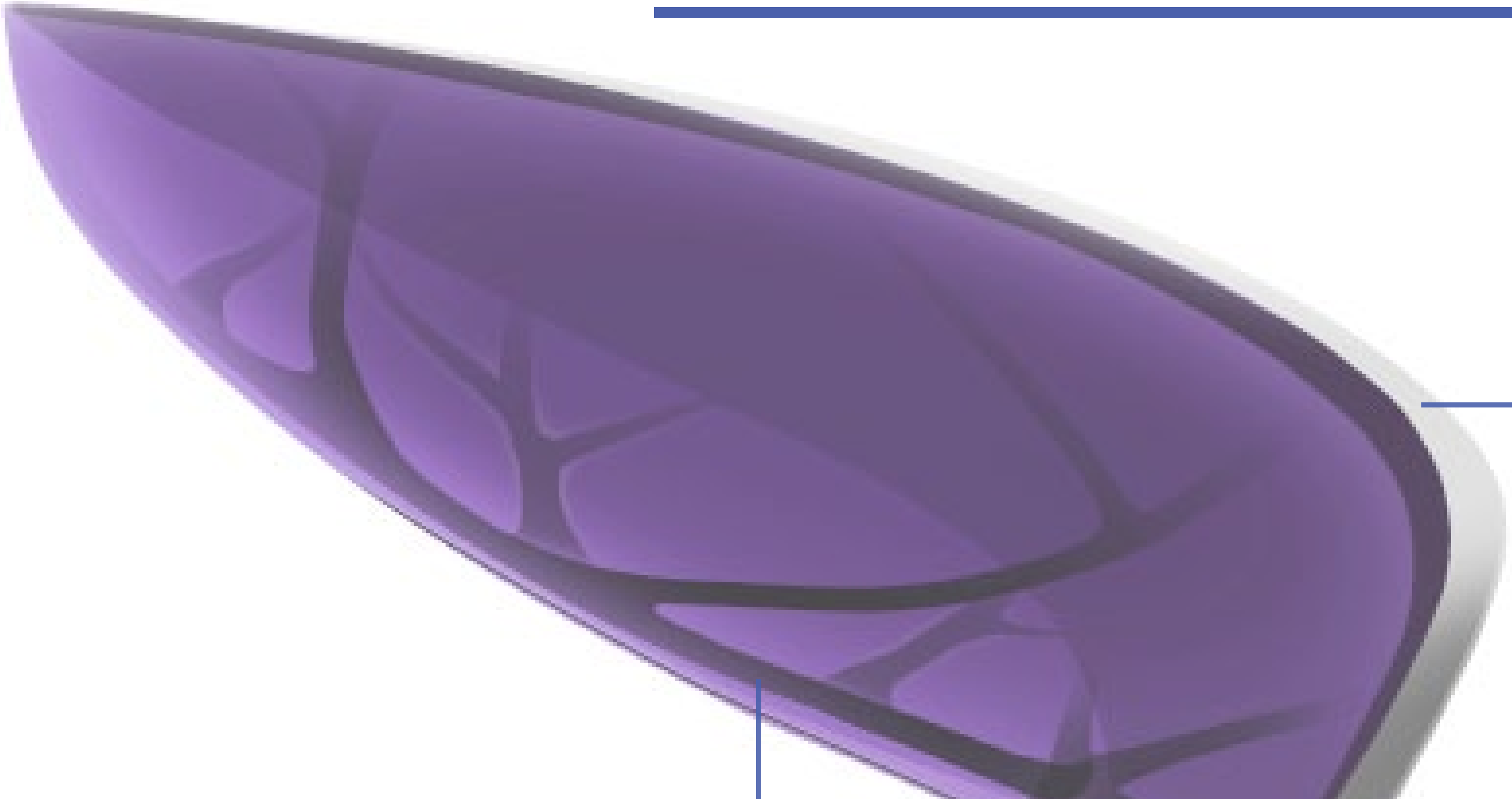
CONCEPT 1 – "LUXURY"

3.1 CONCEPT 1 – “LUXURY”

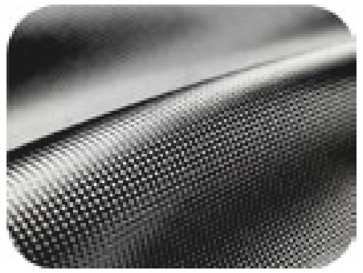
The luxury concept was the most arguably the most “blue sky” of all three concepts. The basis of the concept; an autonomous floating room seating three to four people. The design featured a built in vehicle personality (Illustrated in the hero sketch on the previous page) This on board personality would essentially act as the occupants chauffeur. The justification behind this was to provide an emotional link between user and vehicle as a means of operation. Other design features original to the concept were of a visual nature. The concept has a hard front facia and soft back side with elaborate lighting within the internals of the balloon.

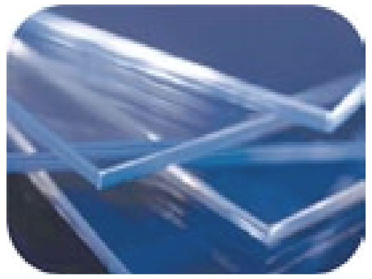
Although the concept wasn’t developed further elements of the design would go on to be included in the final project direction.

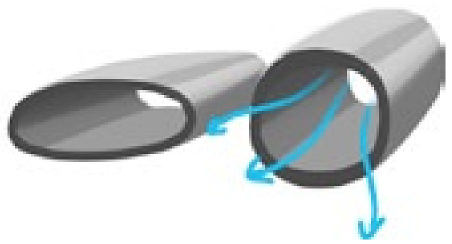




Polycarbonate "facade"
Carbon fiber structure

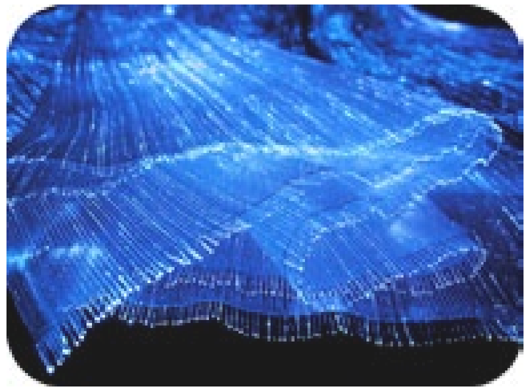






Polyurethane tubing filled with air provides structure

OLED/backlit glass display

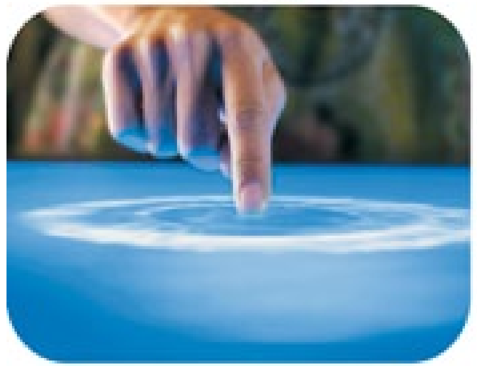


Polyester weather resistant coated fabrics
Impregnated optic fibres for visual display

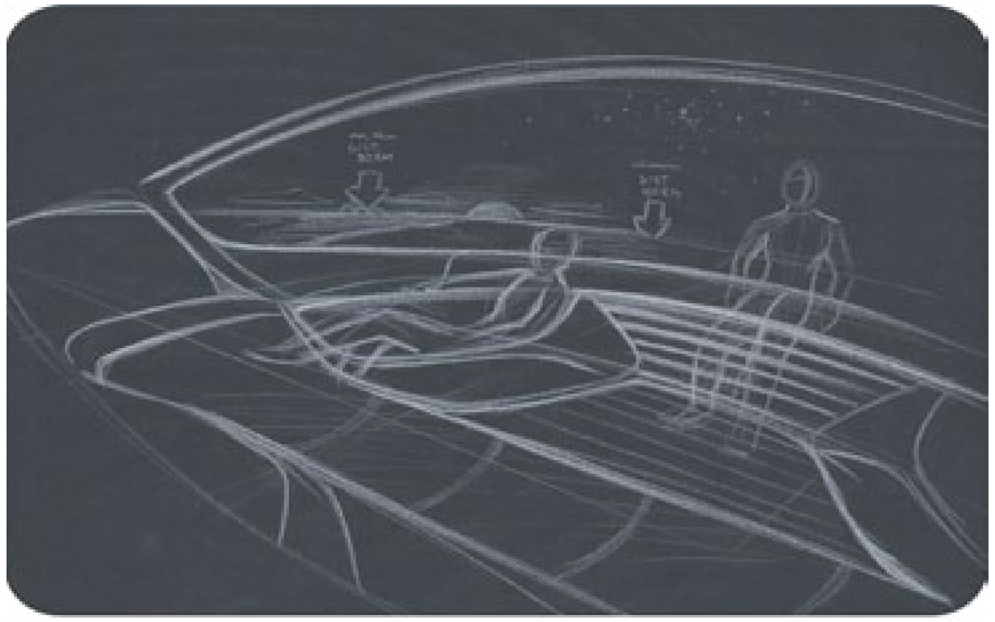
FURTHER DEVELOPMENT

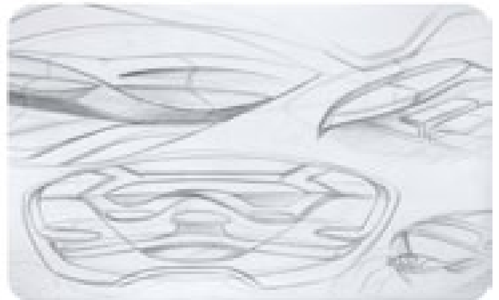
The interior of the concept was also taken into consideration. The interior of the concept would feature a lounge like layout for up to four people. Interactive displays would keep the occupants busy whilst travelling.

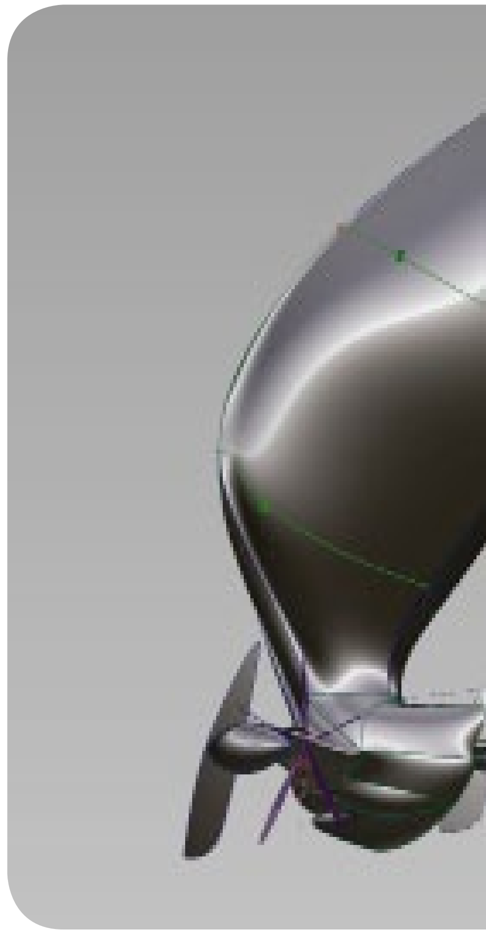
A sketch CAD model was also produced based on relevant packaging data. Whilst the CAD would not win any awards for excellence it did work as a good proportional model.







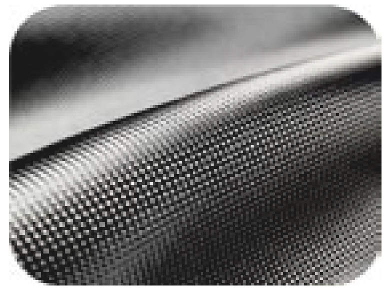


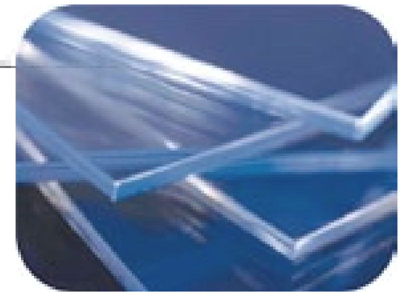

SURF RESCUE

3.2 CONCEPT 2 – "UTILITY"

The utility concept was designed to be an "all rounder work horse" seating one or two occupants. Scenarios illustrated included urban package/small freight delivery (below) and surveillance/support craft (previous page). The concept features expandable storage compartments for extra hauling. The vehicles design was intentionally kept simple. Large surfaces across the balloon allows for branding and or 2D graphical elements. Utility like the luxury concept featured built in autonomy for autonomous package delivery or to be used in a surveillance drone type application.

Polycarbonate "Shell"
Carbon fibre structure



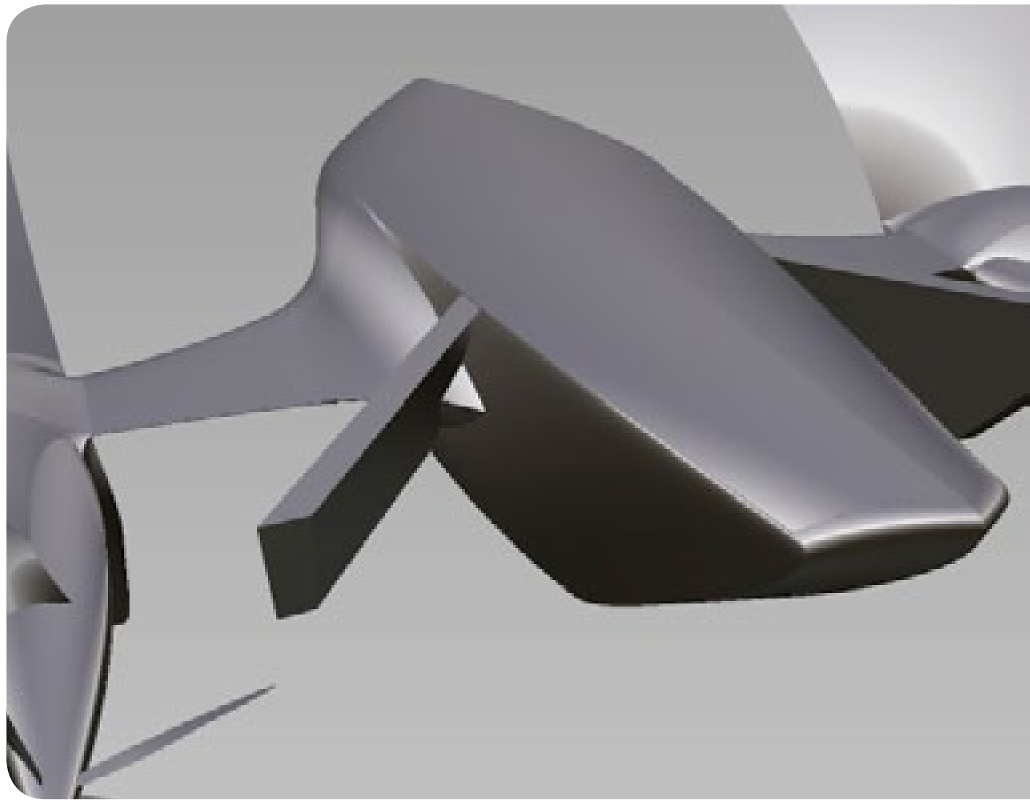


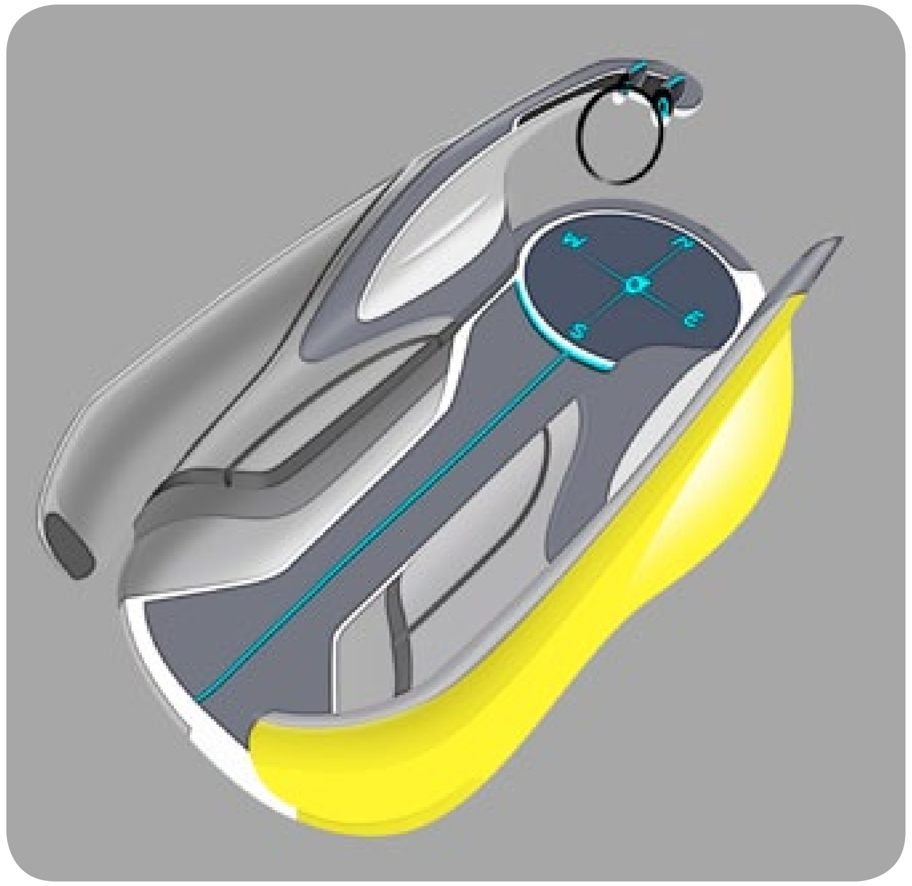
Polyester weather resistant coated fabrics
Textured materials, flexible functional surfaces doors and expandable storage

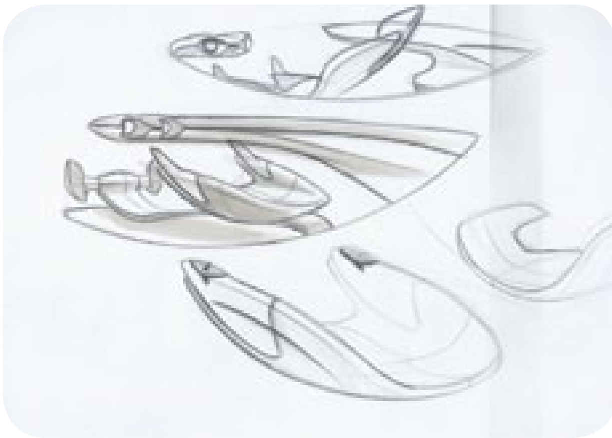
FURTHER DEVELOPMENT

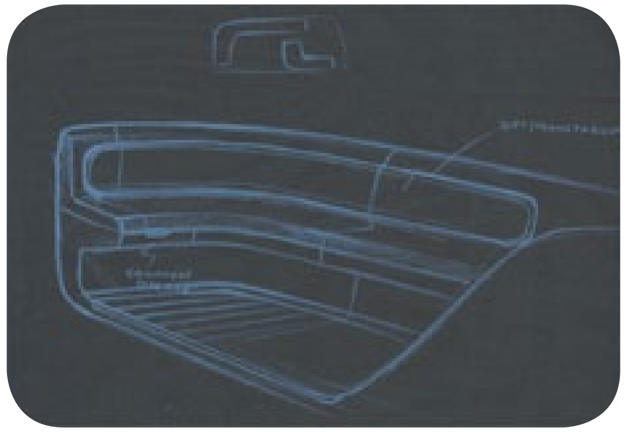
The interior of this concept was taken into consideration. The principle sketch featuring adaptable seating for either passenger transport of cargo transport applications.

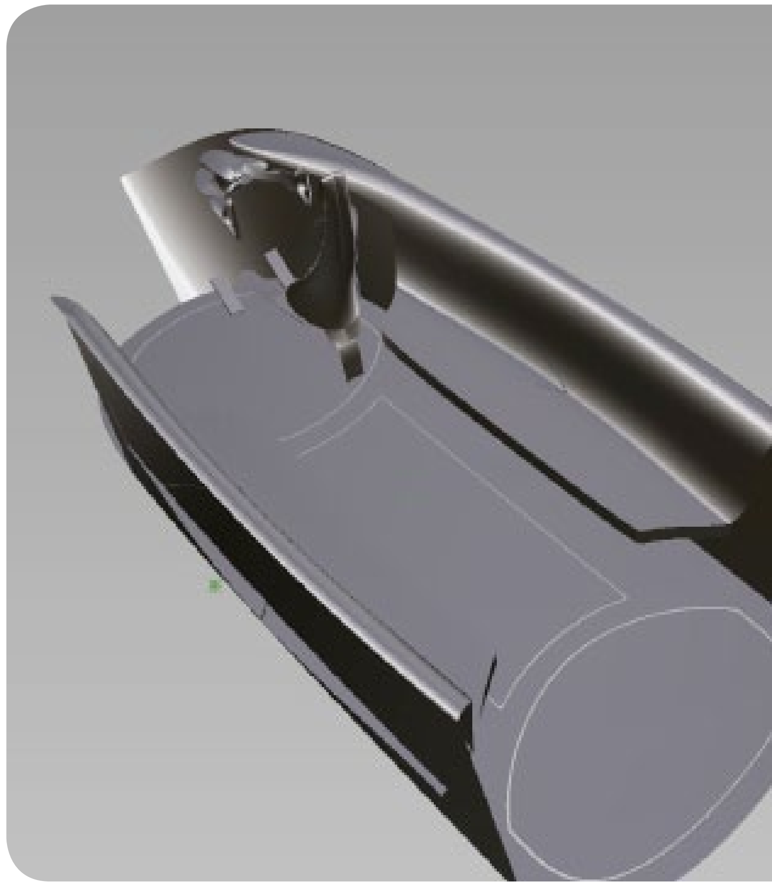
Once again a sketch CAD model was also produced based on relevant packaging data.







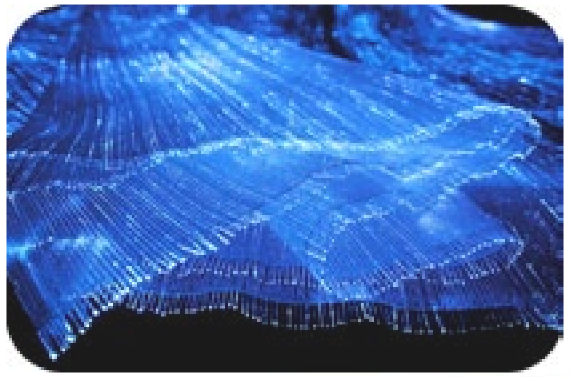




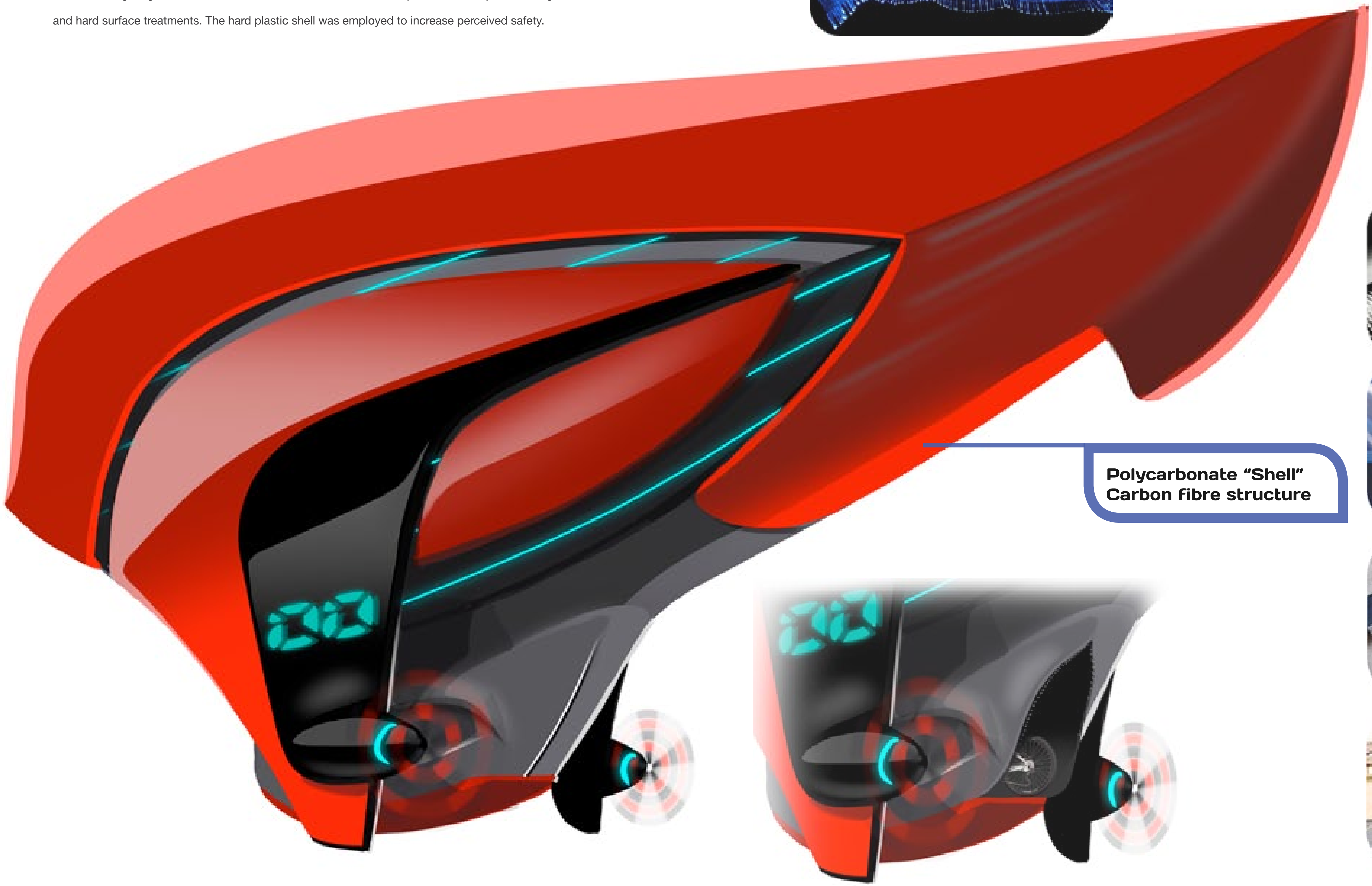
CONCEPT 3 – "SPORT"

3.3 CONCEPT 3 – "SPORT"

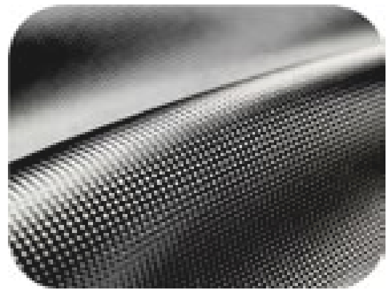
The Sport concept seats 2, a pilot and co-pilot. The concept is designed with recreation and competitive racing in mind. Features include rear storage area for two full sized mountain bikes, programmable OLED body side panel and customised lighting embedded in the balloon surface. Much like the previous concepts the design features both soft and hard surface treatments. The hard plastic shell was employed to increase perceived safety.

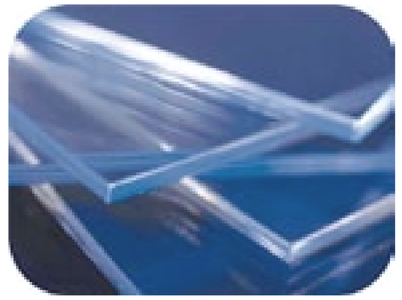


Polyester weather resistant coated fabrics
Impregnated optic fibres for visual display



Polycarbonate "Shell"
Carbon fibre structure

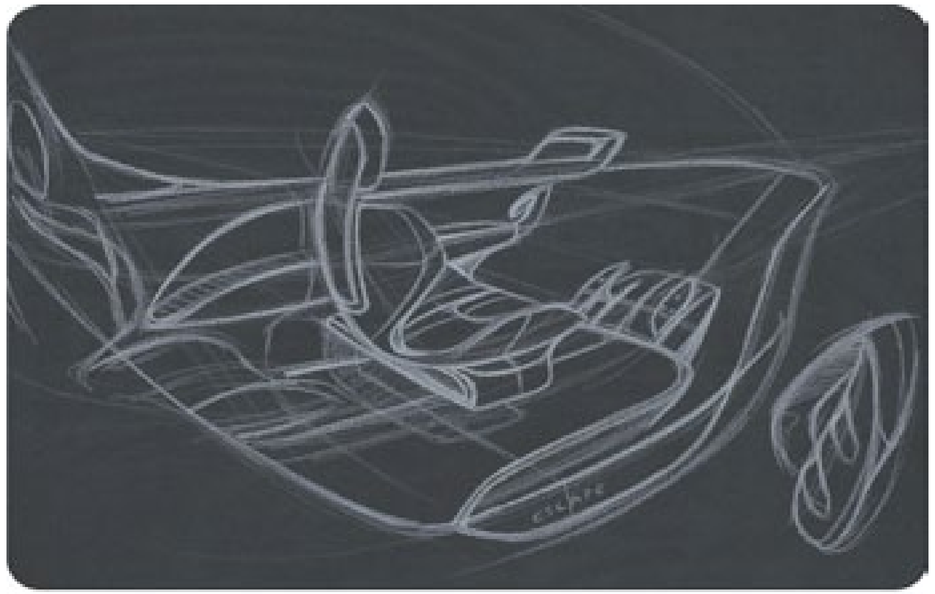


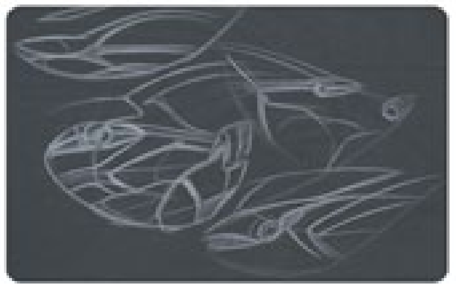


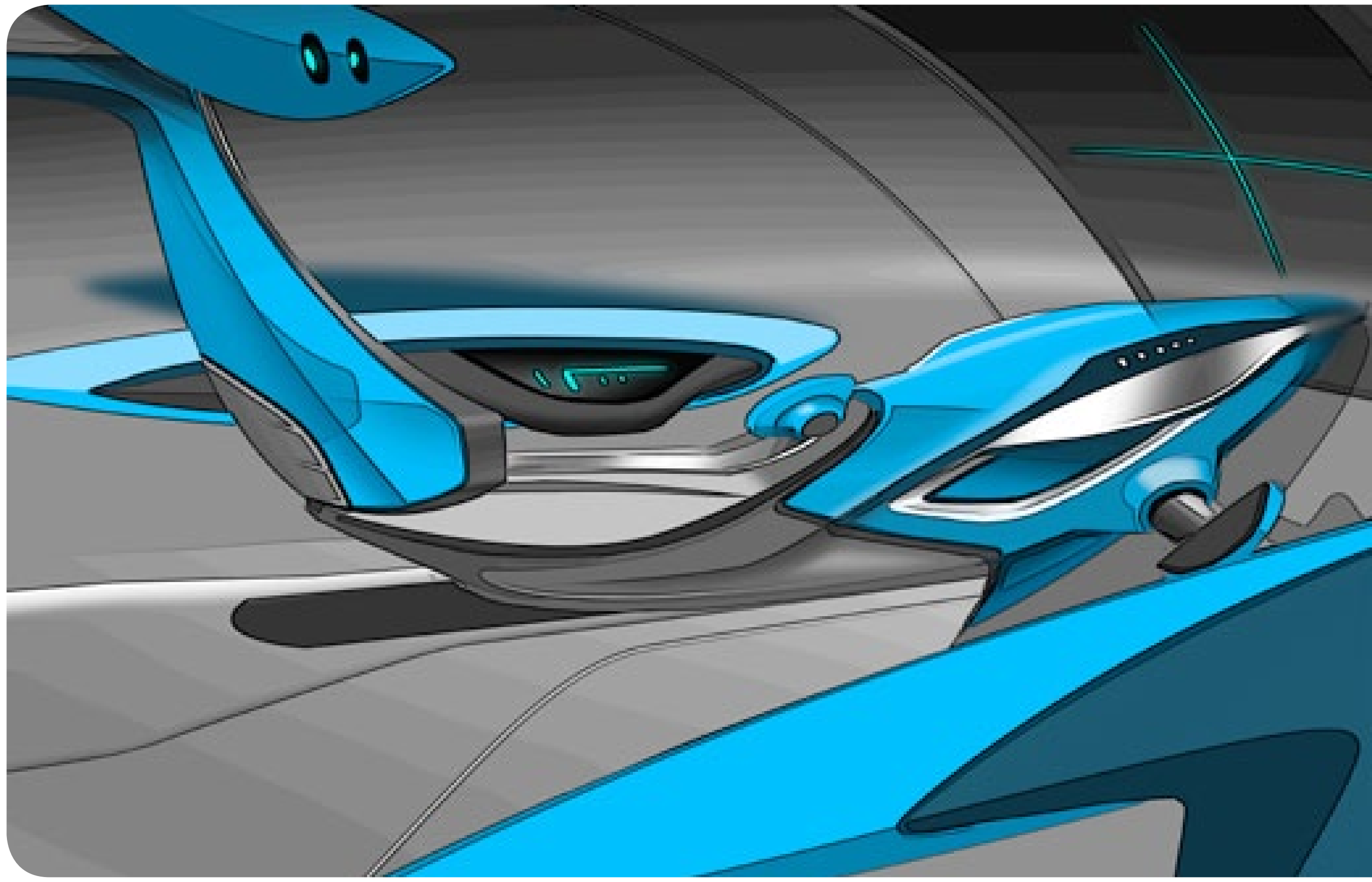
FURTHER DEVELOPMENT

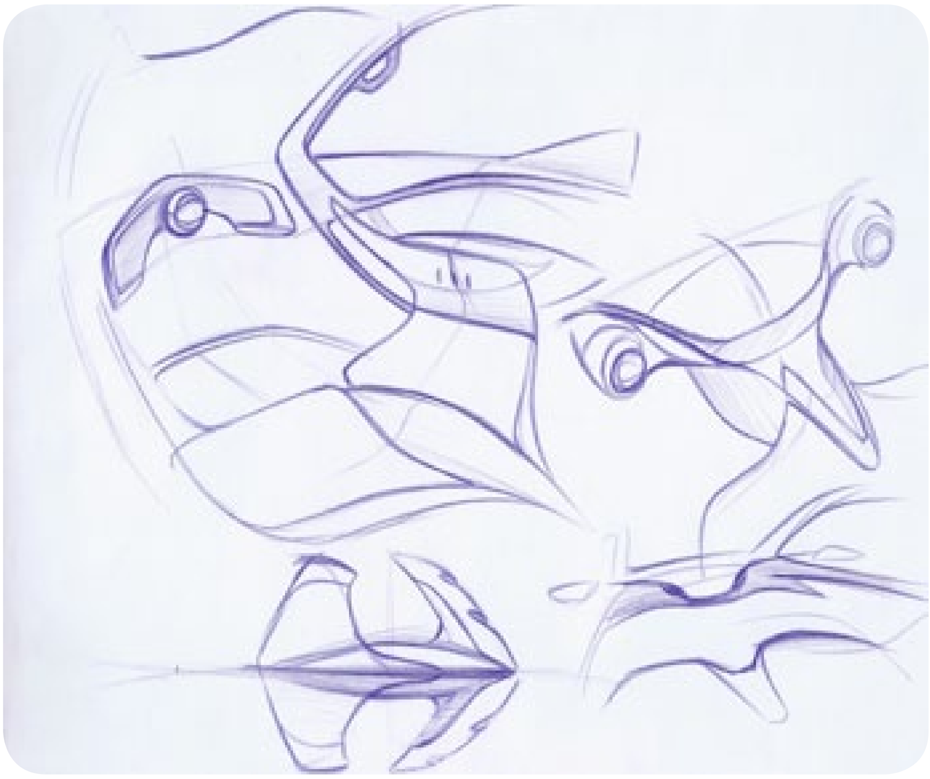
The interior of the sport concept is driver focussed. Previous concepts used an autonomous flight functionality therefore the interior needed to be more technical in its execution. The sketch on the far right takes influence from a motorcycle, with the idea being the pilot would straddle the controls being able to control the roll of the craft by shifting his or her weight, pitch via the foot pedals and direction via head movement.

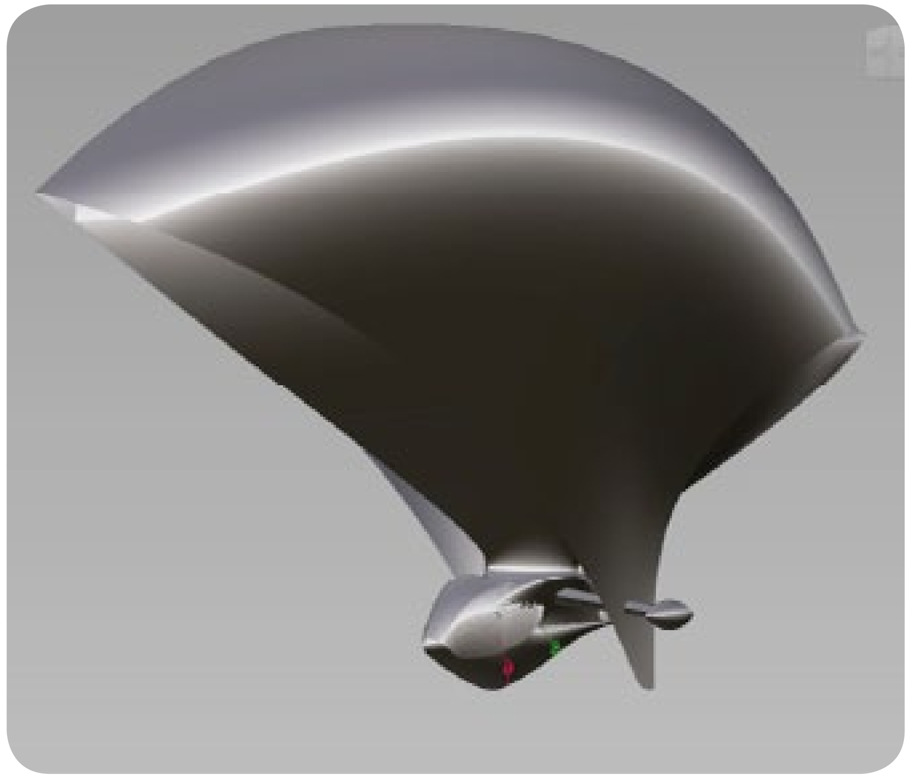
A partial sketch model was completed and once again was used as a proportional model.











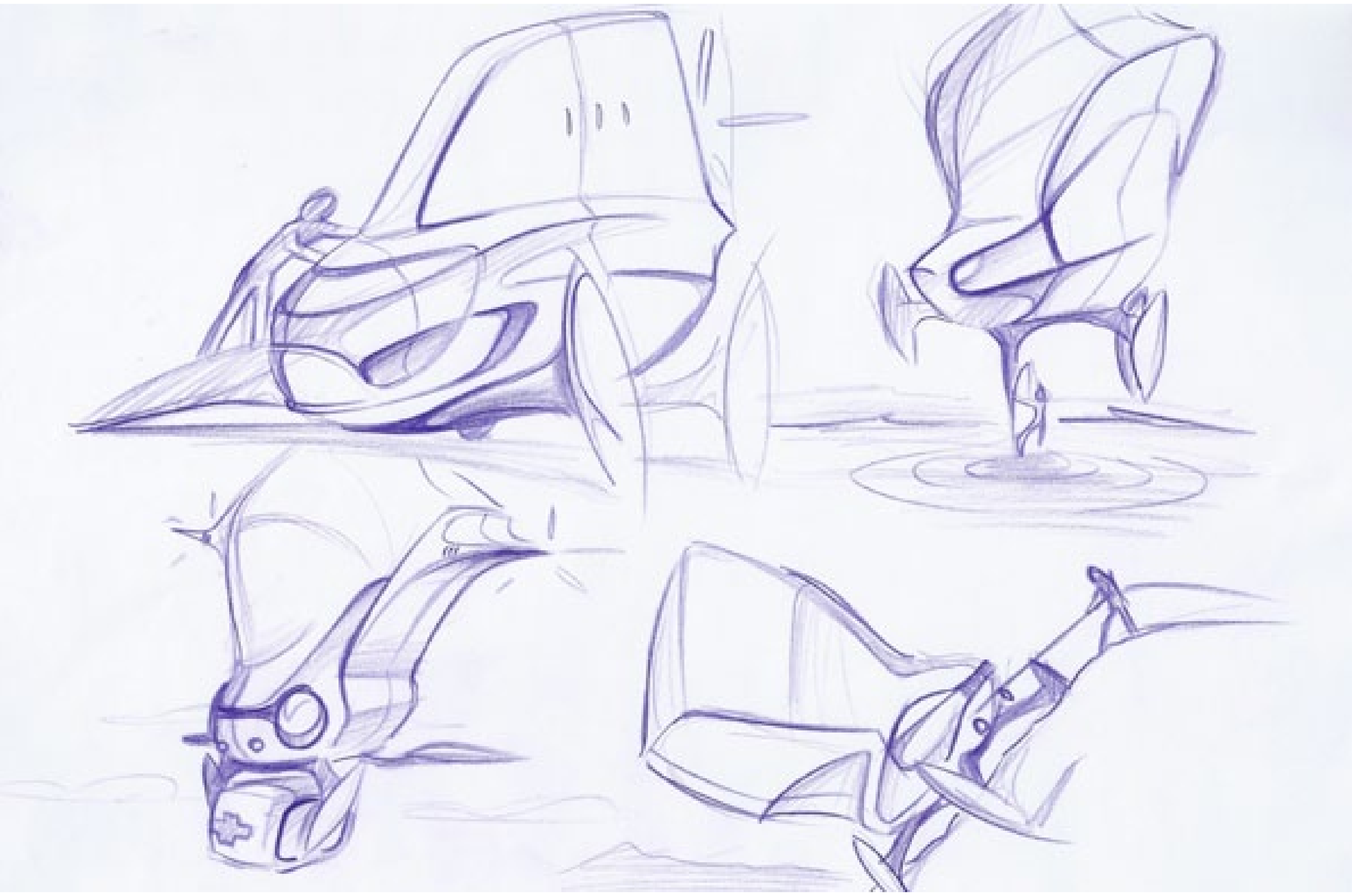
ESCAPE - AKA CONCEPT 4

3.4 CONCEPT 4 – "ESCAPE"

The original Escape aka concept 4 concept came as a response to the previous three concepts. Lecturers and peers alike shared similar opinions on the presented ideas. The general consensus being that the concepts only partially reflected the original objectives and that they relied on existing notions or expectations regarding what an airship should look like and how it should function.

Lessons learned, plans for concept four were drawn up. Drawing on a variety influences from insects, nylon toys and science fiction the resulting concept not only looked completely differently but fundamentally challenged existing airship design lore.

Escape is not only an airship. It is a culmination of different technologies that form a unique vehicle concept. Escape is at its core an Escape vehicle, allowing the user to traverse a variety of terrains on the ground as well as travel through the air.



The above sketches were key in defining the overall feeling of the concept.

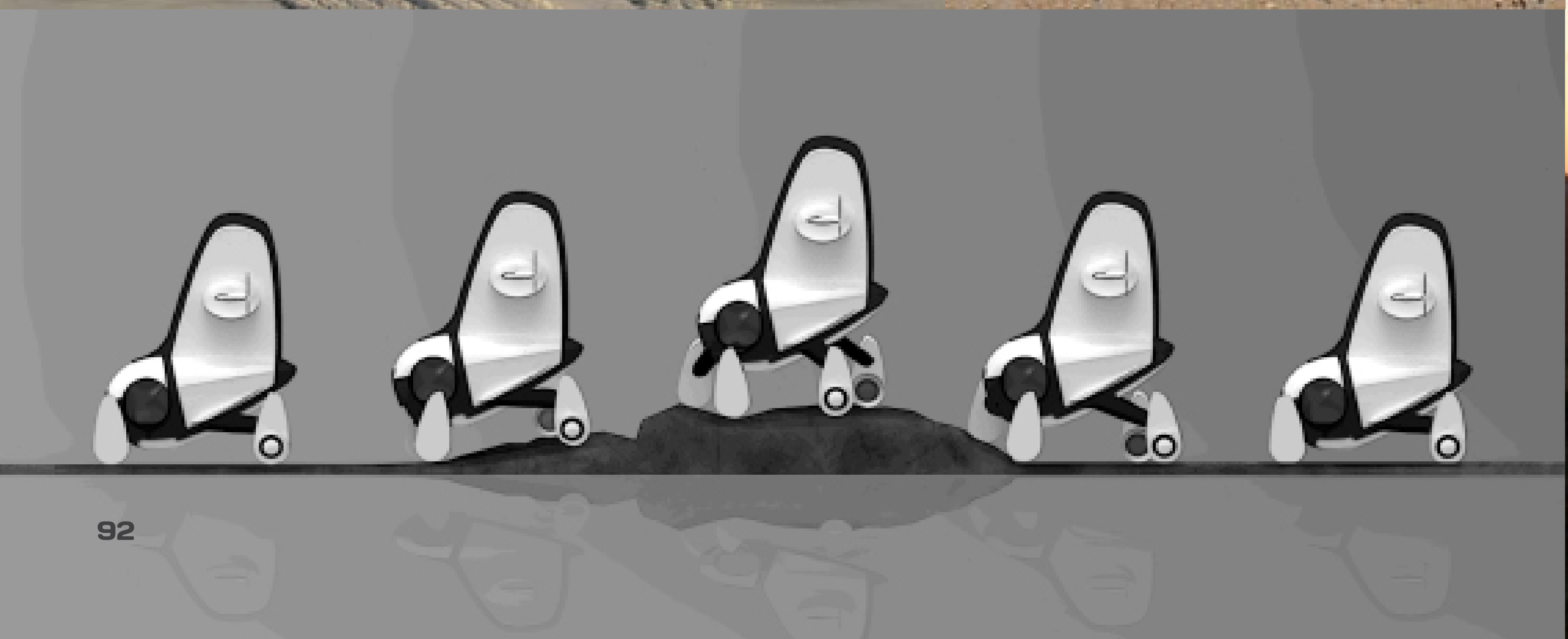
Walker mode

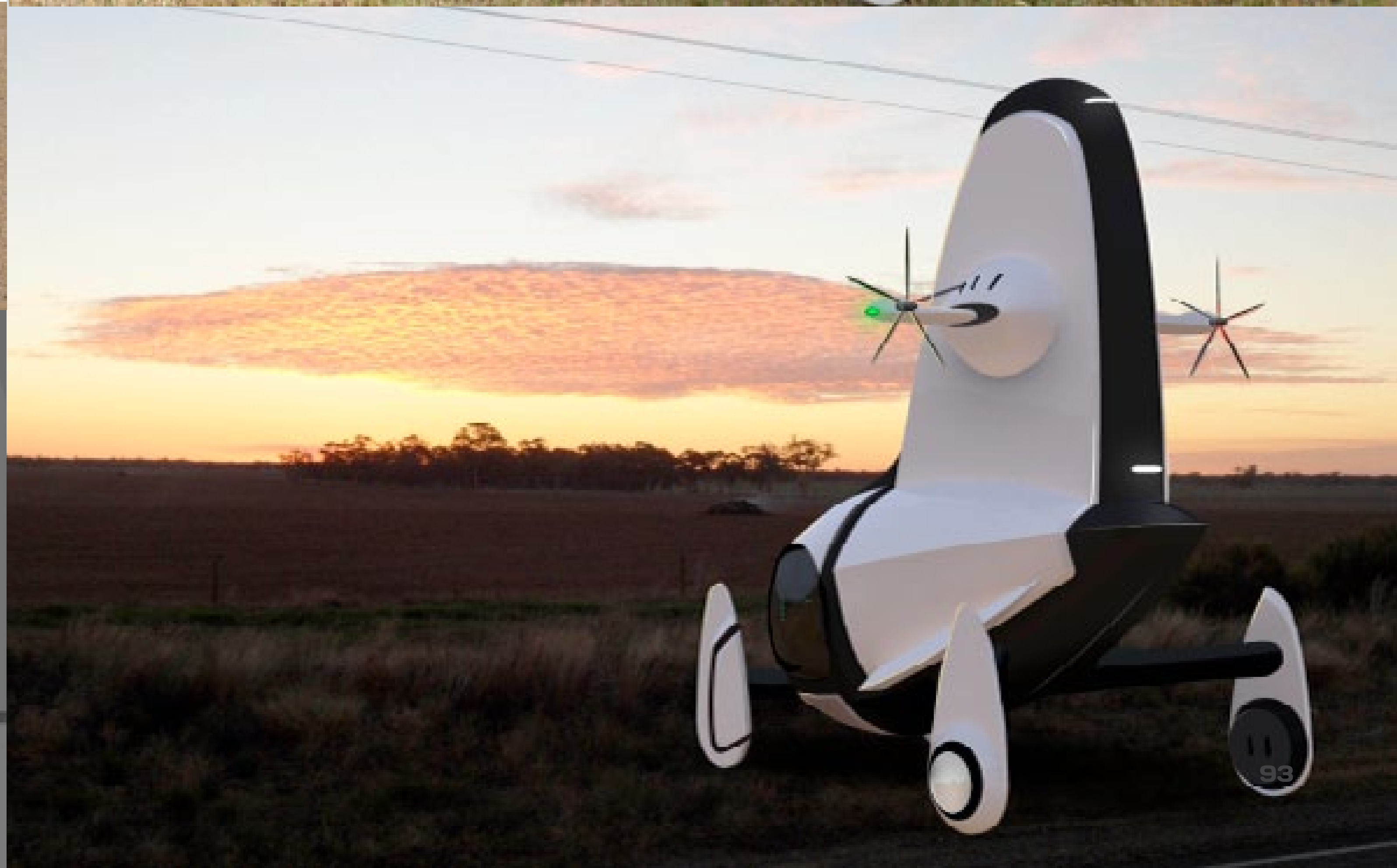
The walker mode component of the concept would use similar if not the same technology produced by Boston Dynamics. Their “Alpha Dog” and “Big Dog” prototypes shows off the technology well. As can be seen in working examples the Big Dog has the ability to navigate terrain in a very natural, almost animalistic way. It has the ability to automatically correct itself if it slips on uneven ground and has been shown to be able to retain its footing in many different environmental scenarios including walking in snow and on ice.

Although in its infancy and currently slated for military use this concept shows promise for what could be a mainstream technology in coming years.

The notion of being able to use the airship as a form of transport whilst it is grounded rules out the need for a secondary vehicle. This integrated technology allows the user to land their craft and simply carry on “by foot” in the comfort of the sheltered cockpit.

The inclusion of four “legs” or “feet” all of which would operate themselves independently, in a coordinated manner over wheels for example would mean the vehicle would have a lesser impact on the terrain itself. Legs and feet also gives the product a unique animal like aesthetic.





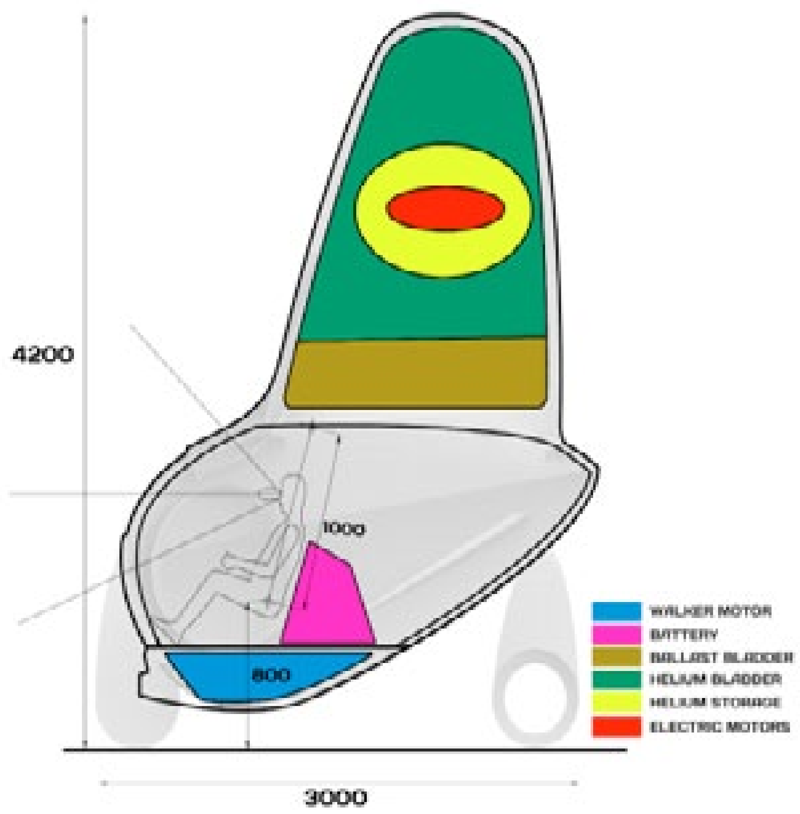
On board helium storage

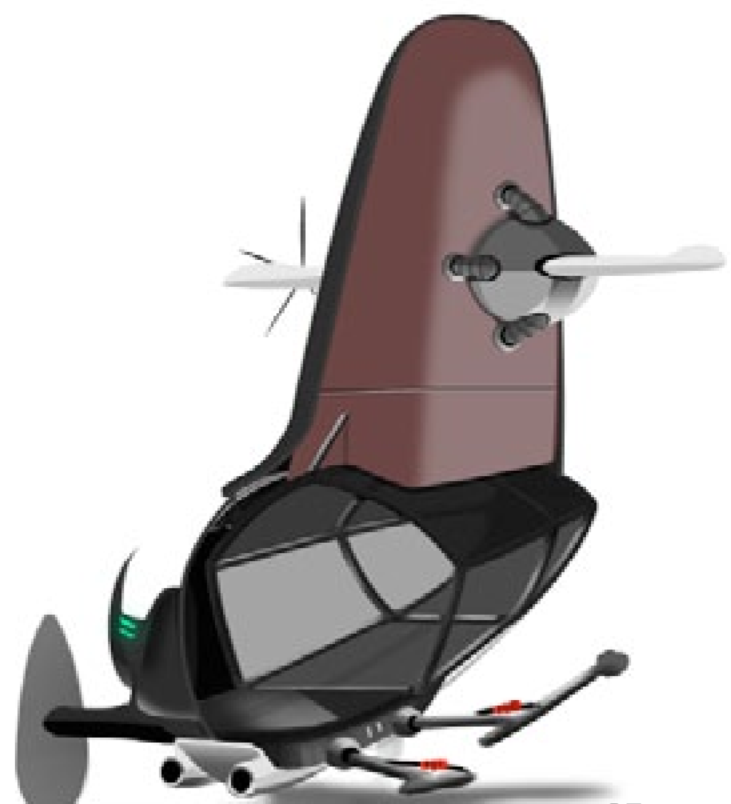
Escape has the unique ability to carry its own source of lifting gas - Helium. The benefit of this is the vehicle is able to change its size on request in contrast to existing airships which retain their same size until the lifting gas is either released into the atmosphere or stored in grounded storage containers. This allows the product to be stored easily, and in a much smaller space than existing airships. Its overall size when grounded would also mean that the vehicle would be more accessible to the potential vehicle owner i.e. the vehicle could be displayed in an indoor retail environment.

Flight dynamics and propulsion

Escape is carried aloft using the lifting gas Helium. Helium unlike Hydrogen which was used in classic airships is inert and non-explosive.

Escape is propelled primarily by two wing mounted electric engines. Electric engines have been used in small electric aircraft for some time. Recent shifts from polluting combustion engines to greener electric engines should see them become mainstream in the coming years. ESCAPE would incorporate similar engines to those used in existing electric aircraft such as the Lange Antares 20E which uses a single EM42 engine capable of producing 38.5kW. “Leg mounted” secondary propulsion and/or directional propulsion fans are also present and help to enhance vehicle manoeuvrability and handling.





Autonomous functionality

Escape has an autonomous functionality built in; it has the ability to fly the occupant to any desired location without intervention from the user. Unmanned aerial vehicles or UAV's currently utilize this technology. Escape would be able to be flown remotely by a trained pilot or could have the ability to fly completely autonomously by using visual references and GPS data. The inclusion of an autonomous functionality allows for a much wider range of users than traditional aircraft.

Vehicle personality and aesthetic

In giving the vehicle a unique animal like aesthetic and personality it is anticipated that the end user will form a much deeper emotional connection with the vehicle than they would with other products of a similar purpose. It is expected that user would see the vehicle not only as a vehicle but rather a flight companion or second skin.

Materials, manufacturing and customisation

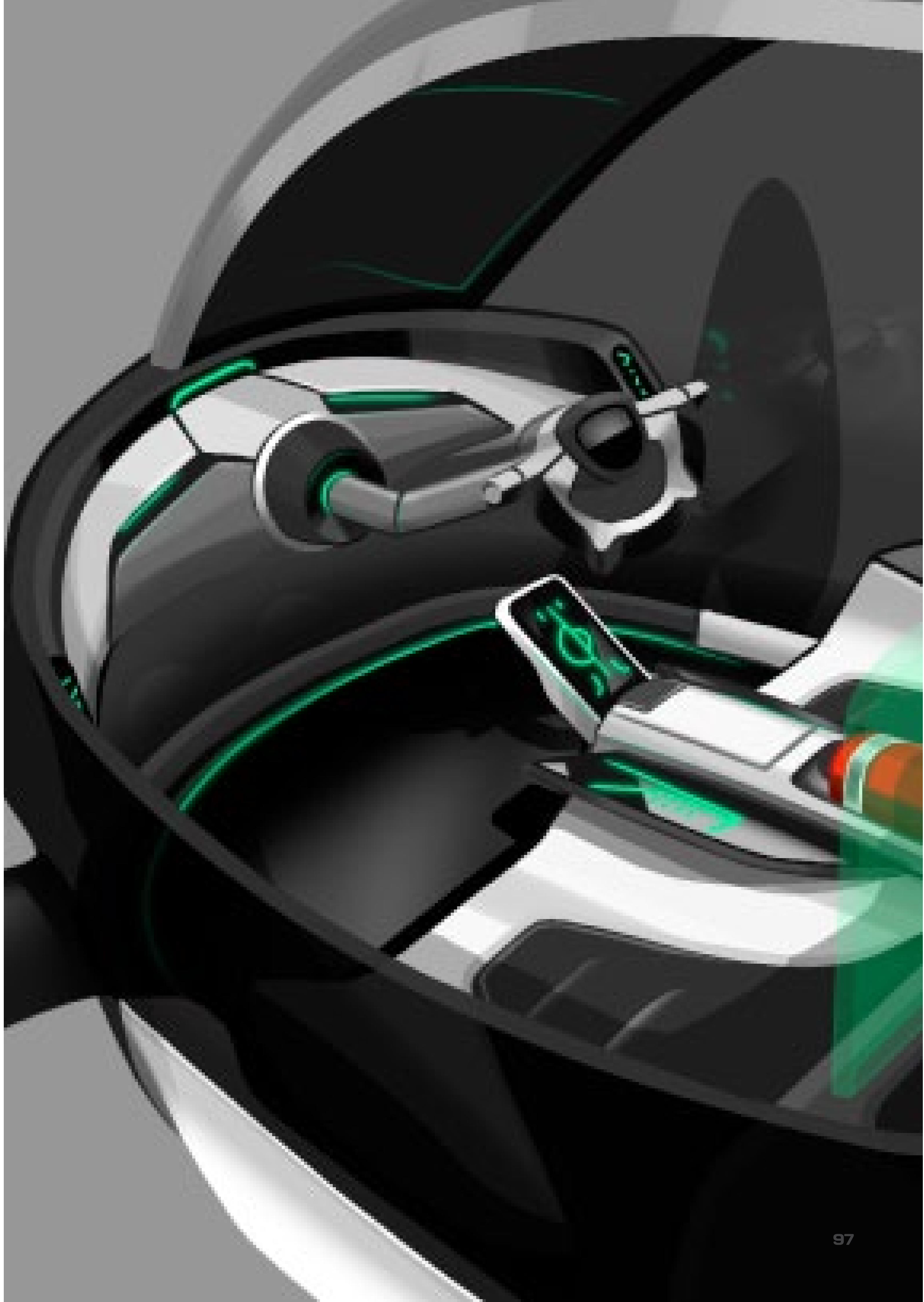
New and emerging materials are used throughout Escape. In order to classify as a Sport Aviation craft the Airship must be less than 600 kg. Therefore weight restrictions govern material choices.

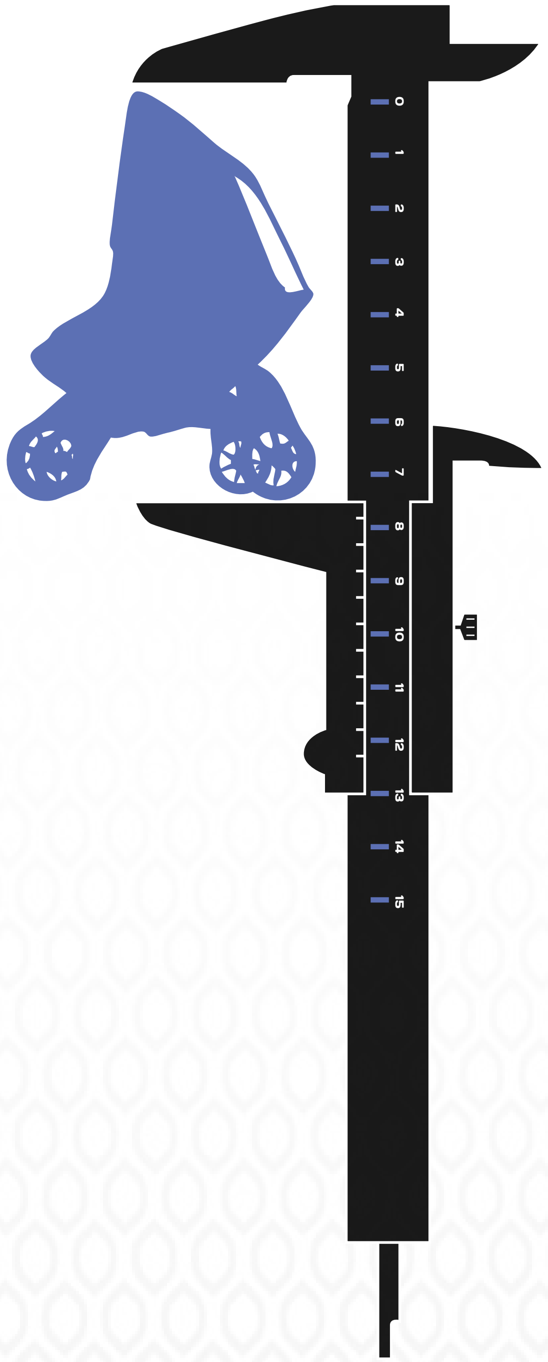
The main structural components of the airship would be made using carbon fiber reinforced plastic and aluminium. The justification for these materials is that they are both lightweight and strong. Carbon fiber components could be produced using a carbon fiber loom, which has proven to be a more accurate, faster method in creating complex 3D parts than traditional methods.

Fabrics are also extensively used throughout. Polyester weather resistant coated fabrics similar to those used in modern airships are used on the exterior, as well as photo voltaic fabrics. The use of fabrics give the vehicle a sense of form without excess weight, they also provide a “soft” touchable aesthetic to the vehicle.

Polycarbonate plastic is used on the shell components of the Escape. Polycarbonate plastics are used because of their high impact resistance. Whilst in walker mode the airship may encounter some obstacle hazards. The polycarbonate shell acts to protect the “delicate” inner balloon components of the airship.

Customisation of the product can be achieved by the use of material colours, which could be optimised for the end user whilst being manufactured. Decals could also be applied to the exterior shell surfaces by the user. Cockpit fit-out, fabrics and components made to customer order. Functionality controls could be designed to end user specifications.





PRODUCT DESIGN SPECIFICATION

4

Escape has several aims in its design performance in terms of its functional exterior features, functional interior features and drivetrain. The product design specification component of the project addresses these requirements.

4.1 ESCAPE FUNCTIONAL REQUIREMENTS

4.1.1) Functional (exterior)

Ingress/egress

Escape is to have an easily accessible cockpit by means of doors that fold forward to allow maximum access. In conjunction to this the vehicle itself is be able to adjust its stance so that the entry/exit point is closer to the ground. A step ladder is also to be included for added ease of access.

Ease of access is to ensure the widest range of users are able to physically access the vehicle. Whilst the design, in its current state is not universally accessible it is believed that with some additional development or the inclusion of functional attachments for non able body users universal accessibility could be achieved.

+ Minimum performance - Able bodied people be able to access the cabin area.

+ Means of assessment - digital mock-ups and renderings.

Rear cargo access

Escape is to have a retractable rear cargo access door for access to the interior cargo area and other interior features. Rear cargo access should allow the user to easily store their luggage and or other equipment that may be required.

+ Minimum performance - The rear cargo door should at least fold down to form ramp access to the cargo area. The door should be either motorised or incorporate gas struts for ease of opening and closing.

+ Means of assessment - digital mock-ups and renderings.

Navigation and safety lighting

Escape is to comply with current aviation standards applicable to navigational and safety lighting. http://www.casa.gov.au/wcmswr/_assets/main/download/caaps/ops/5_13_2.pdf

+ Minimum performance - The design should include all relevant safety and navigational lighting

+ Means of assessment - renderings.

Access to internal helium storage

Escape is to have an external access point to the internal helium storage container. External access to the internal helium storage allows for ease of refilling in the event that the internal storage container become depleted.

+ Minimum performance - A helium exchange valve with a simple lockable door covering.

+ Means of assessment - renderings.

Solar energy capture

Escape is to include a built in means of solar energy capture. The inclusion of solar energy capture is motivated to reduce dependence of grid power and reduce associated infrastructure needed for recharging of on board power supply.

+ Minimal performance - basic solar panels or the like.

+ Means of assessment - renderings.

4.1.2) Functional (interior)

Cockpit environment

Escape is to have; An unobstructed cabin space free from clutter. The pilots view should be extensive, clear and undisturbed as required by design legislation. The pilot should be sufficiently protected from the elements. A visible emergency exit. Interior compartment used by crew or passengers must be made out of at least flame resistant material. Must contain a fire extinguisher/s.

+ Minimum performance - as above.

+ Means of assessment - renderings.

Cargo area

The cargo area must contain provisions to prevent cargo moving during flight. The cargo area must be constructed from at least flare resistant materials.

+ Minimum performance - as above

+ Means of assessment - renderings.

4.1.3) Walking functionality

Escape is to include built in walking functionality to allow the vehicle to traverse various terrains whilst grounded. “A self-contained quadruped robotic walking system” will give the user a more versatile travel experience. Much of the environment in the world is inaccessible by car but is accessible by animals and people, therefore Escape draws on that notion that it has more similarities to an animal mount than a car.

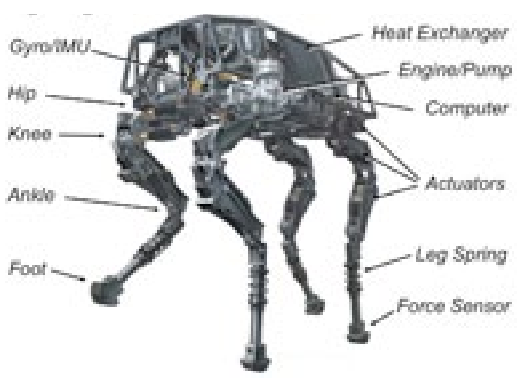
Boston Dynamics “BigDog” robot prototype is a working example of the concept and shows the current state of technology. The following is how the technology works.

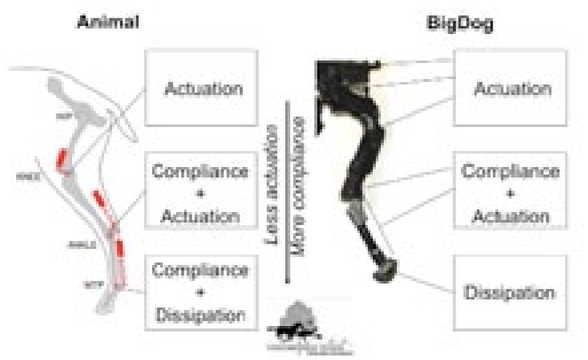
“Control of the robots movement is achieved by braking down the behaviour of walking into into three primary activities: supporting the body with a vertical bouncing motion, controlling the attitude of the body by servoing the body through hip torques during each leg’s stance phase, and by placing the feet in key locations on each step using symmetry principles to keep the robot balanced as they moved about.”

“ BigDog has on board systems that provide power, actuation, sensing, controls and communications. The power supply is a water-cooled two-stroke internal combustion engine that delivers about 15 hp. The engine drives a hydraulic pump which delivers high-pressure hydraulic oil through a system of filters, manifolds, accumulators and other plumbing to the robot’s leg actuators. The actuators are low-friction hydraulic cylinders regulated by two-stage aerospace-quality servo valves. Each actuator has sensors for joint position and force. Each leg has 4 hydraulic actuators that power the joints, as well as a 5th passive degree of freedom.

BigDog has about 50 sensors. Inertial sensors measure the attitude and acceleration of the body, while joint sensors measure motion and force of the actuators working at the joints. The on board computer integrates information from these sensors to provide estimates of how BigDog is moving in space.

The on board computer performs both low-level and high- level control functions. The low-level control system servos positions and forces at the joints. The high-level control system coordinates behaviour of the legs to regulate the velocity, attitude and altitude of the body during locomotion. The control system also regulates ground interaction forces to maintain support, propulsion and traction.





BigDog has a variety of locomotion behaviours. It can stand up, squat down, walk with a crawling gait that lifts just one leg at a time, walk with a trotting gait that lifts diagonal legs in pairs, trot with a running gait that includes a flight phase, and bound in a special gallop gait. Travel speed for the crawl is about 0.2 m/s, for the trot is about 1.6 m/s (3.5 mph), for the running trot is about 2 m/s (4.4 mph) and BigDog briefly exceeded 3.1 m/s (7 mph) while bounding in the laboratory.”

+ Minimum performance - The vehicle should be able to at least traverse flat terrain like that of an airfield at walking speeds (6 km/h).

+ Means of assessment - renderings.

Technical recommendations/further reading - http://www.bostondynamics.com/img/BigDog_IFAC_Apr-8-2008.pdf

4.1.4) Flight functionality

Escape is to use helium gas held within an internal balloon or envelope to achieve lift. As with all other modern airships helium is used because of its remarkable lifting properties. Helium is also an inert gas meaning that it is non-combustible and safer to use than traditional hydrogen gas.

For the vehicle to achieve lift helium would be pumped into the internal envelope. Air would be stored in separate ballonets effectively acting as ballast. As the air is gradually released the vehicle it will begin to ascend. For the vehicle to descend air would again be sucked back into the air ballonets, the heavy air will cause the craft to descend.

Electric vectoring fans will allow for added lift as well as directional flight. Vectoring fans are those that allow for a greater range of movement than traditional fan propulsion. Four electric EM42 engines capable of producing 38.5kW will power the fans which will operate in den pendently of one another allowing for more precise controlled movement.

+ Minimum performance - The vehicle should at least operate as effectively as a current airship.

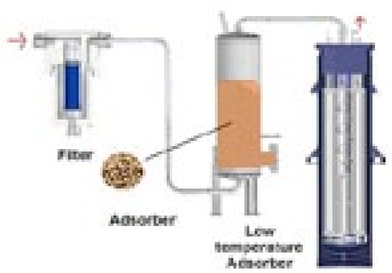
+ Means for testing - Digital mock-ups and renderings.

Helium storage, compression and purification system

Escape is to have a system in which its helium lifting gas is able to be recaptured, purified, compressed and stored between uses. This particular system does not currently exist in an airship application, however the individual processes used in the system do exist and are proven technologies.

The motivation behind this approach is to make Escape more versatile as a vehicle allowing for more varied use and application. Another motivation is to reduce overall grounded vehicle size, allowing for easier storage opportunities and a less dominating appearance.

If proved the system would pump the helium gas through a purification system to remove any containments, given that the system would be isolated in the relatively contaminant free environment of the envelope the process is likely to take less time than it would in more traditional applications i.e. the initial mining or separation from natural gas. Therefore purification is to retain the quality of the gas so that it can be used over and over again without loss of its lifting properties.



The helium purification process (at its source) is as follows.

The basic principle of helium purification is the removal of impurities like moisture, oxygen, nitrogen and any other contaminants it may have been exposed to. Since helium has a lower boiling point than any other element, low temperature and high pressure are used to liquefy nearly all the other gases which are then removed. The remaining gas mixture is purified by successive exposures to lowering temperatures, in which almost all of the remaining nitrogen and other gases are precipitated out of the gaseous mixture. Activated charcoal is used as a final purification step, usually resulting in 99.995% pure Grade-A helium.

Airships currently operate using a lower grade 70% helium, therefore the process described and the accompanying equipment used to perform the process could be simplified or customised to better fit an airship application.

After the gas is purified it would be then compressed into liquid form and stored. The liquefied helium would remain in storage unaffected until further use.

+ Minimum performance - As above

+ Means of assessment - Digital mock-ups and renderings.

4.1.5) Physical properties and size

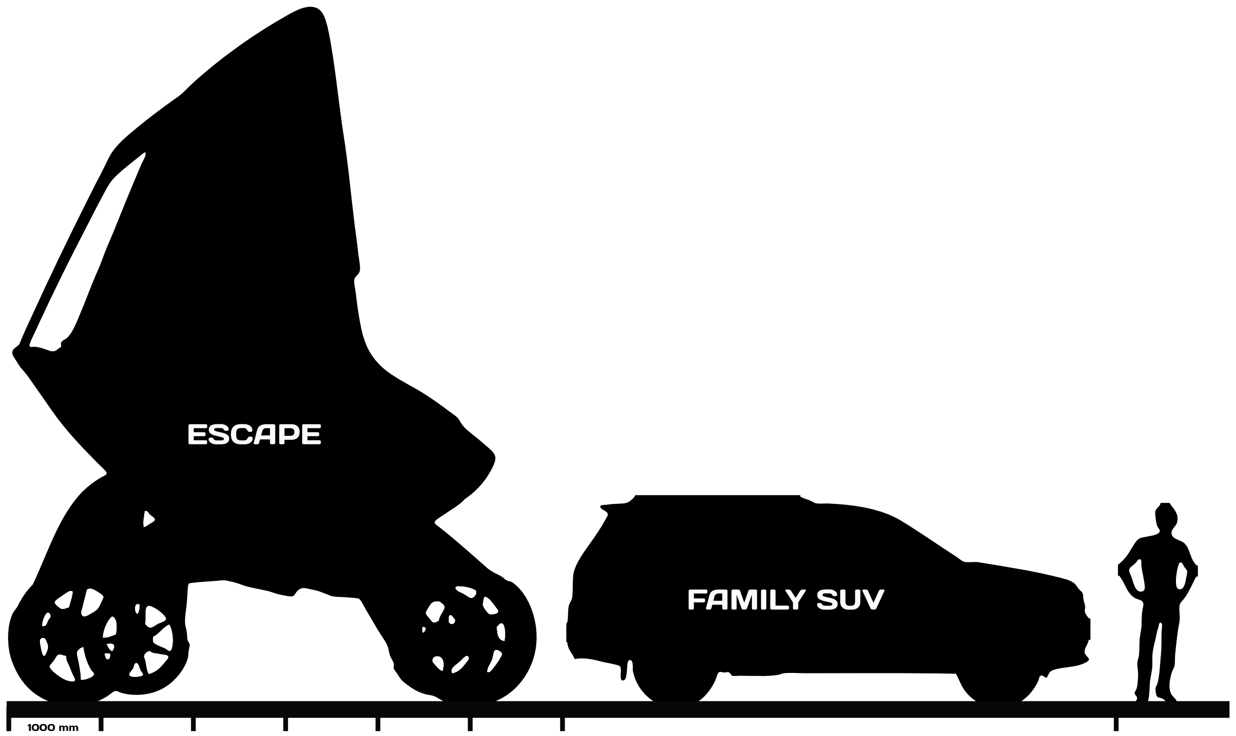
A design for emotion approach was used when creating the aesthetics for Escape. Escape is designed to have a unique physical presence; the concepts personality reflected through the vehicles unique animal like characteristics and aesthetic. The method in this approach is to make the vehicle intentionally unfamiliar to the user. Using a conventional or a more familiar form like that of airships of the past could potentially attract negative emotions or feelings about the product arising from the average user's own previous conceptions of the product. Using a more unfamiliar form even incorporating an animal like aesthetic the product is aimed at creating a positive visceral response in those that see it.

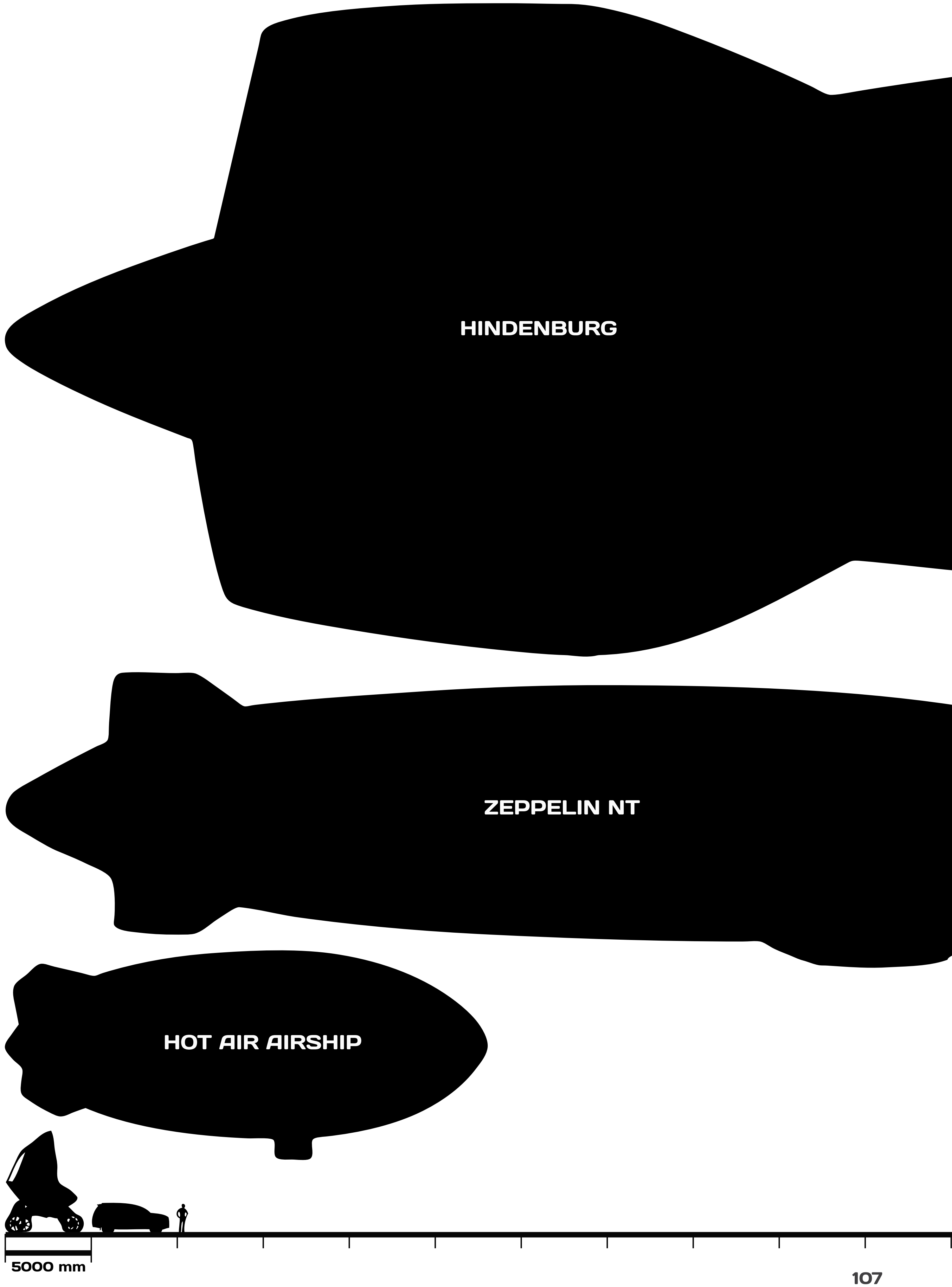
Escape is to be much smaller than existing airships when grounded. The physical size of the vehicle can dictate how it is managed and stored. Another motivation for reducing the size of the vehicle is to reduce its overall visual dominance.

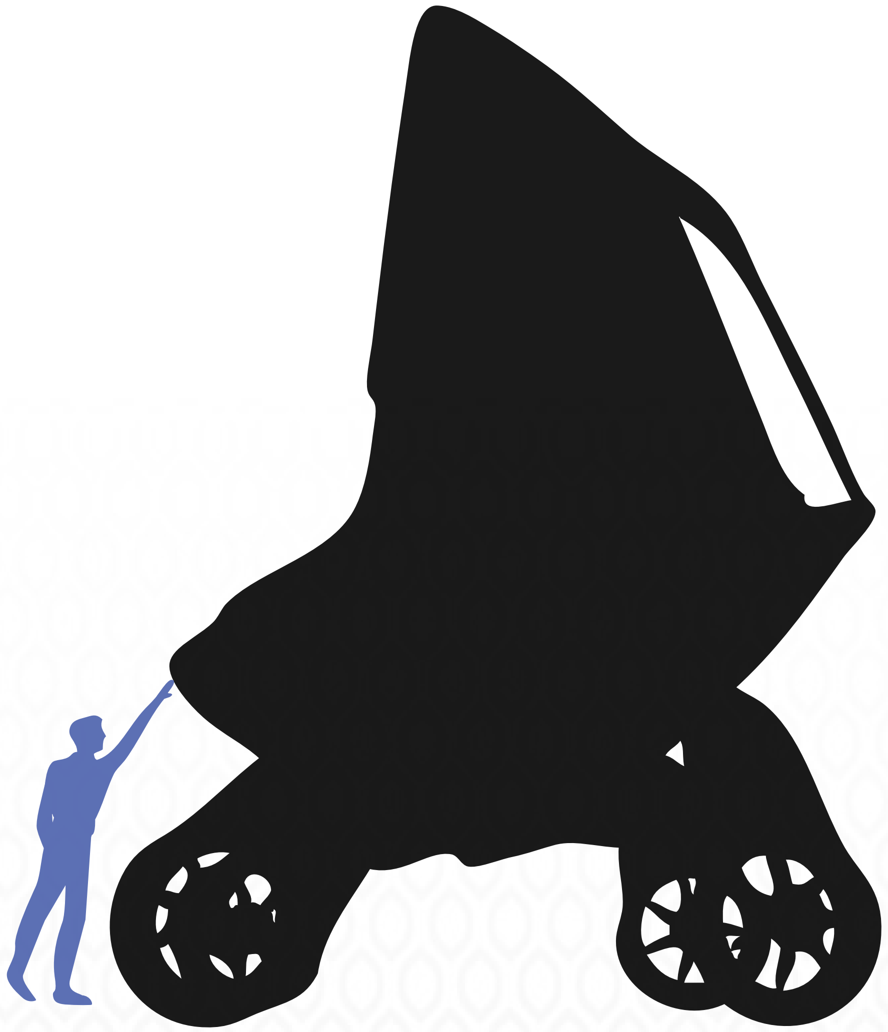
Airships of the past were gigantic, the Hindenburg itself measuring over 240m from bow to stern with a diameter at its widest part of over 40m. Modern airships although tiny compared to the giants of the past are still much larger than conventional aircraft. The smallest commercially available airships (hot air airships) measure over 30 m in length with a minimum diameter of 15 m.

+ Minimum performance - Escape is to be as big as or smaller than existing commercially available airships.

+ Means to assess - Package development.







CRITICAL JUSTIFICATION

5

The critical justification component of this report aims to answer original project objectives and provide imagery and additional information to answer particular functional requirements outlined in the product design specification chapter. It will also provide an overall glimpse at the model making process and finally a reflective statement from the designer on the entire project from initial concept inception through to delivered product.

5.1 SEMESTER TWO GANTT CHART

The below Gantt chart was used as a means of tracking course progression throughout semester two.

ID	TASK GROUP	DURATION	WEEKLY TASKS	WEEK 1 26/07 - 02/08 T W T F S S M	WEEK 2 02/08 - 09/08 T W T F S S M	WEEK 3 09/08 - 16/08 T W T F S S M	WEEK 4 16/08 - 23/08 T W T F S S M	WEEK 5 23/08 - 30/08 T W T F S S M	WEEK 6 30/08 - 06/09 T W T F S S M	WEEK 7 06/09 - 13/09 T W T F S S M	WEEK 8 13/09 - 20/09 T W T F S S M	WEEK 9 20/09 - 27/09 T W T F S S M	BREAK 27/09 - 04/10 T W T F S S M	WEEK 10 04/10 - 11/10 T W T F S S M	WEEK 11 11/10 - 18/10 T W T F S S M	WEEK 12 18/10 - 25/10 T W T F S S M	WEEK 13 25/10 - 01/11 T W T F S S M	WEEK 14 01/11 - 08/11 T W T F S S M	WEEK 15 08/11 - 14/11 T W T F S S M
1	CLAY SCULPTING	5 WEEKS	A) Build model buck B) Apply base clay																
2			A) Produce 2 clay sketches B) Paper sketching																
3			A) Produce 2 clay sketches B) Paper sketching																
4			A) Refine design direction																
5			A) Refine design direction B) Prepare for clay scan C) Create support sketches (parts)																
6			A) Finish clay surfacing B) Clay property scan C) Assess scan in alias D) Apply basic surfaces																
7	DIGITAL SCULPTING/REFINEMENT	3 WEEKS	A) Consult digital sculptor B) Create support images for digital sculptor C) Start CJ, layout and TC																
8			A) Model rear and front feet B) Model turbines C) Create exploded view for print and painting D) Create colour and trim theme board E) C&T final theme hero F) Colour variation themes G) C&T presentation document								A B C D E F G								
9			A) Consult digital sculptor in preparation for model print B) Get printing cost quote from manufacturer C) Finalize design for print D) Send model to printer									A C D B							
Break	PRESENTATION	5 WEEKS	A) Finish CJ document layout										A A A A A A A						
10			A) Hero flight mode imagery for presentation B) Hero walker mode imagery for presentation C) Hero in-situ imagery for presentation D) Hero cross section & package image											A B C D D E E					
11			A) Insert imagery into CJ B) Finalise CJ C) Business card design D) Presentation poster layouts												A B C D				
12			A) Digitalise sketches B) Finish poster C) Send off CJ, Poster and business card for print D) Animation enquirey...													A B C D			
13			A) Build plinth/display B) Paint display stand C) Apply display stand garnishing														A B C		
14	RELAX	2 WEEKS	A) Assess prentation space lighting etc B) Prepare presentation C) Practice presenation															A B C	
15			A) Final presentation																A

5.2 CONCEPT EVOLUTION

The final form and proportion of Escape was born out of clay. Clay sculpting was employed in this part of the project as a means of rapidly exploring vehicle proportion and overall form. Over a period of five weeks several different themes were developed and evolved into the final form.

















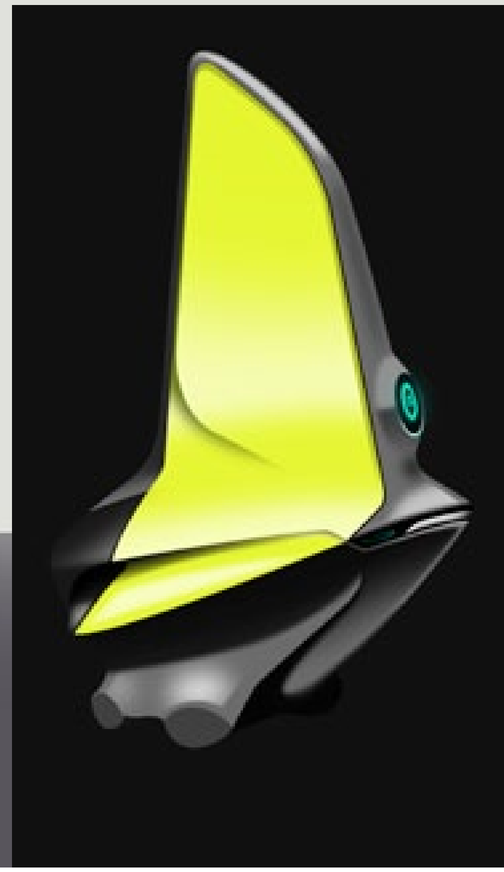






Throughout the clay process photos were taken of the clay properties. These photos were then used as underlays for sketching. Paper sketches along with digital sketches allowed the designer to apply colour, trim components and extra parts to get an overall picture of the visual impact of the concept.

The below imagery was used as a design guideline for the finalised physical clay model.

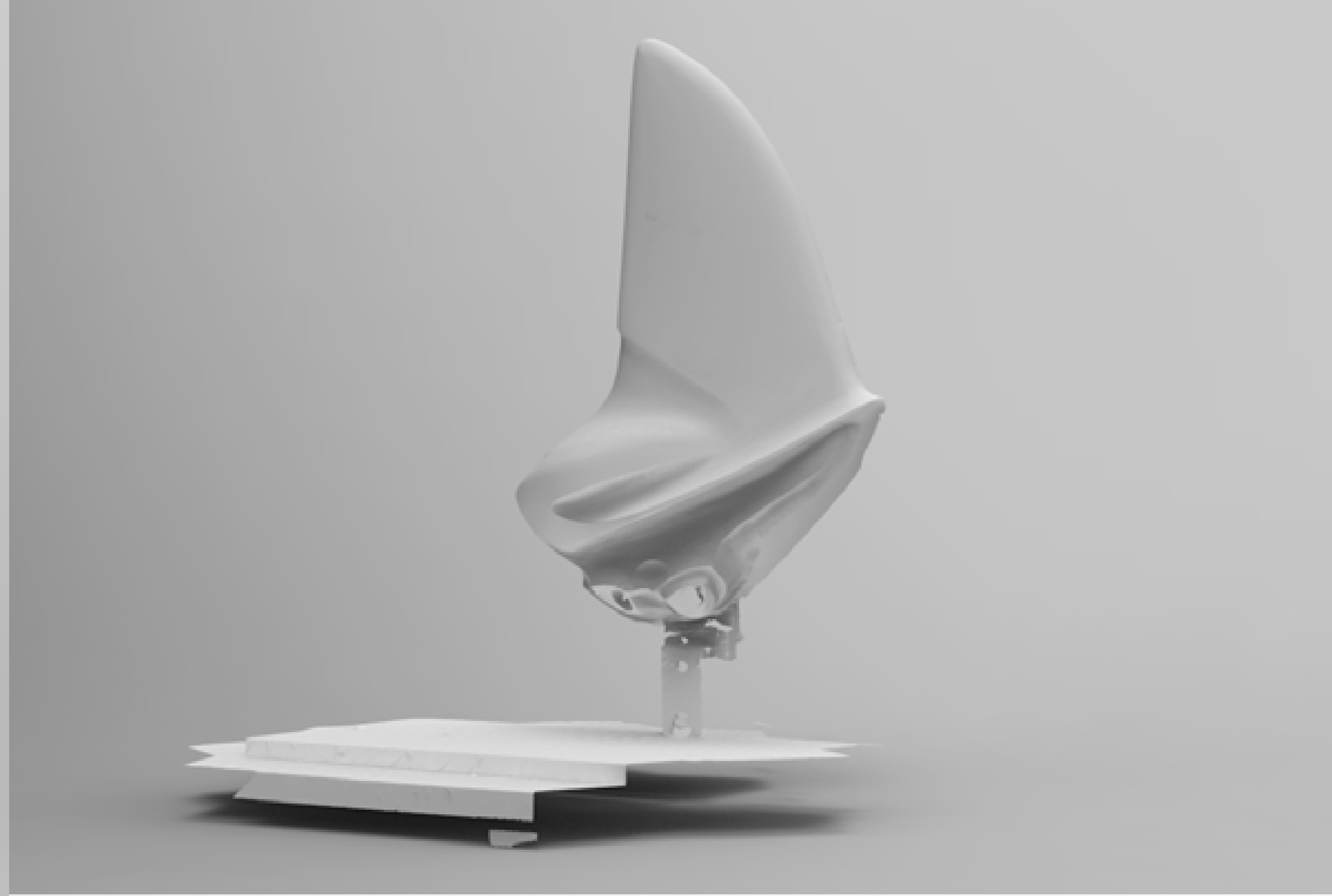


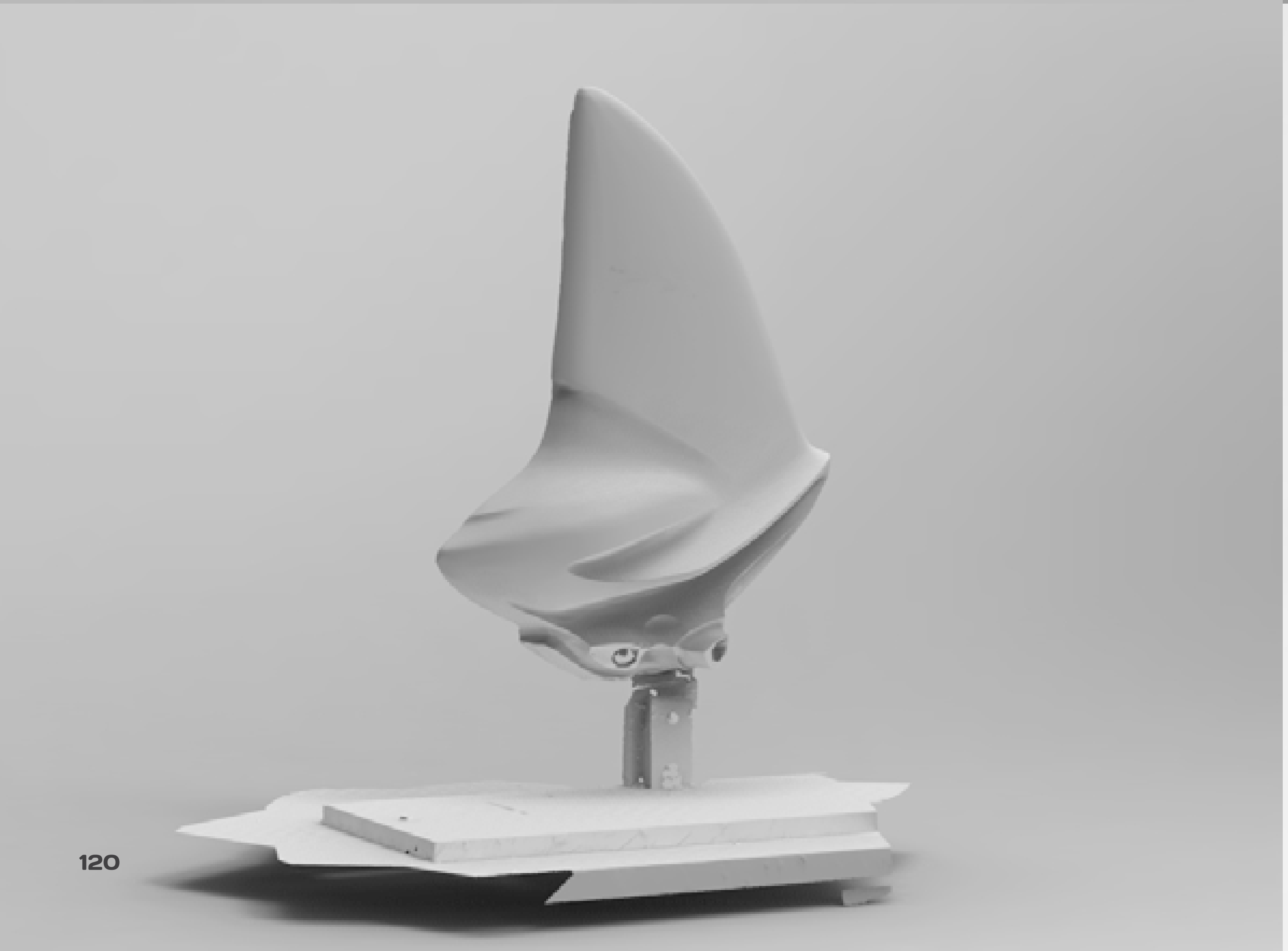


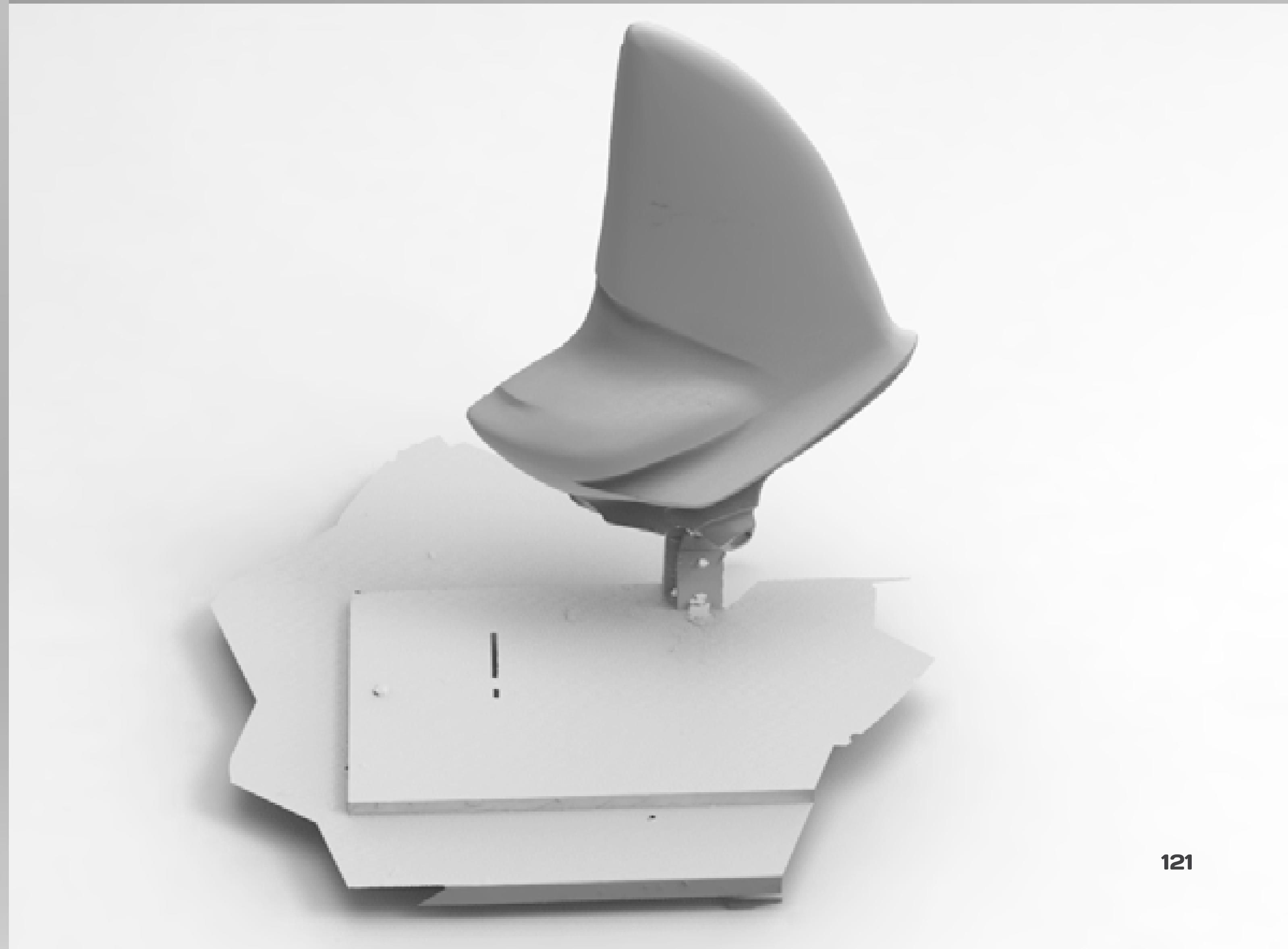





The finalised clay property accurately represented the overall form and proportion that was desired. The property was then scanned using a 3D scanning technique, the result an accurate 3D CAD property that could be manipulated in a digital space.

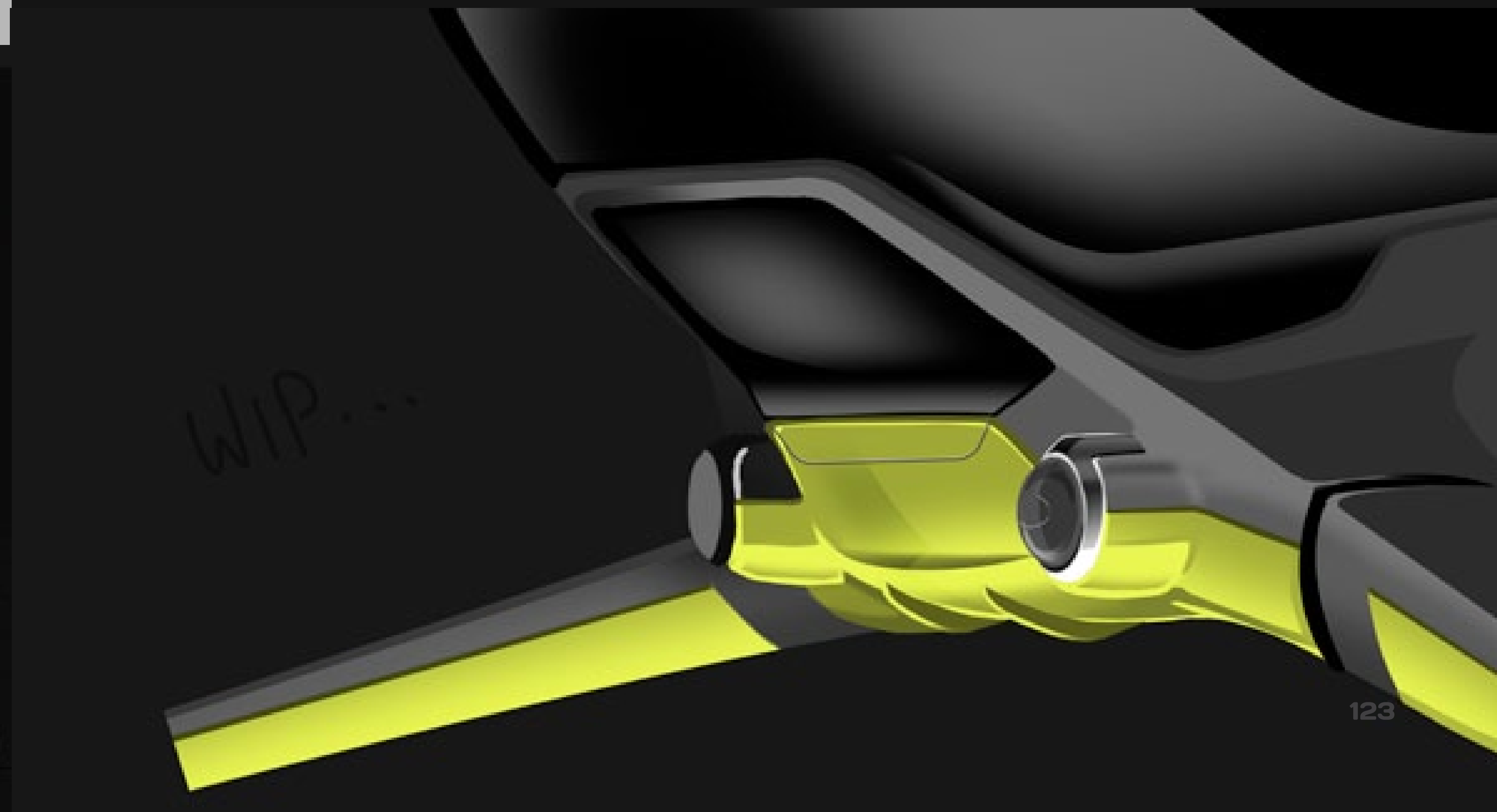


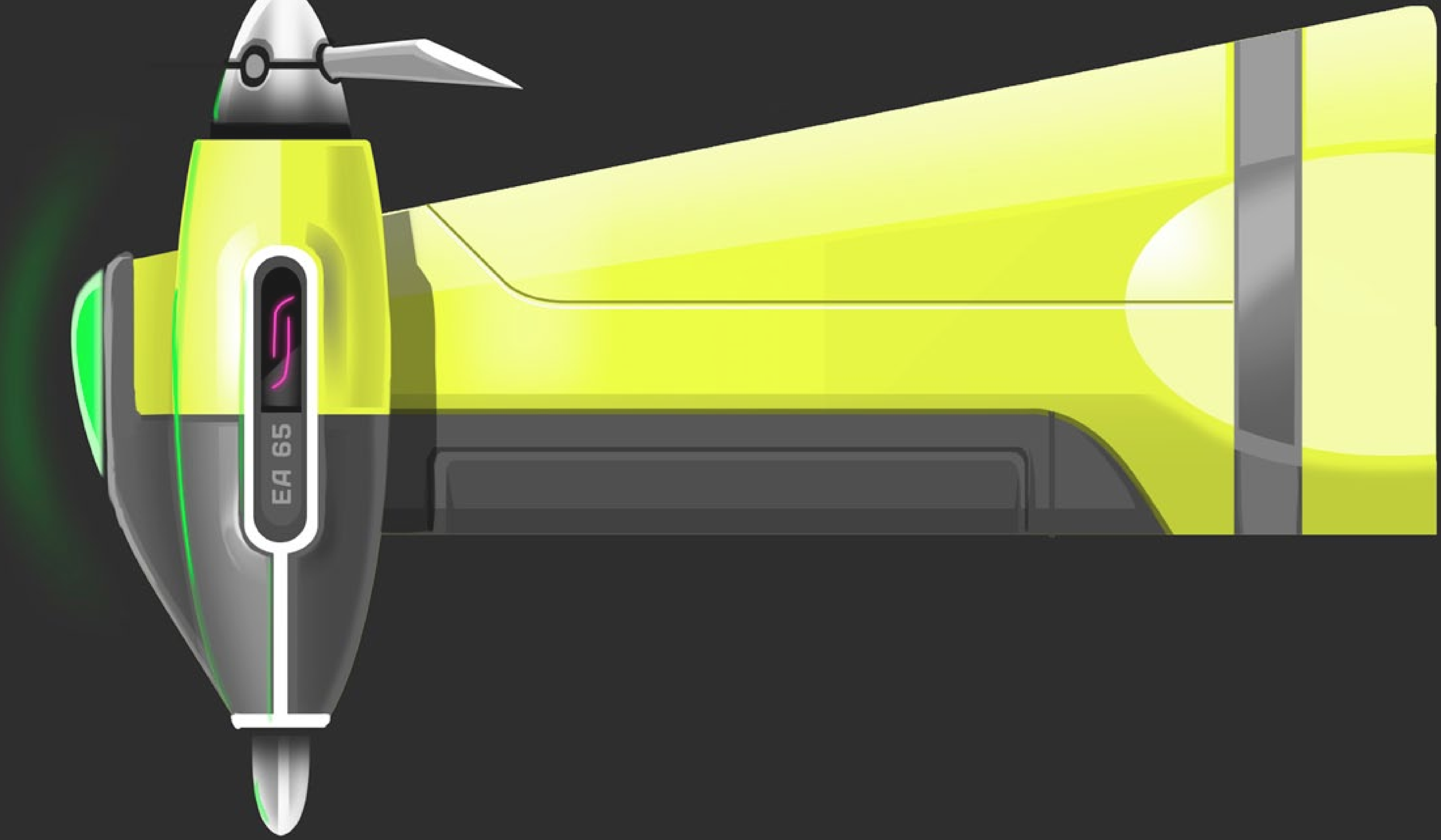


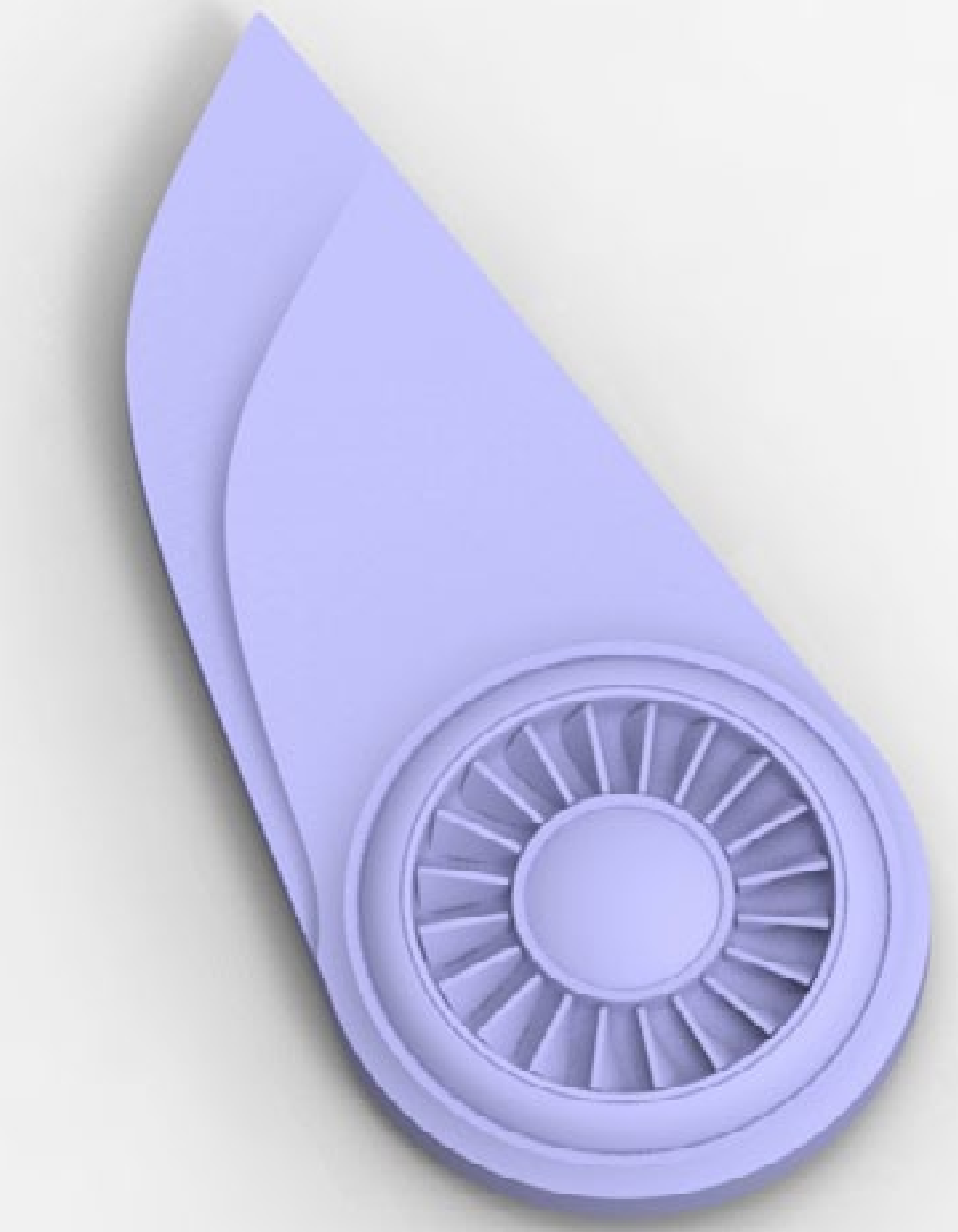


5.3 CAD DEVELOPMENT

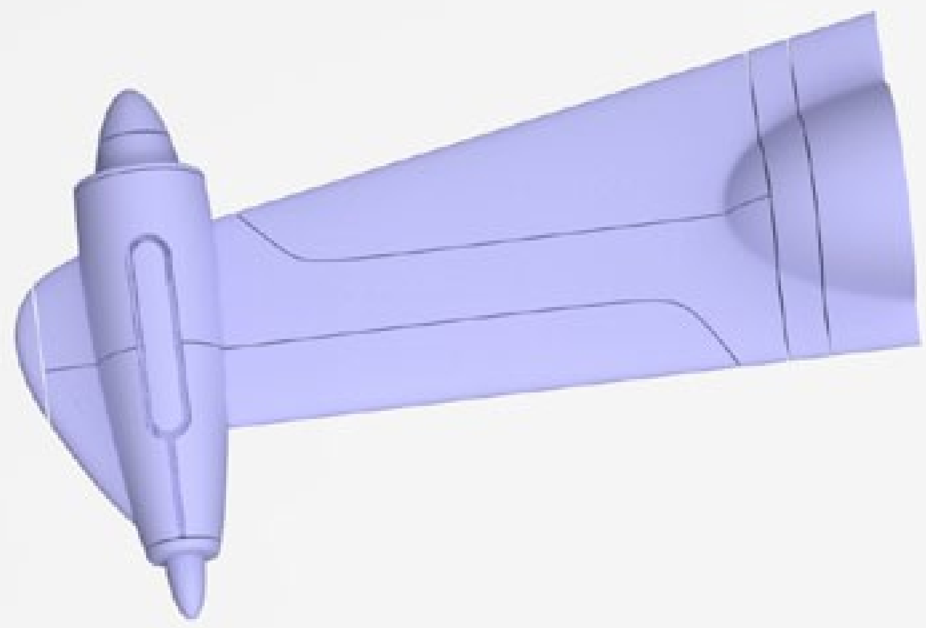
Post scan the data was imported into Autodesk Alias, a digital sculpting program. The data was mirrored in the program to create a complete representation of the final form. Basic surfaces were then added to symbolise placement of certain parts. This data was then sent to a digital sculptor for appraisal along with sketches of individual parts.

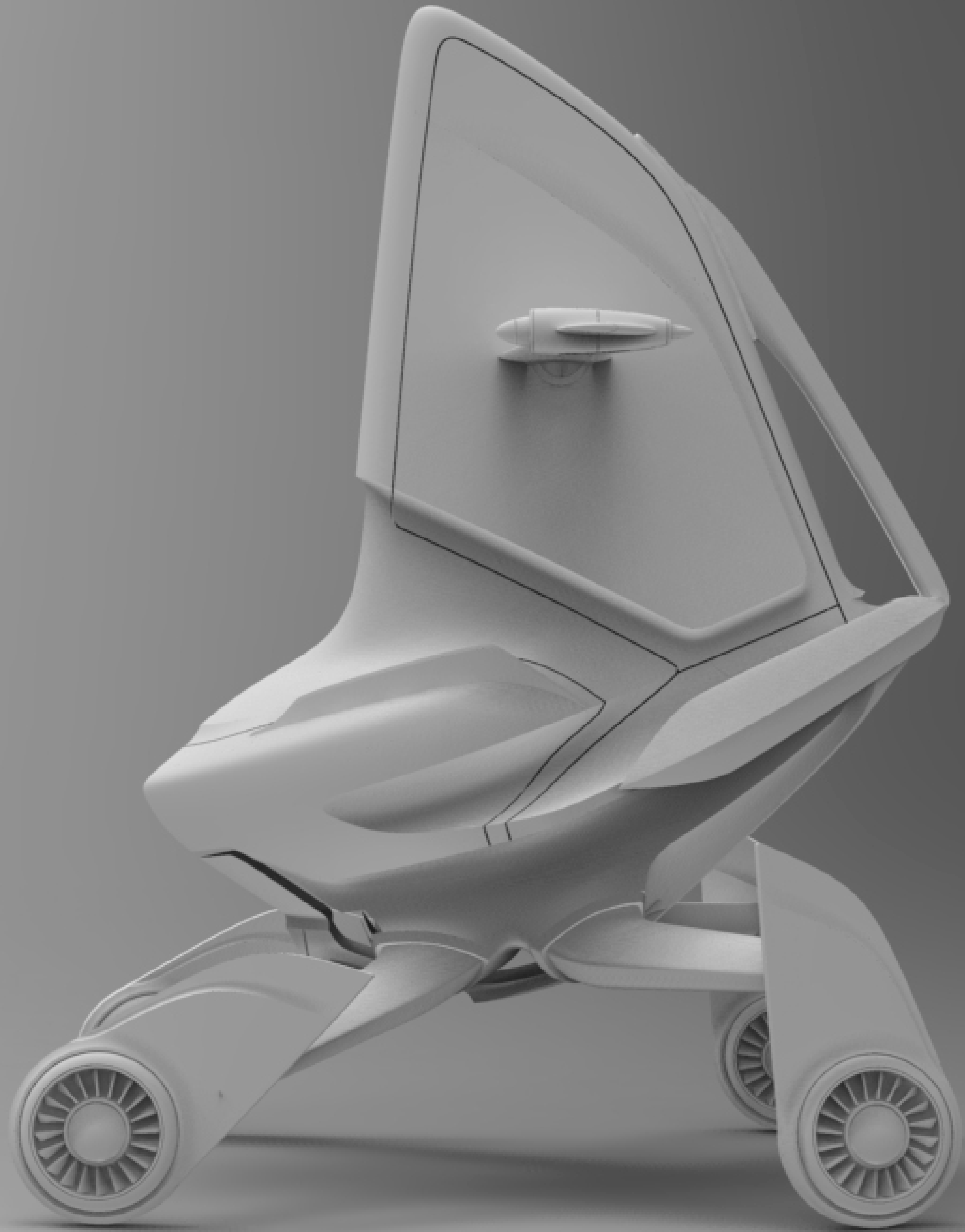



EA 65

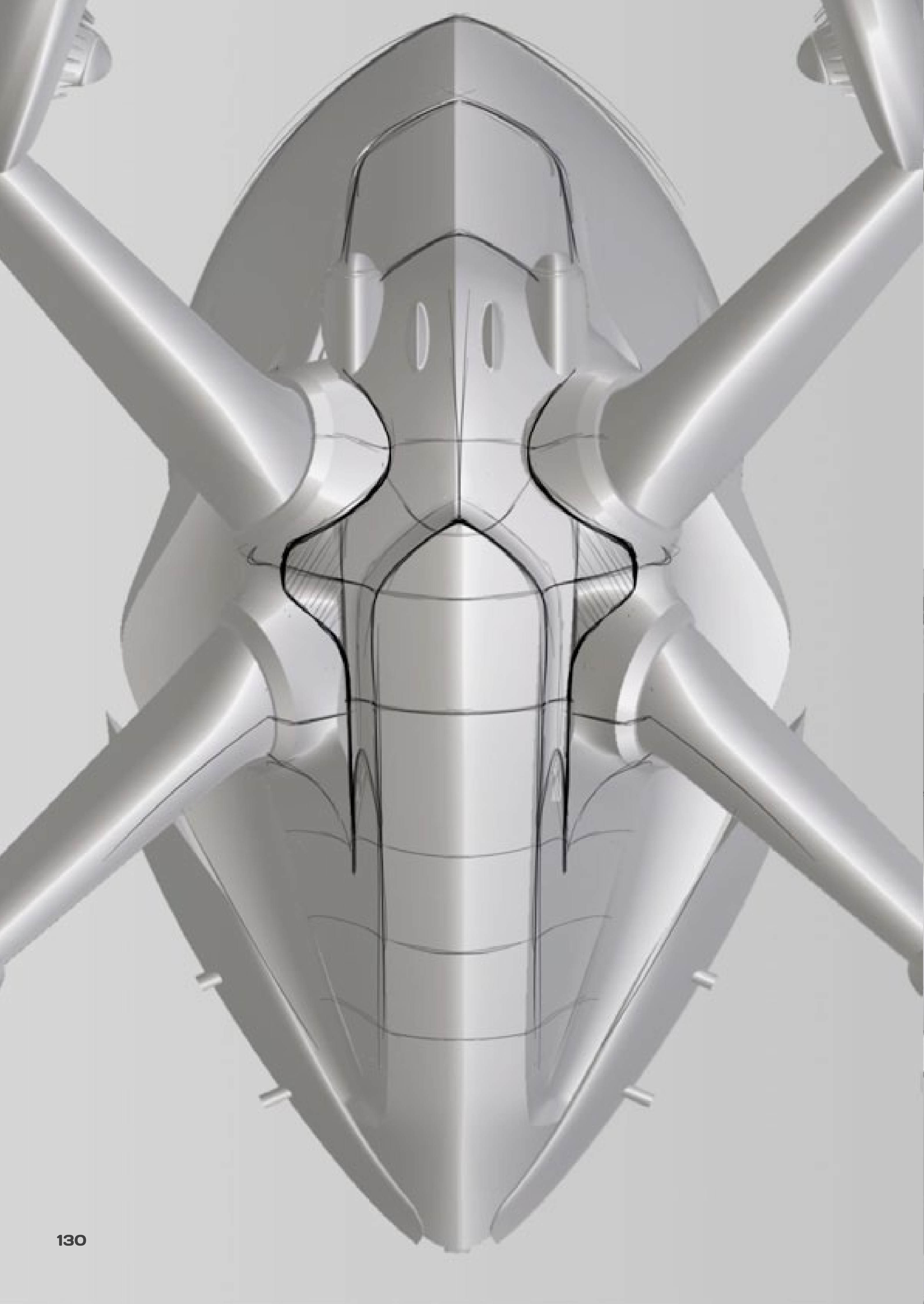


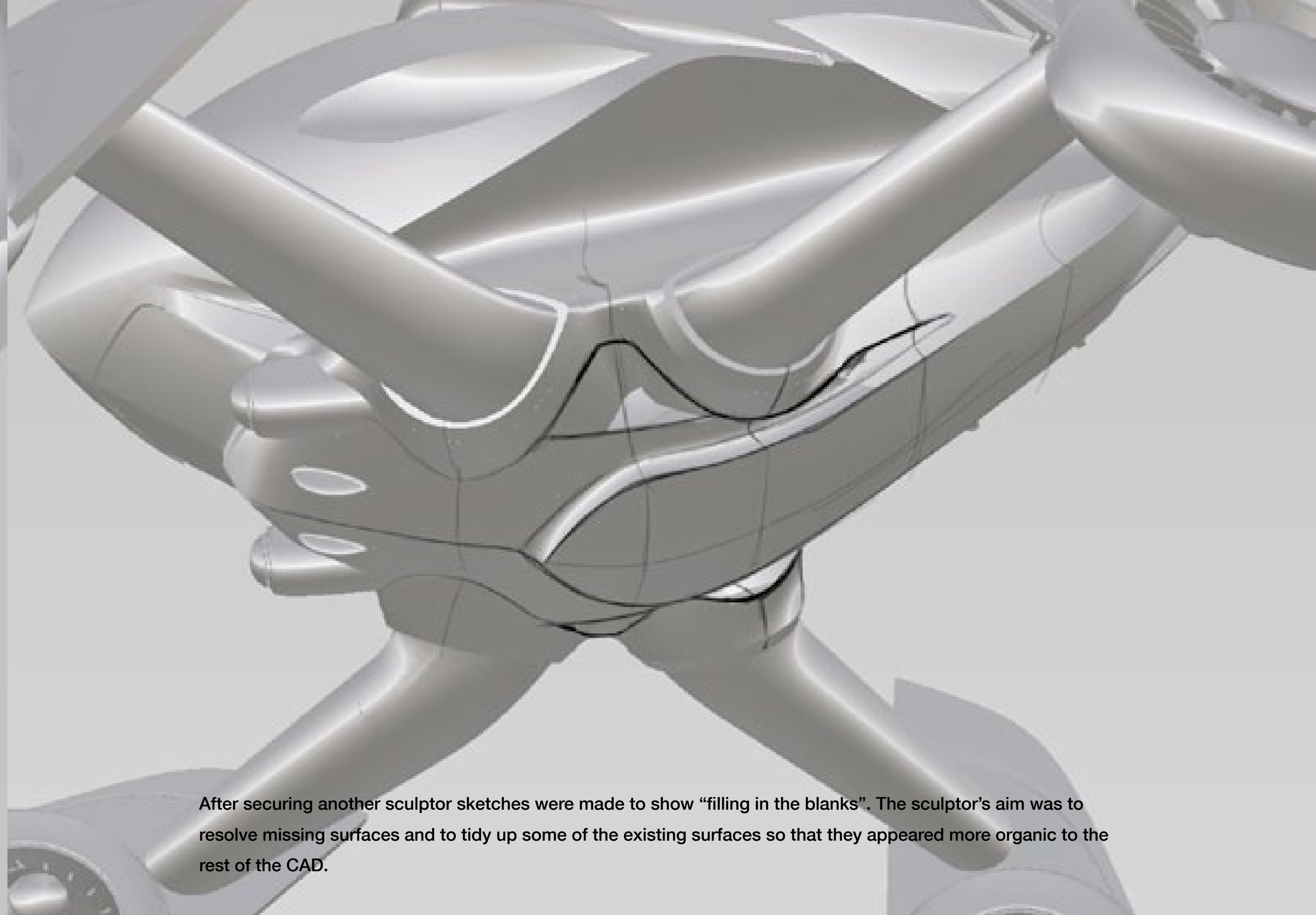
The first CAD was received within one week after the clay scan was done. Several parts had already begun to take shape.



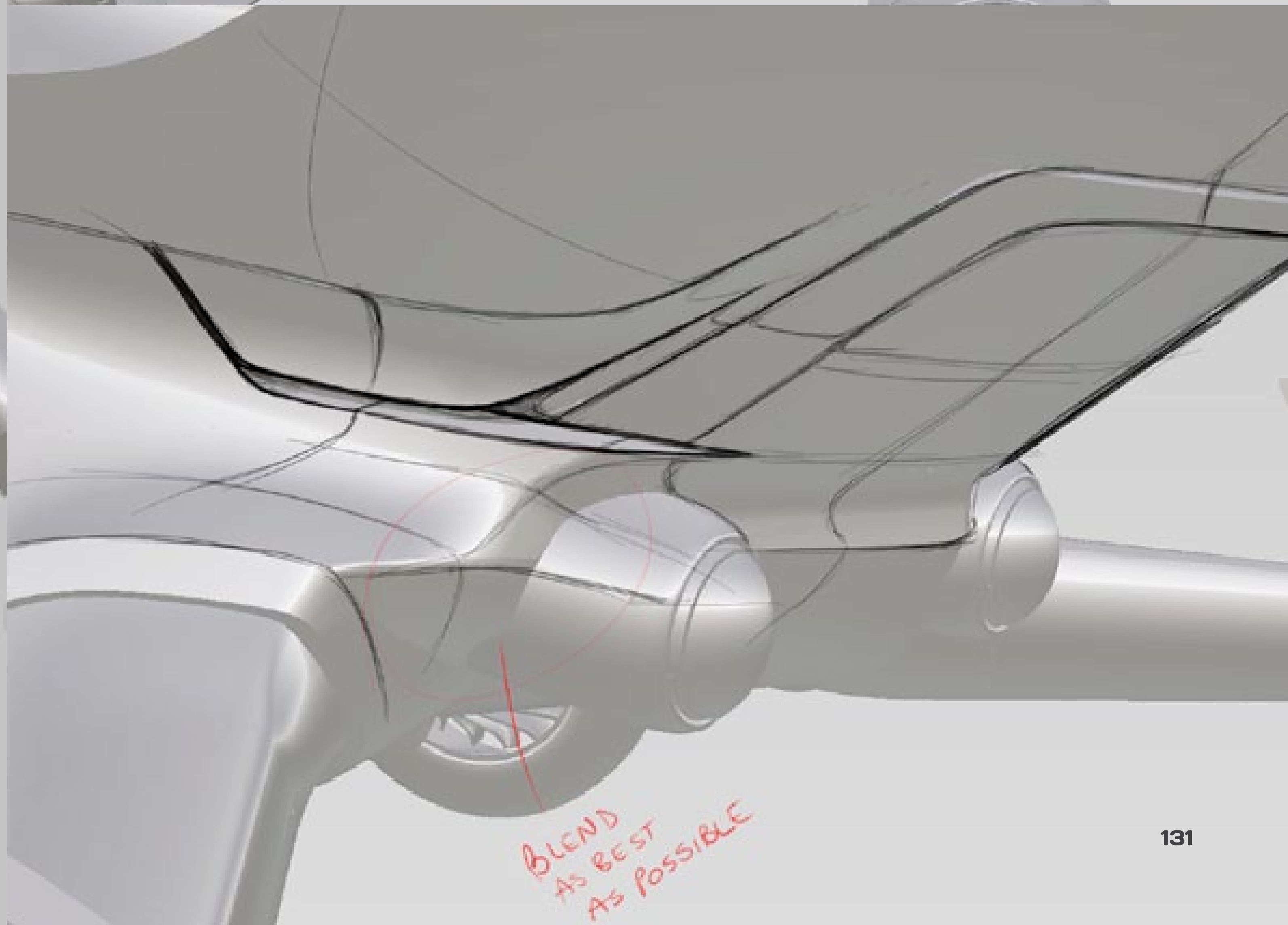


At this stage of the project the CAD was 90% completed, missing just a few surfaces.





After securing another sculptor sketches were made to show “filling in the blanks”. The sculptor’s aim was to resolve missing surfaces and to tidy up some of the existing surfaces so that they appeared more organic to the rest of the CAD.



5.4 FINAL CAD DESIGN

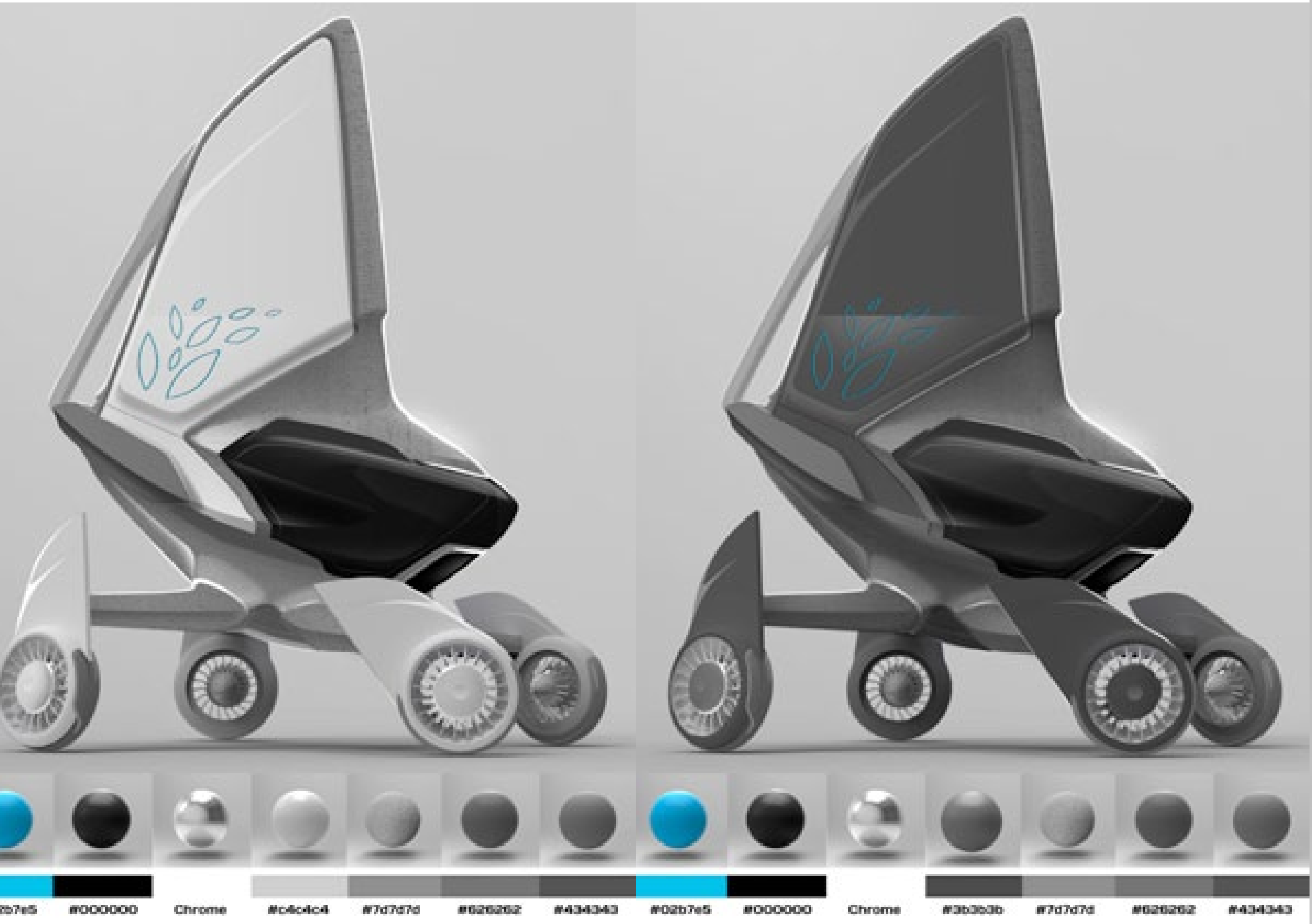
The imagery display on these pages represents the final CAD data and the model that was sent off for prototyping quotes. At this stage, time was the biggest contributing factor for stopping further development of the model, as the turn around time provided by the manufacturer was nudging closer to the final submission date.

5.5 COLOUR AND TRIM

Colour and trim is a process in which the designer is able to juxtapose different colour schemes and trim variation possibilities for the final product.

The method in which the colour and trim variations were devised for this project looks at the concepts intended applications. In most cases the colour schemes follow logic, using predictable colours specific to particular applications.

The Images below and right represent the projects colour and trim direction at the time of the September colour and trim review. The final choice of colours was kept simple reflecting a traditional airship colour scheme. Chrome parts complemented the colour scheme and was intended as an additonal nod to aircraft of the airship time period.




Virgin
ECO
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Chrome
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#626262
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01
#ff2524
#000000
Chrome
#292929
#626262
#434343


#f2db01
#000000
Chrome
#292929
#626262
#434343


#ffffff
#000000
Chrome
Dark stain timber
#292929
#626262
#434343

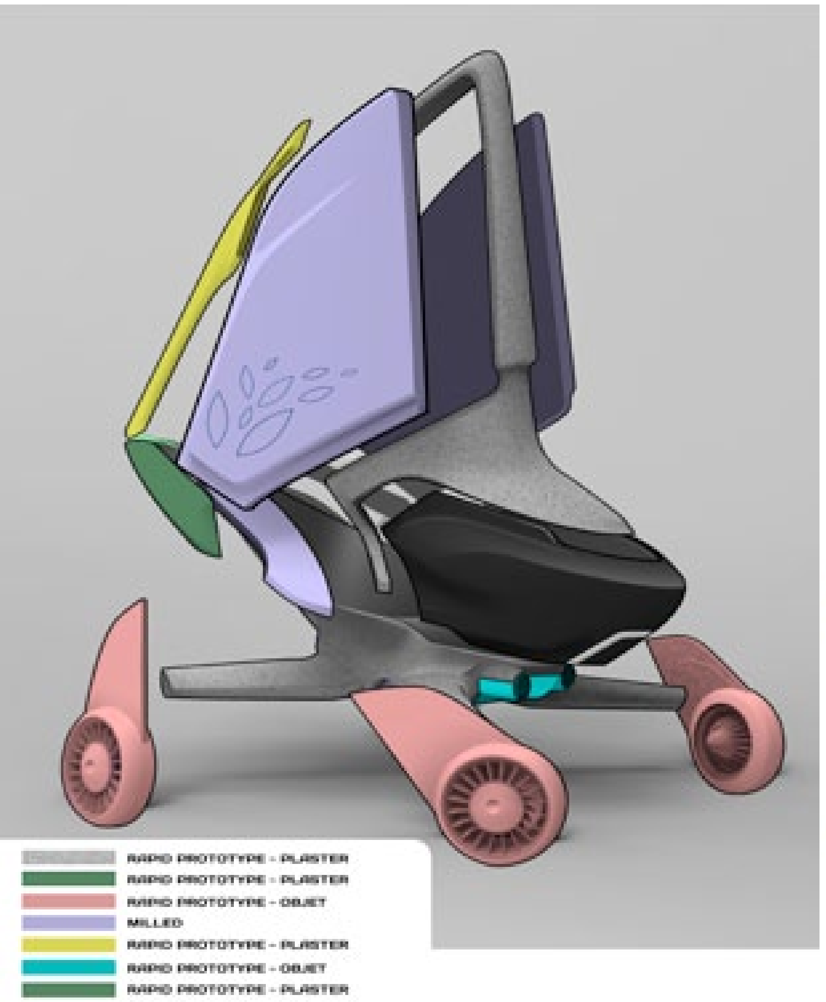

#1e1e1e
#000000
Chrome
Brushed SS
#292929
#626262
#434343

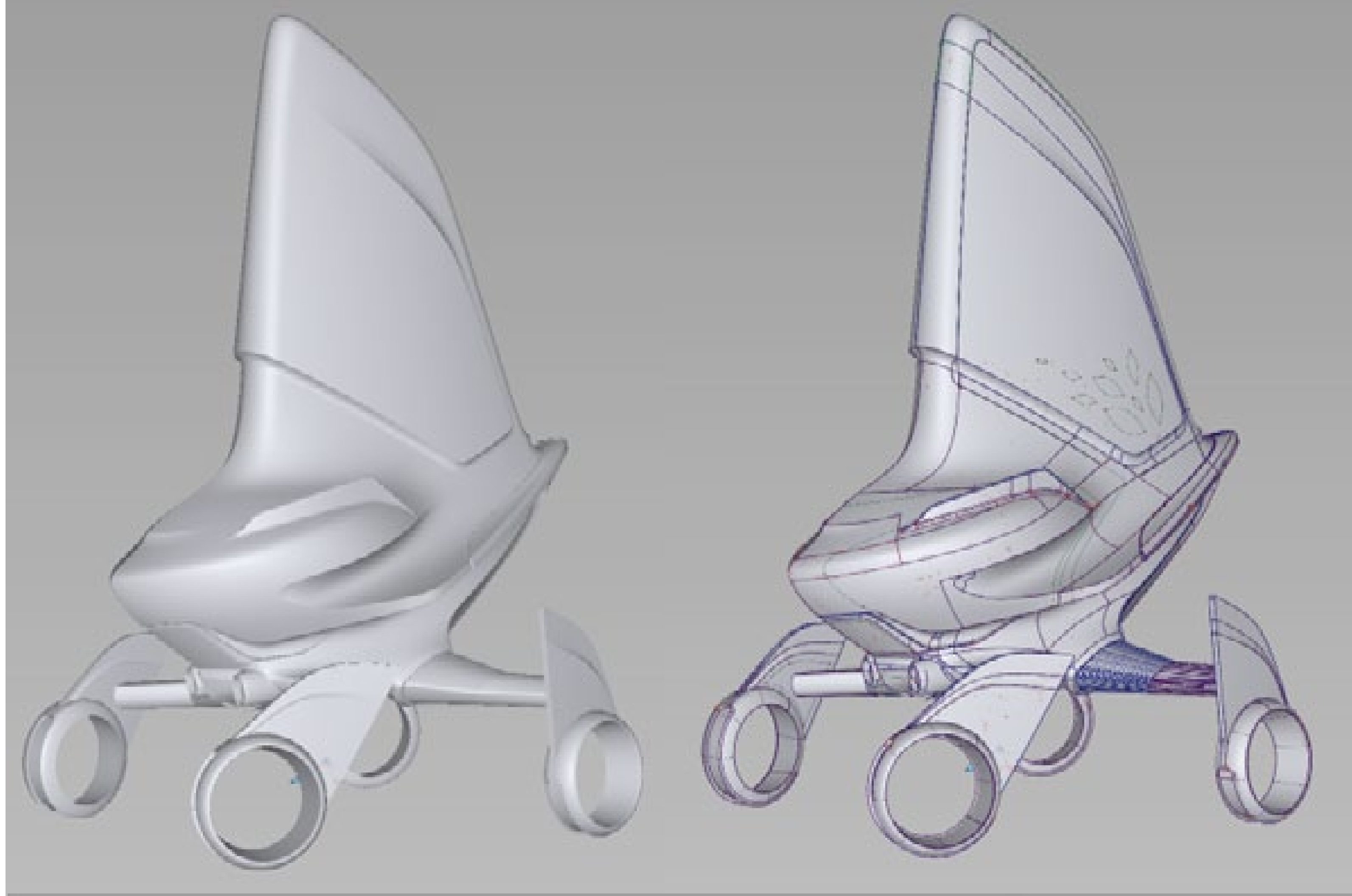
5.6 ESCAPE MODEL MAKING PROCESS

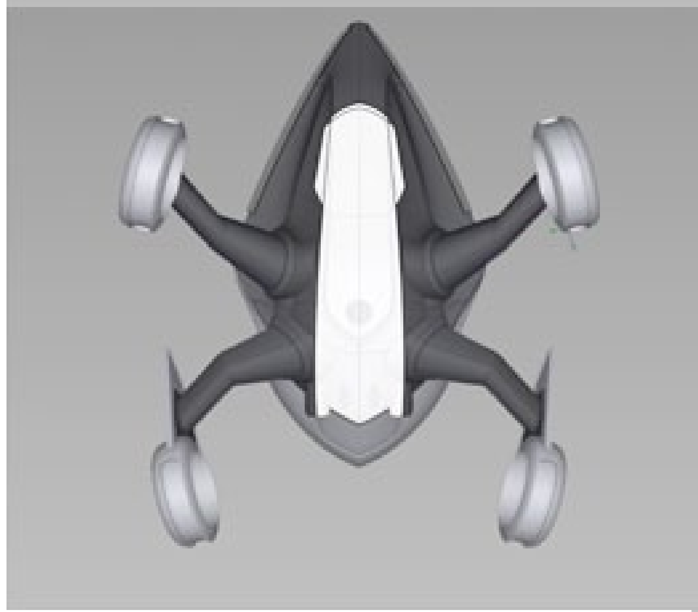
After the colour and trim process was completed the model was evaluated for its “prototypability”. Originally the model was to be split into several pieces and printed in plastic or plaster, however after speaking to manufacturers it was recommended that most of the model could be made from one piece to lower cost and reduce complexity of assembly. Therefore the main body of the model would be made from one piece with smaller parts printed.

The imagery on the opposite page shows the main body of the model as it was to be made. The model was to be made from essentially one piece of ABS plastic, with part lines milled.

A colour breakup was required by the manufacturer as the model was to be painted shortly after fabrication.

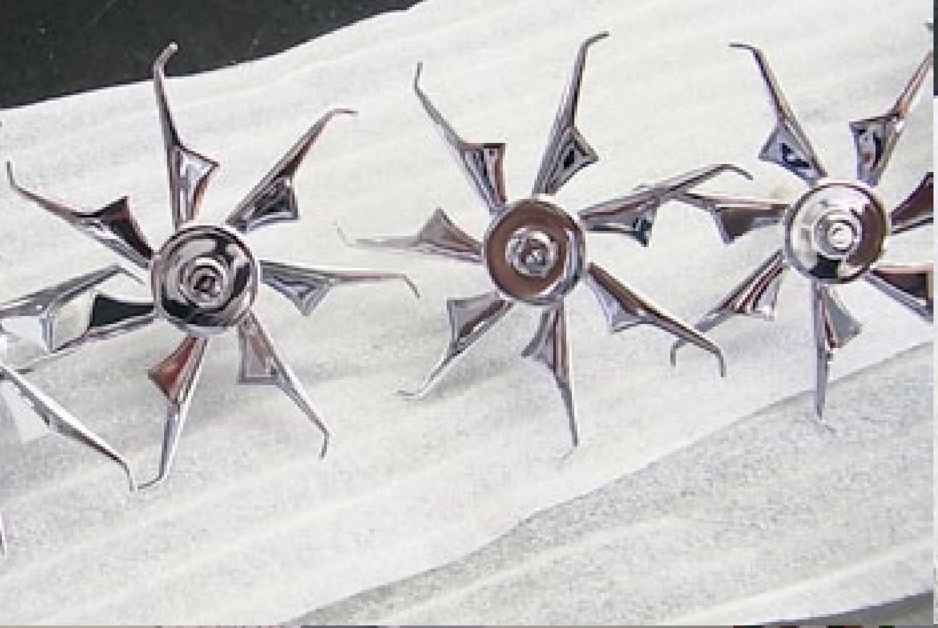






Escape model general assembly

Individual parts to be rapid prototyped totalled 61 pieces including the main body of the model. Within a week of the model being finalised the first images were sent of what had been already made (below). At this stage smaller parts were sent off for plating whilst rubber parts were still being printed. The main body of the model was sent to be finished and prepped for painting.

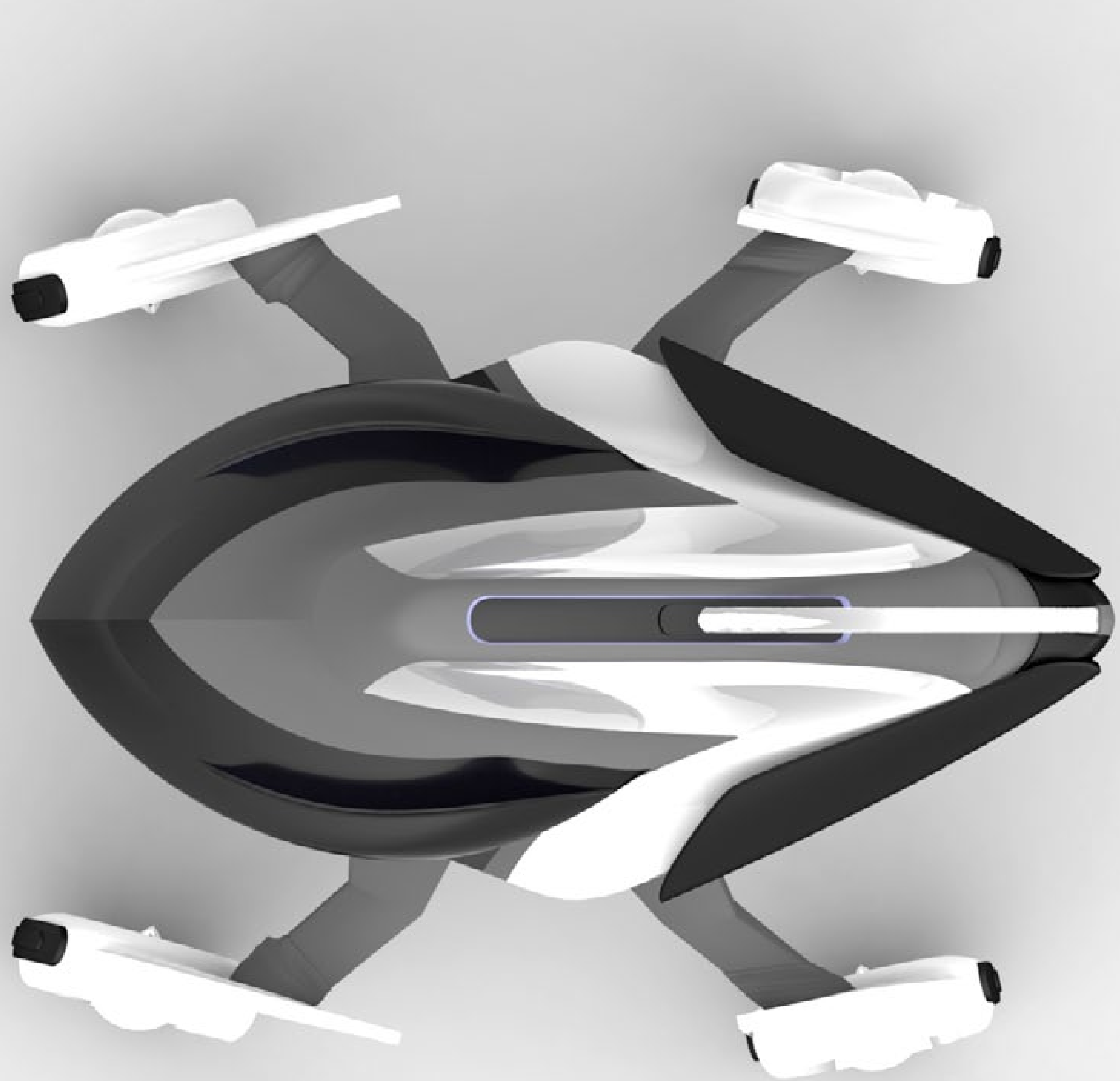







A week after the first images were sent more came through showing the progression of the model. At this stage the model had been finished and first coats of paint had been applied. Plated parts had also been completed along with some of the rubberised parts.

By the beginning of the third week the model had been completed and was arranged to be sent. There were some small discrepancies noticed in the assembly of some parts of the model but alas nothing could be done as the model was already in transit.



5.7 DEMONSTRATION OF DESIGN OBJECTIVES

5.7.1) To create a new form of sustainable personal air transport.

The primary objective of this project was to create a new form of sustainable air transport drawing inspiration from airships in particular. Sustainability can be measured by the vehicles potential to cause environmental harm by design and/or through the vehicles manufacture, materials and processes.

Escape is indeed a new form of sustainable air transport, incorporating several key environmentally friendly functionality features inherent to traditional airships and adding a range of new possible functionality characteristics unique to the concept. Escape also addresses the use of materials and manufacturing processes used to manufacture this type of vehicle in an environmentally savvy fashion.

Escape is technically a lighter than air vehicle hybrid utilising helium to render the vehicle neutrally buoyant and four independently operated vectoring fans for propulsion. Helium gas (when used as a source of lift) greatly reduces the amount of effort needed to carry a vehicle aloft when compared to conventional aircraft. A helicopter by way of example needs to produce vast amounts of lifting force to become airborne, consequently the amount of energy expended is usually matched by the amount of fuel used and carbon emissions produced. Escape would be able to operate with little or no carbon emissions because, unlike aforementioned conventional aircraft requires far less effort to become airborne and to remain airborne.

Escapes electric vectoring fans require little energy and would be able to operate solely on infinitely available, environmentally friendly solar energy. Airships by design have a large surface area, Escape is no exception. Utilising its large surface area in built with solar energy capturing fabrics Escape would be able to recharge its on board power supply by demand.

Escapes walker architecture would incorporate a small hydrogen fuel cell engine (potentially borrowed from a automobile) to carry the vehicle at walking pace. Although this technology is currently commercially un-viable it is likely to become mainstream looking to the future post electric vehicles. Water is the only emission produced by this type of engine technology.

Renewable or reusable “green” materials and manufacturing processes would be incorporated throughout the manufacture of Escape (covered in the materials and manufacturing rationale) complementing its unique green operational characteristics.

In the long term design elements incorporated into Escape will be redefined as higher performing technologies become available.

5.7.2) To restore confidence in perceived airship safety.

There is no doubt that the events that transpired on May 6th 1937 destroyed public confidence in airships as a form of transport. The Hindenburg disaster ended the airships reign over the skies. The imagery captured on that day would go on to become popularised as a measure of destruction akin to the atom bombs mushroom cloud.

A key objective of Escape is to restore humanities lost confidence in airships as a form of transport. “Restore”, the operative word indicates that airships once had public confidence, indeed prior to the Hindenburg disaster airships were looked upon by many with fascination, intrigue and excitement. Airships were the first commercial means of passenger air transport, a chance to escape and visit foreign lands.

Escape looks to rebuild confidence in airships by targeting the personal user, over the mass consumer. It is hoped that Escape will succeed in breeding confidence back in the general public through a safe, hip, environmentally friendly, ultimately attainable (by the private consumer) personalised aircraft that will give the user an unparalleled opportunity for adventure and escape.

Escape offers an environmentally friendly way to have fun in the sky inclusive to Escapes unique visual aesthetic and operational functionality and unlike airships of the past Escape is hydrogen free, operating using safe inert helium.

Further safety bias functionality includes modernised navigation, weather forecasting and operational technologies.

The Hindenburg was the largest, most grandiose aircraft ever created and was ultimately one of the most flawed. Whilst the defining pieces of imagery taken on the day of its demise are likely to forever remain in the airship psyche, one can hope that a product like Escape will one day revolutionise the mode of transport allowing the general public to once again see the airship in a positive light.

5.7.3) Push functionality and styling boundaries.

Push functionality and styling boundaries as an objective was born out of the designers frustration in seeing repetitive airship design.

Escape looks to budge convention by introducing a new range of functionality and a new aesthetic never before seen in airship design. Escape is intentionally against the grain from a design point of view as the objective was to take what is known and to venture into the unknown in a sort of design adventure.

5.7.4) Create an approachable, humanistic mode of transport.

Escape is to be an approachable, humanistic mode of transport. Approachability can be defined as a products ability to draw attention to itself through its visible functionality and aesthetic and thus draw the user or consumer to the product for investigation. A “humanistic” design can be defined as design that is reflective of the human condition.

Escape is undoubtedly an approachable vehicle as it is unlike any other product currently available. its unique operating functionality and aesthetic are visual lures, aiming to intrigue and fascinate its potential audience. Its animalistic like walking functionality and the general ability of flight look to prompt emotional responses from those who operate it.

Escape looks to reflect the human condition by including the ability to recognise its owner, greet its owner and ultimately share or reflect emotional experiences during operation. This is achieved through visual and audio feedback from the vehicle before, during and after use.

5.7.5) Redefine the airship.

Another key objective of this project was to ultimately redefine the airship from a functional and aesthetic standpoint . This objective coupled with the previous objectives yields a new breed of airship unlike any other.

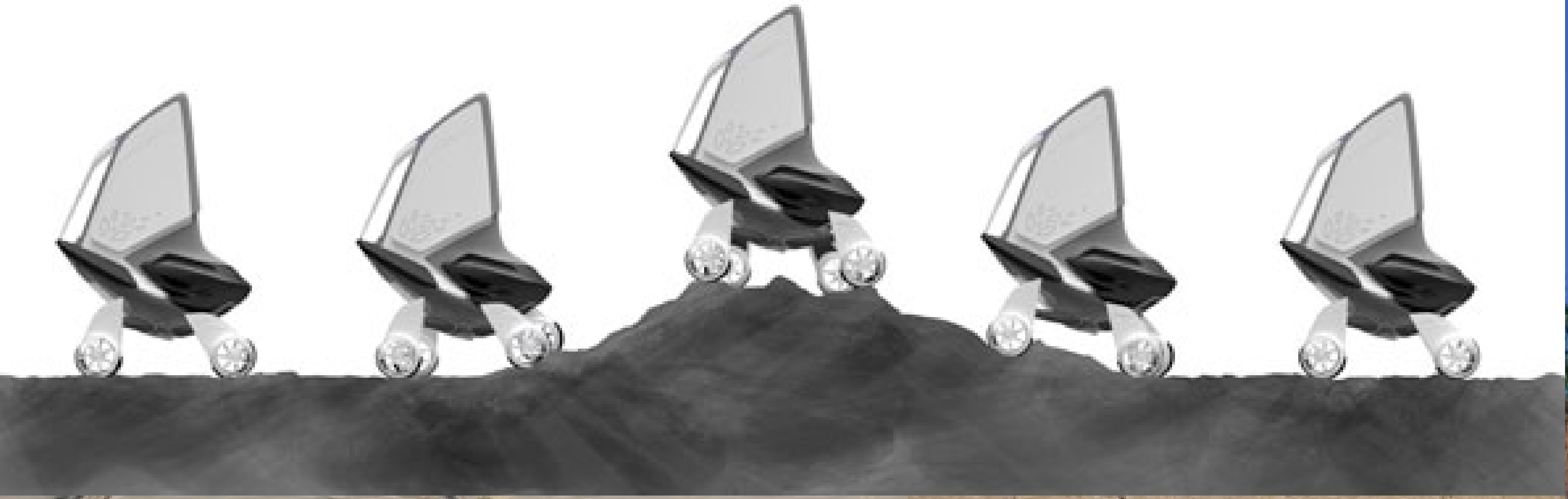
Airships are no longer lumbering giants. The physical size of airships has always been one of their most defining features amongst others including their bullet shape design and perceived safety issues. Escape looks to shake perceptions of airships by greatly reducing their overall size when grounded in plain field of view of potential users.

it is believed that by changing or reducing the visual impact of an airship whilst it is grounded will potentially reduce or abolish any initial negative emotional responses a user may have when approaching the same type of vehicle of much larger size. Negative emotional responses born out of perceived safety concerns through the likes of the Hindenburg disaster. Therefore Escape is to remain compact in comparative size to other grounded airships and only increase in size when it needs to.

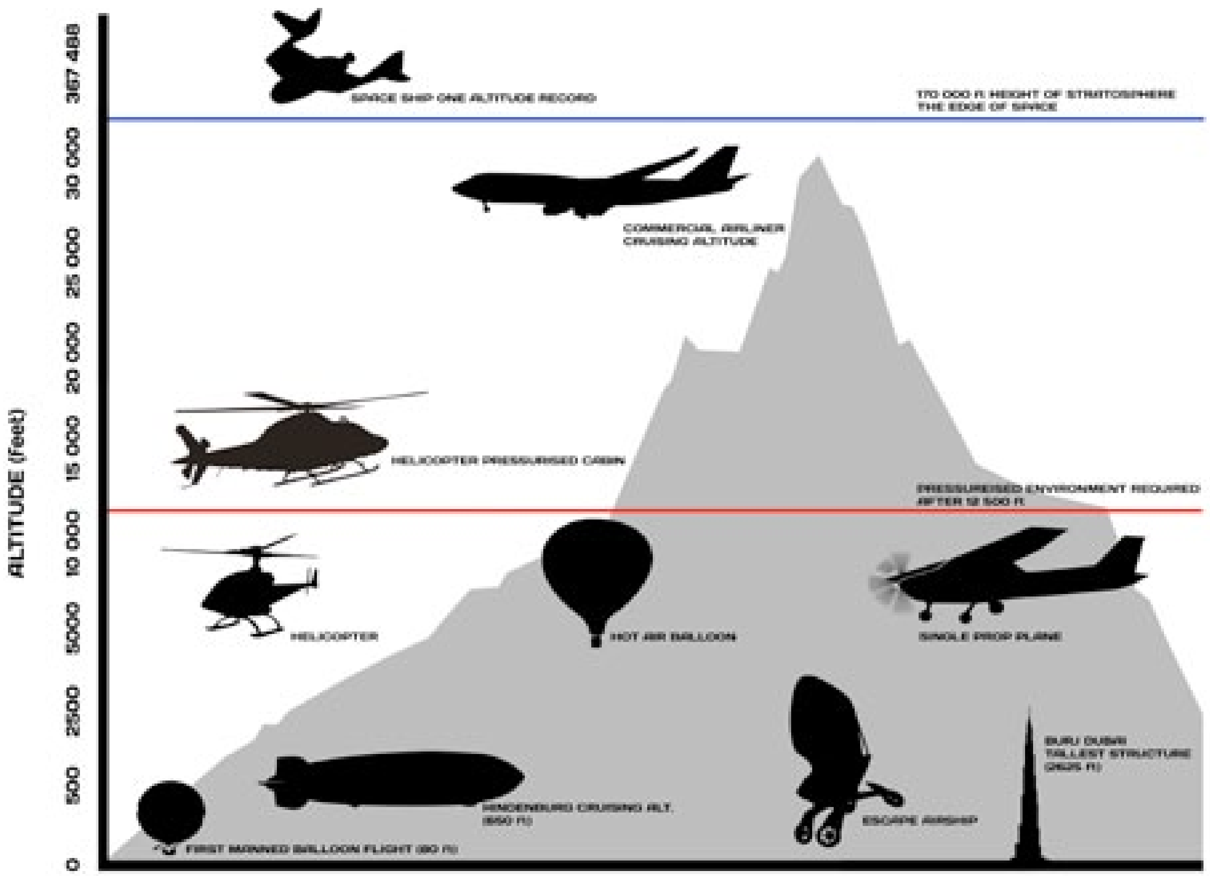
Another method in redefining the airship was to include unexpected functionality in the form of the walker component of Escape. The walker functionality allows greater versatility in vehicle operation and inherits an animal like aesthetic.

Escape is successful in redefining the airship as it borrows important functionality from traditional airship design, modernises it, redefines it and injects it into a visually unique aesthetic.

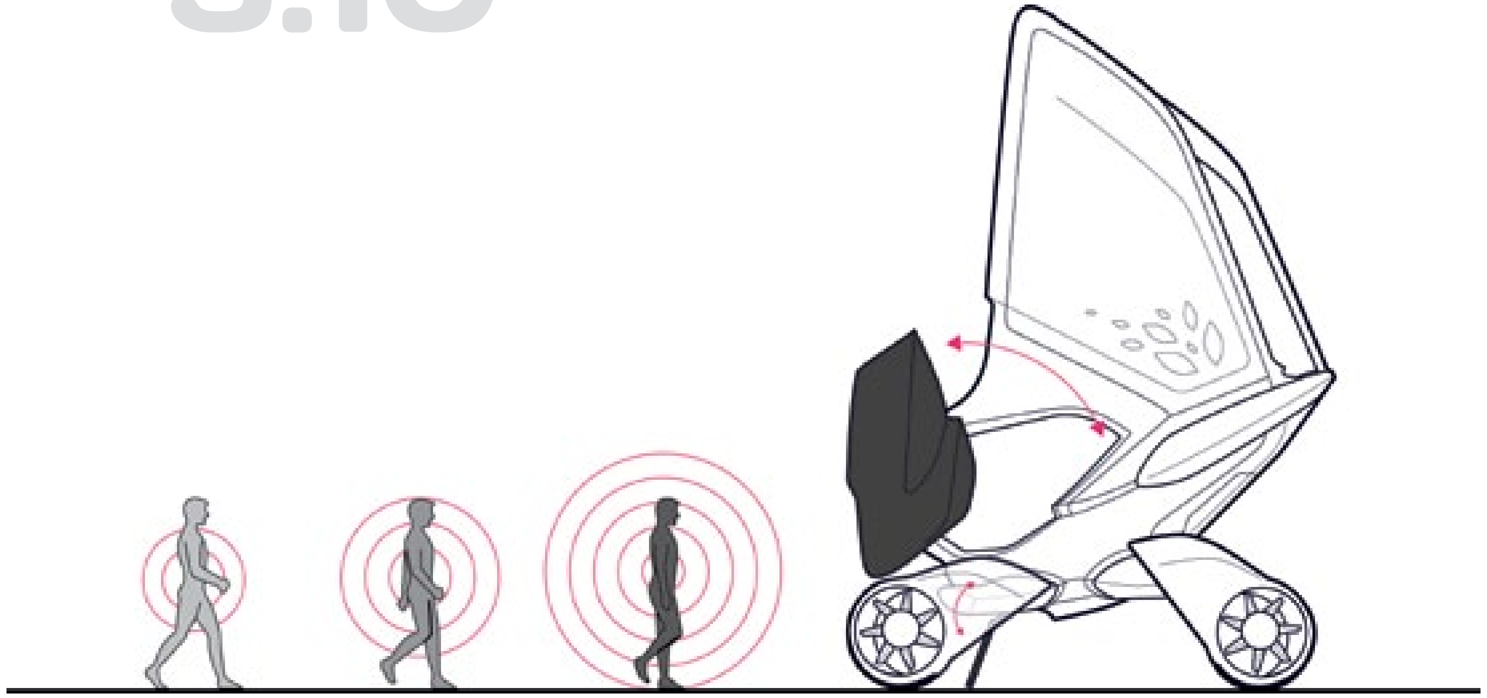
5.8 WALKER FUNCTIONALITY



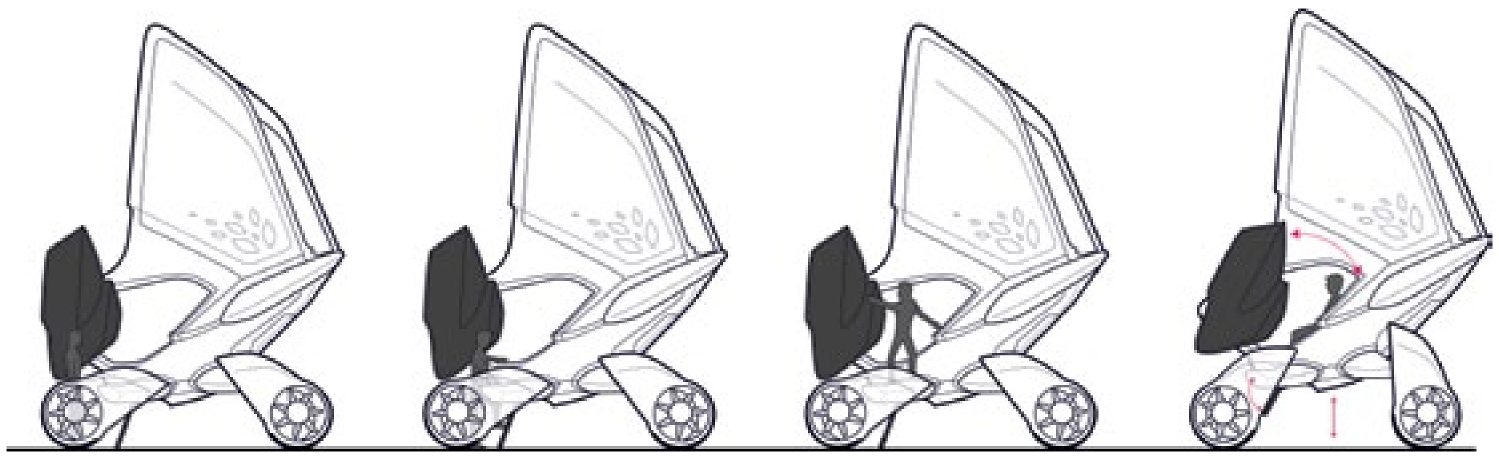
5.9 FLIGHT FUNCTIONALITY



5.10 EXTERIOR FUNCTIONALITY



Escape is to be able to recognise its owner. Upon approach (when prompted) Escape is to prepare itself for journey, firing all necessary systems anticipating departure.

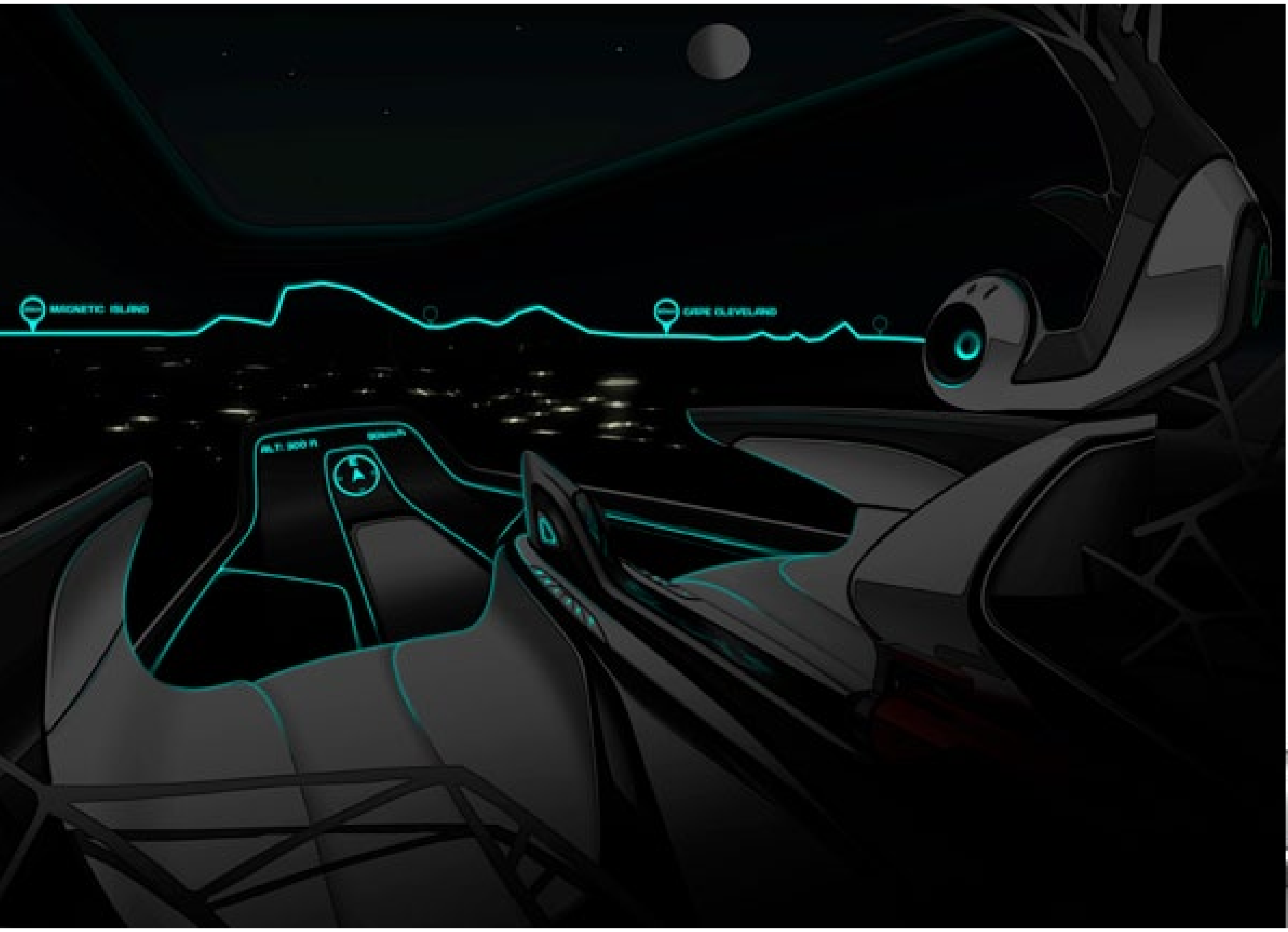


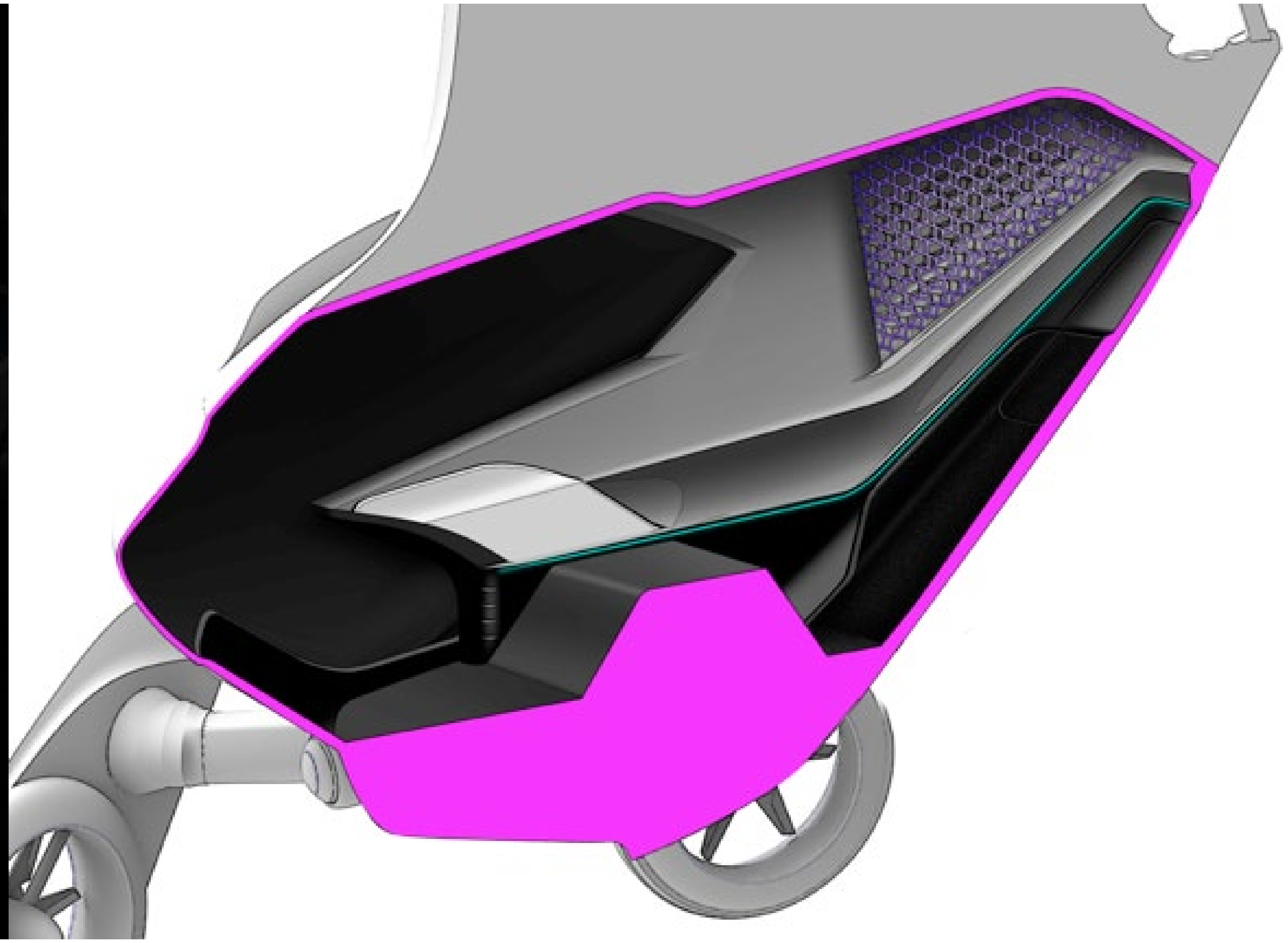
Once the user of Escape has approached the vehicle the vehicle itself is to adjust its stance accordingly. A retractable ladder is also to be deployed for ease of ingress.

Escape is to also include a retractable rear cargo entry point (top right)

A recharging/refuelling station infrastructure is to be available for Escape to replenish on board helium supplies and batteries if required. (bottom right)

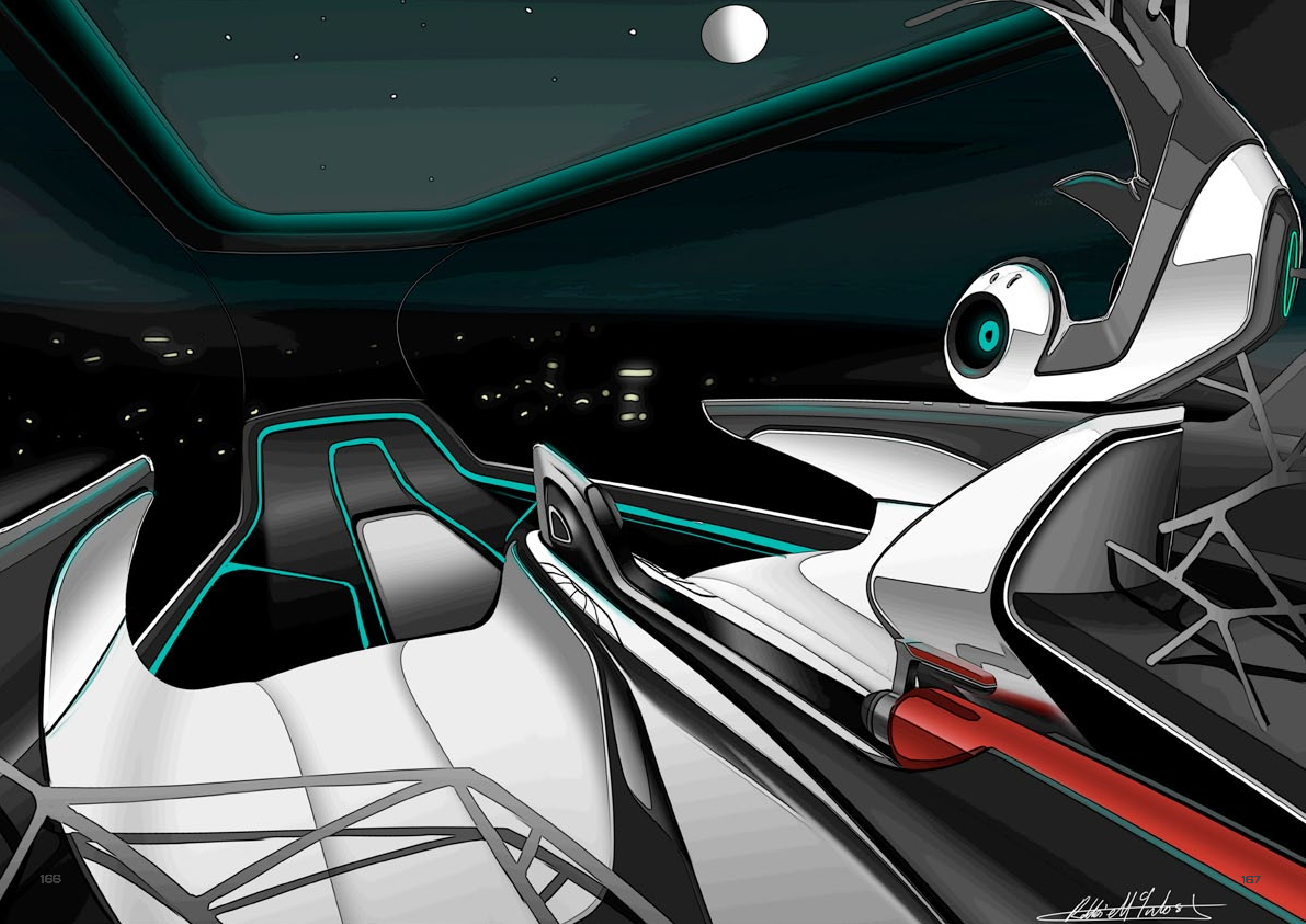
5.11 INTERIOR FUNCTIONALITY





Escapes interior is to incorporate a navigation system which suggests to the occupant potential travel destinations or points of interest.

Escapes main cargo area rearward of the occupant is to incorporate functional accommodations for the securing of cargo.



5.12 ADDITIONAL DESIGN FUNCTIONALITY

1) Escape has two distinct functionalities built in. The walker mode and the airship mode could be separated to form alternative vehicles with a single main functionalities increasing overall vehicle product range.

2) Escape, given its relatively small size could be sold in a display room/warehouse type setting.

3) Escape would most likely be transported from factory manufacturing facilities by traditional road transport.

4) Escape like most other privately owned aircraft would most likely have to stored in a hanger if its owner is living in an urban area.

1)

2)

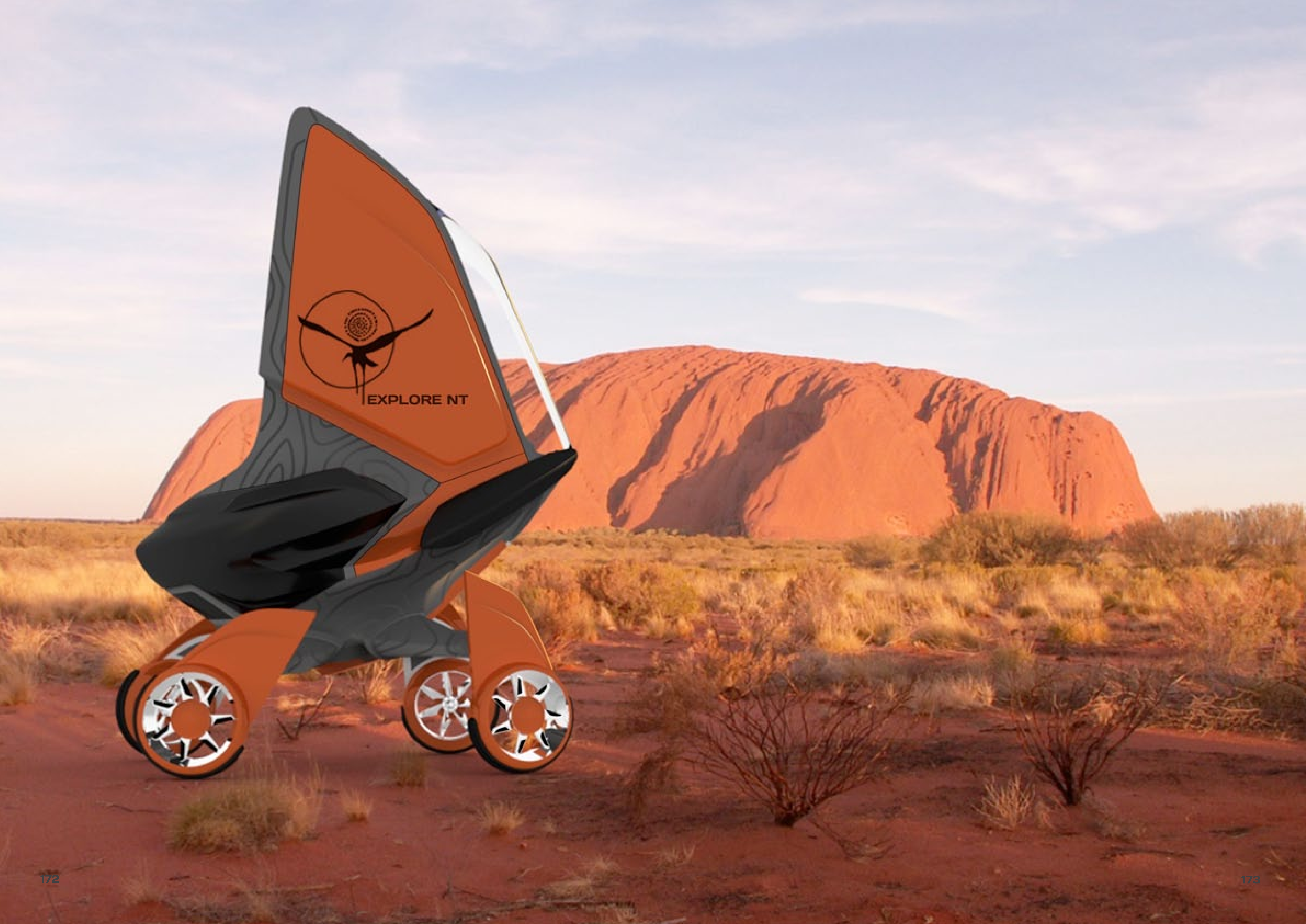
4)

3)

5.13 DESIGN APPLICATIONS

Escape has the potential to be used in a number of commercial and non commercial applications including eco/ adventure tourism, advertising, package delivery/freight and disaster relief.

Its adaptability to its operating environment allow Escape to go where no other craft of its type has gone before, therefore there is the potential for completely new industries and ventures to founded based on this vehicles capabilities.


EXPLORE NT

5.14 A DAY IN THE LIFE OF ESCAPE

The following imagery is representative of a day in the life of Escape as used in this scenario by a Grazier/farmer.

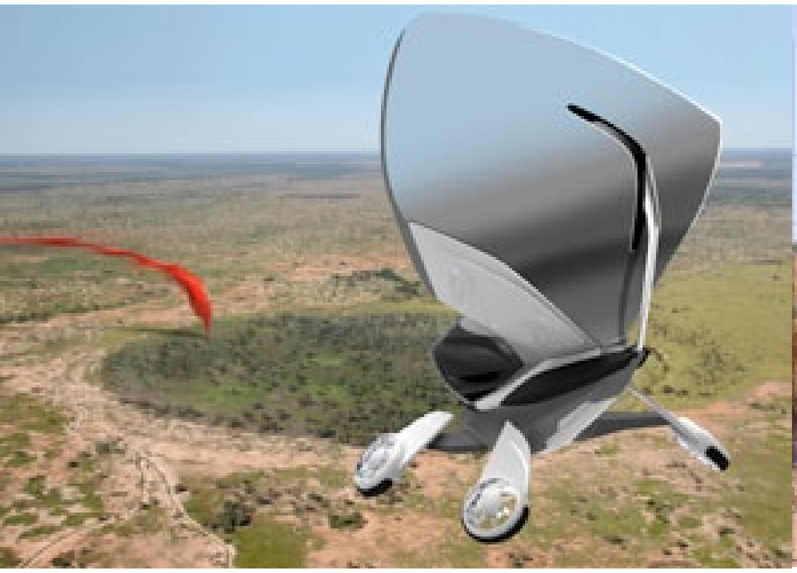



6;15 am: As the sun rises Escape enters charging mode. Its crest expands to increase its surface area allowing for maximum generation of energy.

8:00 am: The property is already awake and buzzing as Escape takes off for its first run of duties.

9:00 am: There was reports of a broken water pump. Jack meets with a field staff member who is to help him fix the problem.

9:30 am: Jack approaches the water pump




11:00 am: During a typical fly over of the property Jack notices some suspicious looking smoke

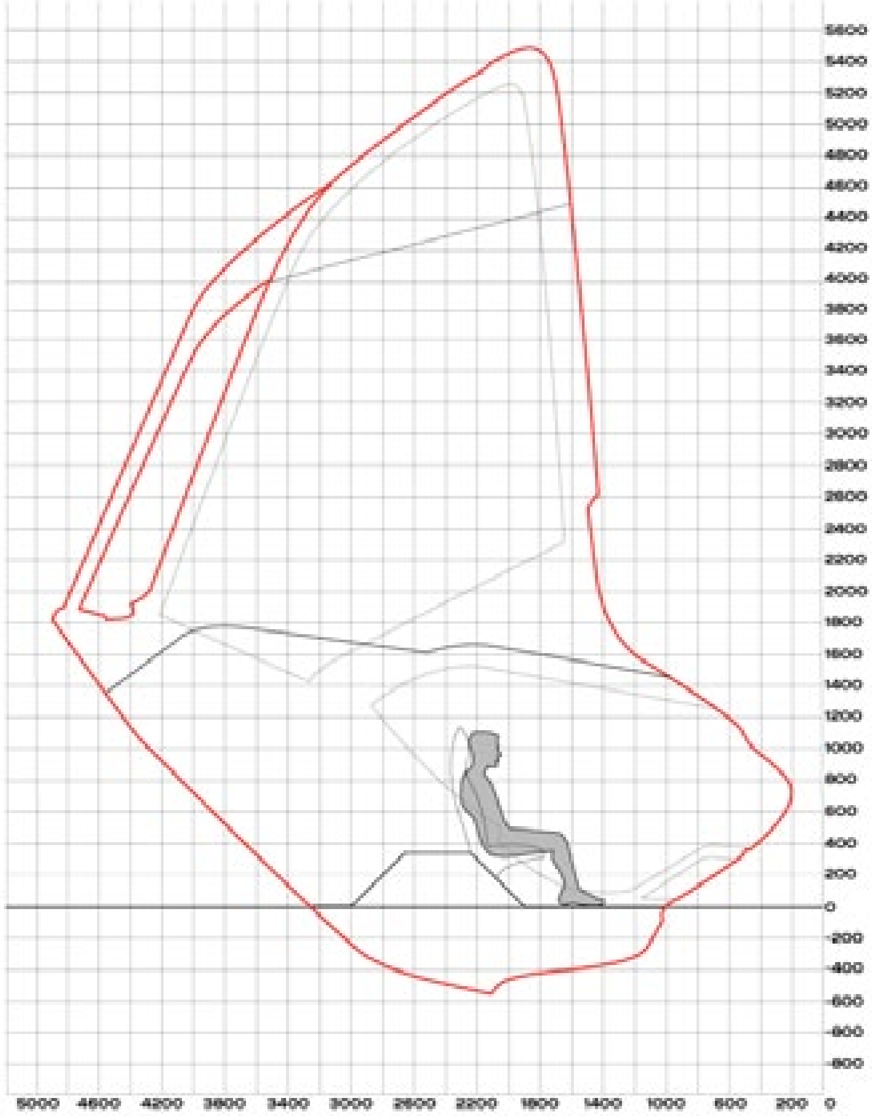
12:00 pm: Jack inspects some 150km of fencing, noticing a breakage Jack heads back to pick up supplies

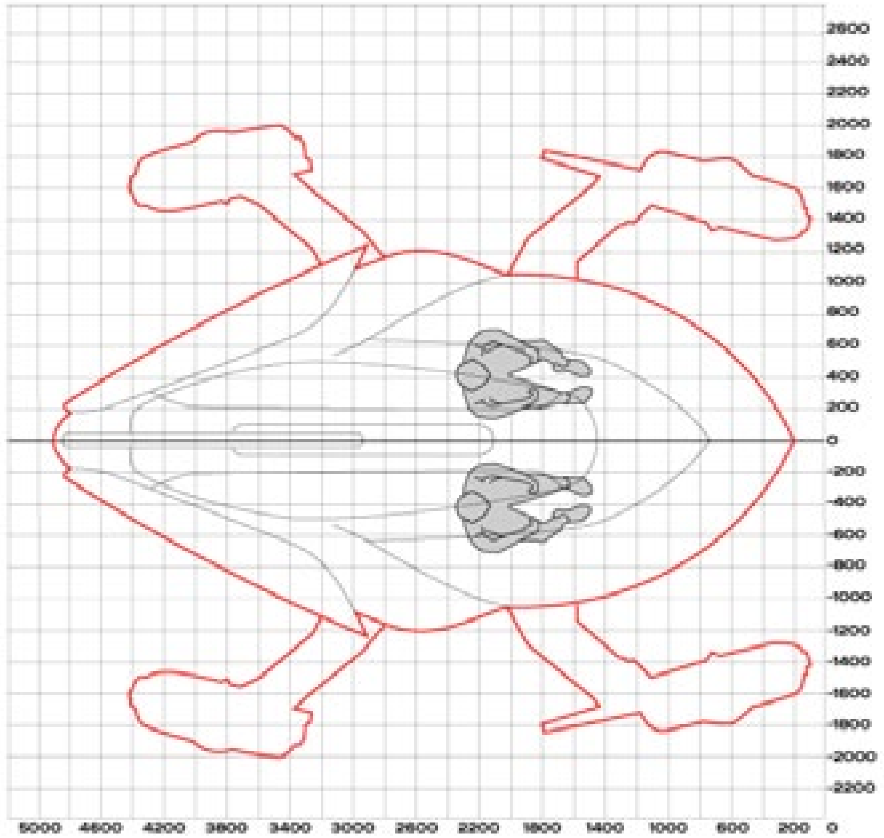
1:30 pm: Jack heads back to the fence line with 30 pound of wire to fix the fence.

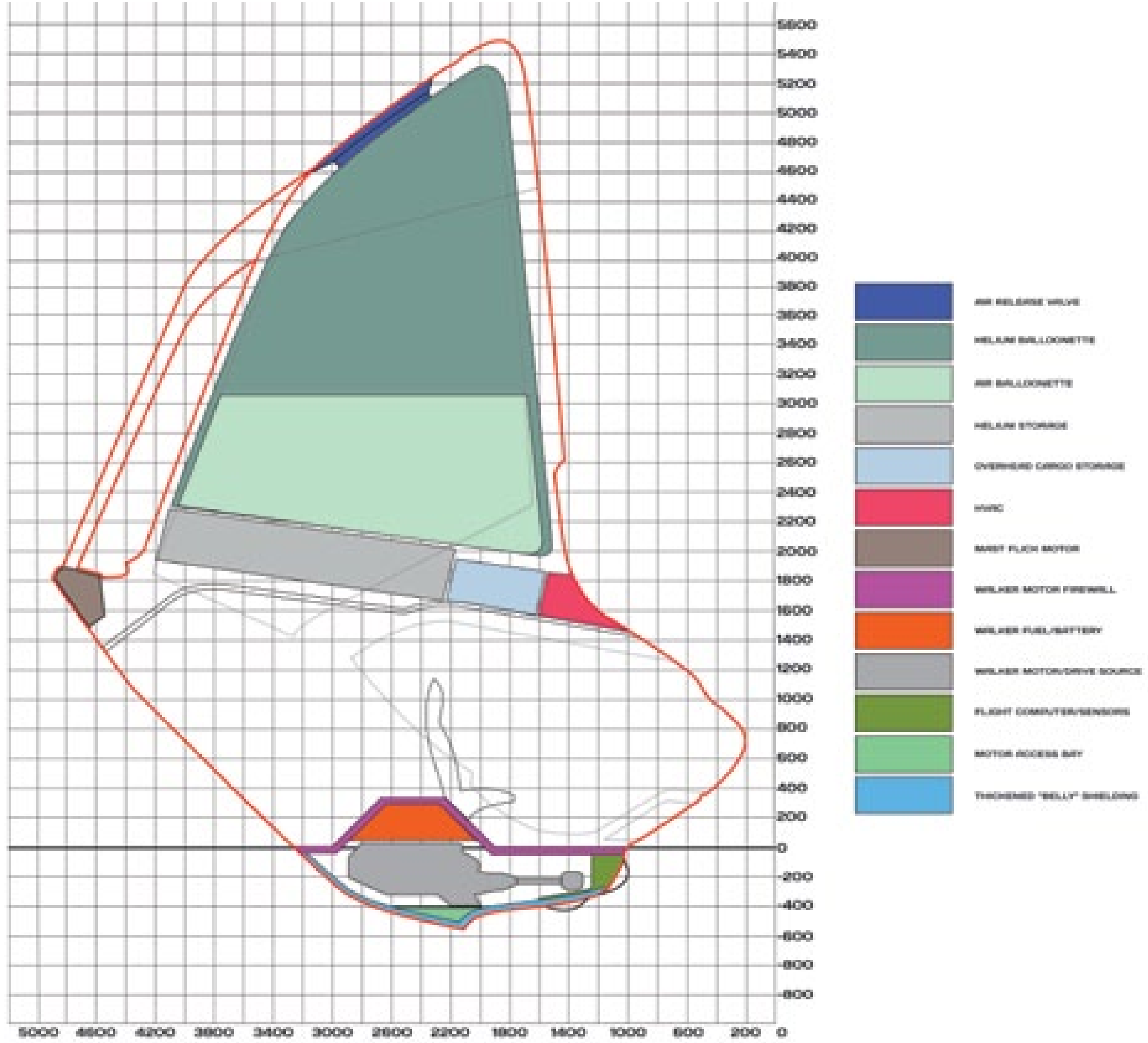
4:30 pm: Jack helps with some mustering duties.

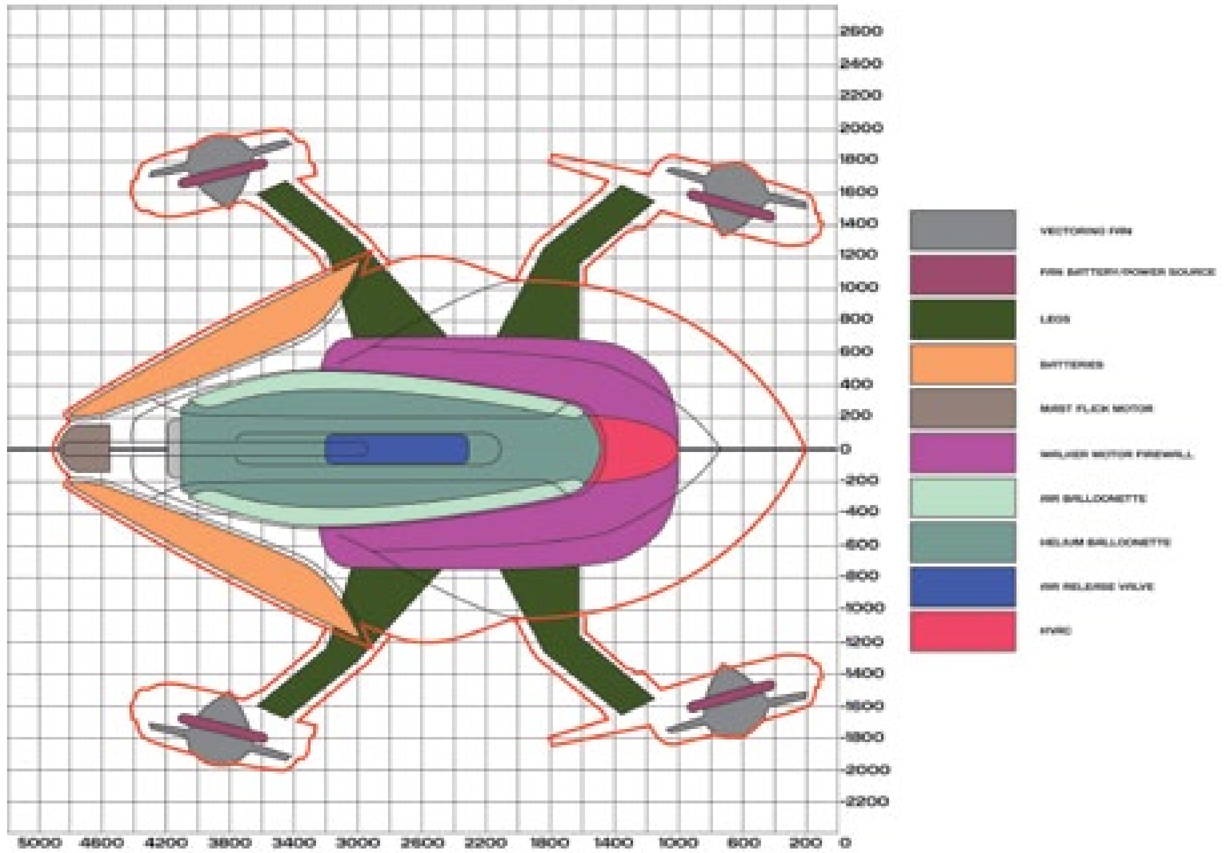
5.15 PACKAGING REQUIREMENTS

The following imagery is representative of Escapes overall size and packaging requirements.






AIR RELEASE VALVE
HELIUM BALLOONETTE
AIR BALLOONETTE
HELIUM STORAGE
OVERHEAD CARGO STORAGE
HVAC
MAST FLICK MOTOR
WALKER MOTOR FIREWALL
WALKER FUEL/BATTERY
WALKER MOTOR/DRIVE SOURCE
FLIGHT COMPUTER/SENSORS
MOTOR ACCESS BAY
THICKENED "BELLY" SHIELDING

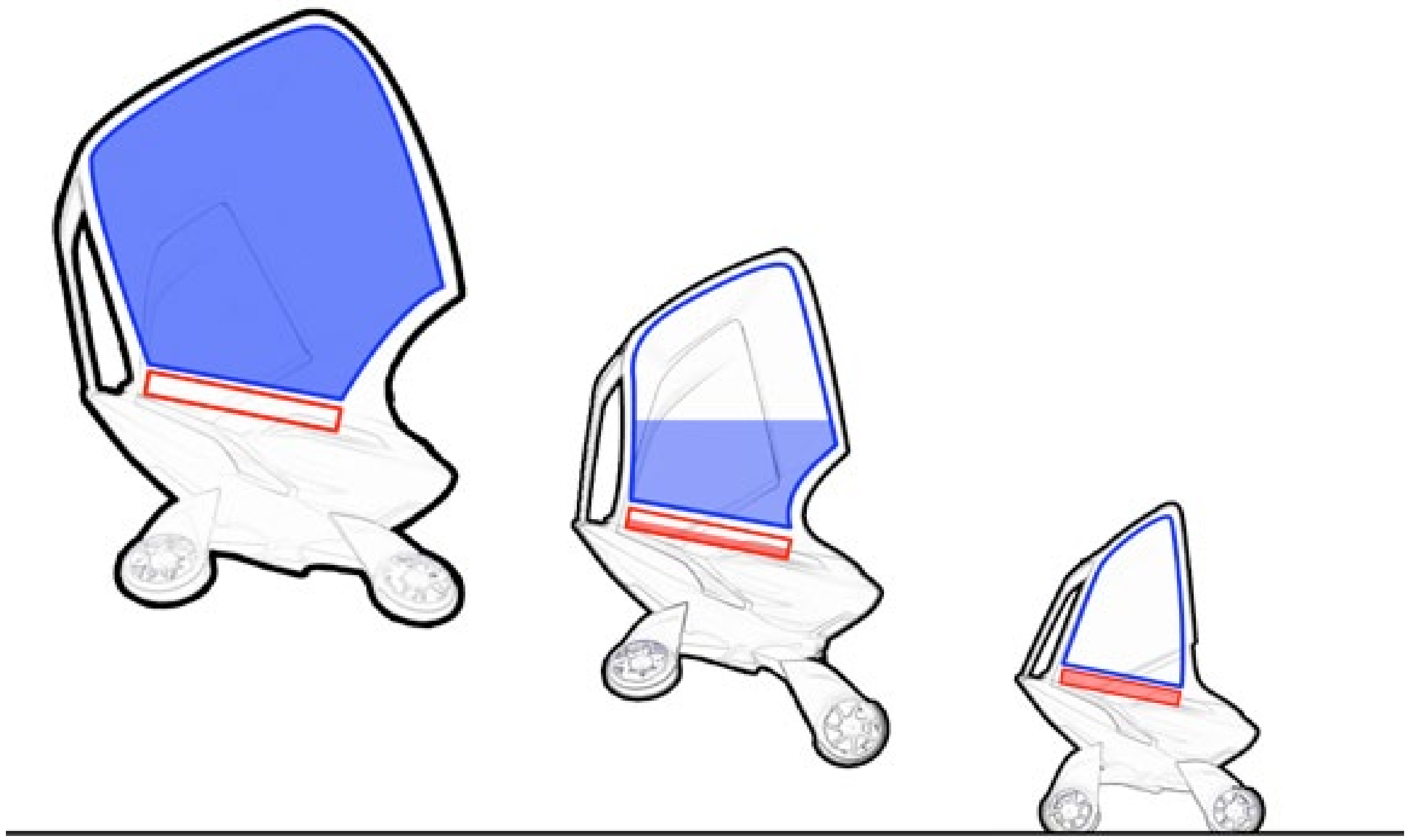

VECTORING FAN
FAN BATTERY/POWER SOURCE
LEGS
BATTERIES
MAST FLICK MOTOR
WALKER MOTOR FIREWALL
AIR BALLOONETTE
HELIUM BALLOONETTE
AIR RELEASE VALVE
HVAC

5.16 TECHNICAL STORY

Escape is to incorporate similar manufacturing and construction techniques employed by traditional air transport. Early aircraft were constructed using internal frames usually made from wood or steel tubing, This frame work was then skinned with fabric or sheet metals such as aluminium to increase structural rigidity.

Escape is to incorporate a one piece basalt fibre airframe. Accompanied by hard molded and soft stretch fabric exterior and interior cabin surfaces. Because of the uniqueness of the concept a realistic airframe design cannot be created without the assistance of persons with adequate knowledge.

Escape is to incorporate a system in which the helium used in flight operations is able to be recaptured for reuse in future journeys. As this particular system does not exist in this particular application the designer must draw on common sense rather than engineering finesse in the conceptualisation of this system. Imagery in the package requirements section show general placement of such a system. Imagery on the left show the designers interpretation of the technology within Escape concept. The imagery below show the general principle behind the idea.



In full flight most of the stored Helium will have been released into the airship allowing for maximum lift. During decent Helium is pumped back into its storage container. Once on ground the Helium storage should be full and the ballonet empty.

Basic materials breakdown

5.17 MATERIALS AND MANUFACTUREING RATIONALE

Airships have always been cast as a environmentally friendly aircraft, however materials and manufacturing processes used to create this kind of vehicle haven't always shared the same reflection.

The use of green materials and construction processes is becoming more and more common in contemporary design practice. Utilising new and emerging green materials, including super bio-plastics and organic fibre composites the designer is effectively able to replace conventional petroleum based materials. The processes in which these materials are made are also able to be manipulated so that minimal or no negative effects on the environment are felt. Carbon offsetting the production processes and recycling or reusing existing materials are just a few ways that this can be achieved.

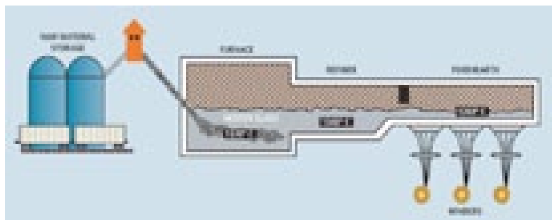
Escape if it were to be made would incorporate green materials and processes into its manufacture where able.

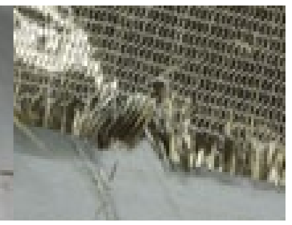
Internal framework and structural components

Basalt fibre reinforced materials would be incorporated into Escapes internal structural framework. Infinitely available, recyclable basalt fibre is made from volcanic rock and has similar properties to that of other structural materials including aluminium and carbon fibre.
Basalt composite components (such as pipes and rods) are made from unidirectional basalt reinforcement. By industrial production of basalt fibers on the basis of new technologies their cost is equal and even less than cost of glass fiber.

"Basalt fiber is produced in a continuous process similar in many respects to that used to make glass fibers. Quarried basalt rock is first crushed, then washed and loaded into a bin attached to feeders that move the material into melting baths in gas-heated furnaces. As crushed basalt enters the furnace, the material is liquefied at a temperature of 1500°C/2732°F. With overhead gas, the melting basalt must be held in the reservoir for extended periods of time — up to several hours — to ensure a homogenous temperature. Like glass filaments, basalt filaments are formed by platinum-rhodium bushings. As they cool, a sizing agent is applied and the filaments are moved to speed-controlled fiber stretching equipment and then on winding equipment, where the fiber is spooled."

Basalt fiber basic manufacturing process Basalt rock raw material Spun Basalt fiber Basalt fabric



“Basalt fibers are naturally resistant to ultraviolet (UV) and high-energy electromagnetic radiation, maintain their properties in cold temperatures, and provides better acid resistance than glass fibers.. Reportedly, basalt also is superior in the realm of worker safety and air quality as well. Since basalt is the product of volcanic activity, the fiberization process is more environmentally safe than that of glass fiber. The “greenhouse” gases that might otherwise be released during fiber processing, he says, were vented millions of years ago during the magma eruption. Further, basalt is 100 percent inert, that is, it has no toxic reaction with air or water, and is noncombustible and explosion proof.”

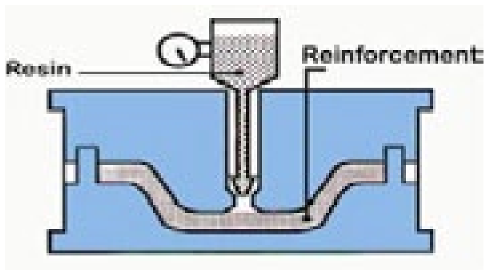
“While basalt fiber is still not widely used, it is slowly making its way into the hand of consumers. At price points that vary between S-glass ($5/lb to $7/lb) and E-glass ($0.75/lb to $1.25/lb), basalt fibers have properties akin to S-glass. A common use is in the fire protection sector because of its high melt-point. Fire-blocking tests performed by Basaltex placed its basalt fabric in front of a Bunsen burner, placing the yellow tip of the flame in direct contact with the fabric. The yellow tip reaches temperatures of 1100°C to 1200°C (2012°F to 2192°F) and causes the fabric to become red hot, similar to a metal fabric. When exposed to the flame, basalt fiber maintains its physical integrity for extended periods of times, but the company found that a fabric made of E-glass with the same density can be pierced by the flame in a matter of seconds.”
Source: Composites world. http://www.compositesworld.com/articles/basalt-fibers-alternative-to-glass

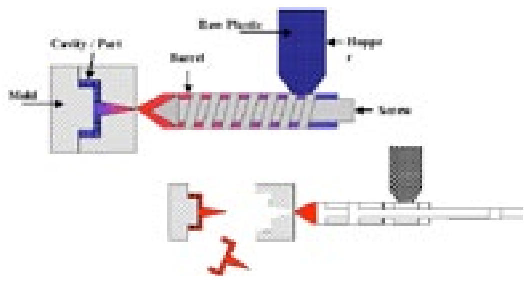
Molded exterior and interior components/surfaces

Basalt fibres is also to be incorporated into Escape’s Molded exterior panelling as well as secondary surfaces including vehicle insulation, mechanical componentry insulation and interior fabrics.

“Resin Transfer Molding (RTM) allows the molding of components with complex shapes and large surface areas with a good surface finish on both sides. It’s a process suited for short and medium production runs and is employed in many different transport applications (truck cabs are an example).

The motive force in RTM is pressure. Therefore, the pressure in the mold cavity will be higher than atmospheric pressure. In contrast, vacuum infusion methods use vacuum as the motive force, and the pressure in the mold cavity is lower than atmospheric pressure.





Resin Transfer Molding process

Basic injection molding process

In the RTM process, a liquid thermoset resin system is pumped into a closed mould cavity wherein it is preloaded with dry reinforcements. On the cure of the thermosetting resin, the moulded FRP product is released from the mould” Source: RTM composites. http://www.rtmcomposites.com/rtm.html

Basalt has good sound insulating properties. Its sound insulating properties would be utilised to reduce noise pollution produced by mechanical componentry heard in the cockpit allowing for a more pleasant journey.

UV-cure clearcoat would be applied to all exterior panelling. The clearcoat is exposed to ultraviolet light rather than to the high temperatures that are used traditionally. This system provides a harder finish and means the Escape will be more resistant to scratches. The process eliminates the need for a bake oven and uses less energy and solvents than traditional systems.

Molded bio-plastics including those derived from corn starch and kenaf would replace molded petro-plastic components throughout.

Escapes rubber foot pads would include corn-based fillers over carbon fillers offer lower weight and improved traction on flat wet surfaces.

Polycarbonate plastic would be used for the cockpit surface because of its durability, its weight and its resistance to shock.

Flexible/expanding surfaces

Expandable surfaces which make up the soft surfaces on the crest of escape would be made from stretch fabric. A coating would need to be applied to the spandex to improve overall durability. BedouinFLEX is a specialised material produced by Australian company Bedouin tents.

“The range of BEDOUINFLEX TM fabric all contain a UV Absorber to prevent fading and a non- toxic microbial treatment to ensure the fabric is anti-fungal and bacteria resistant to provide the longest lasting stretch tent solution in the market. The fabric is incredibly strong with a two tonne breaking strain at any point, yet provides greater stretch than any comparable product.

BEDOUINFLEXTM is also the only stretch fabric designed in Australia to specifically meet the local climate conditions and rigorous fire, structural and safety standards. The additional unique feature of this fabric is its 100% recovery. BEDOUINFLEXTM fabric completely retains its original shape.” Source: Bedouin tents. http://www.bedouintents.com.au/Portals/0/BedouinTents/Files/Bedouin%20Tents%20-%20FAQ.pdf

Spandex can be produced in a number of different ways. The similarity between these processes is that the all require the mixing of monomers to produce a prepolymer. Below is one of the aforementioned processes used to create spandex.

“1 The first step in the production of spandex is the production of the prepolymer. This is done by mixing a macroglycol with a diisocyanate monomer. The compounds are mixed in a reaction vessel and under the right conditions they react to form a prepolymer. Since the ratio of the component materials produces fibers with varying characteristics, it is strictly controlled. A typical ratio of glycol to diisocyanate may be 1:2.

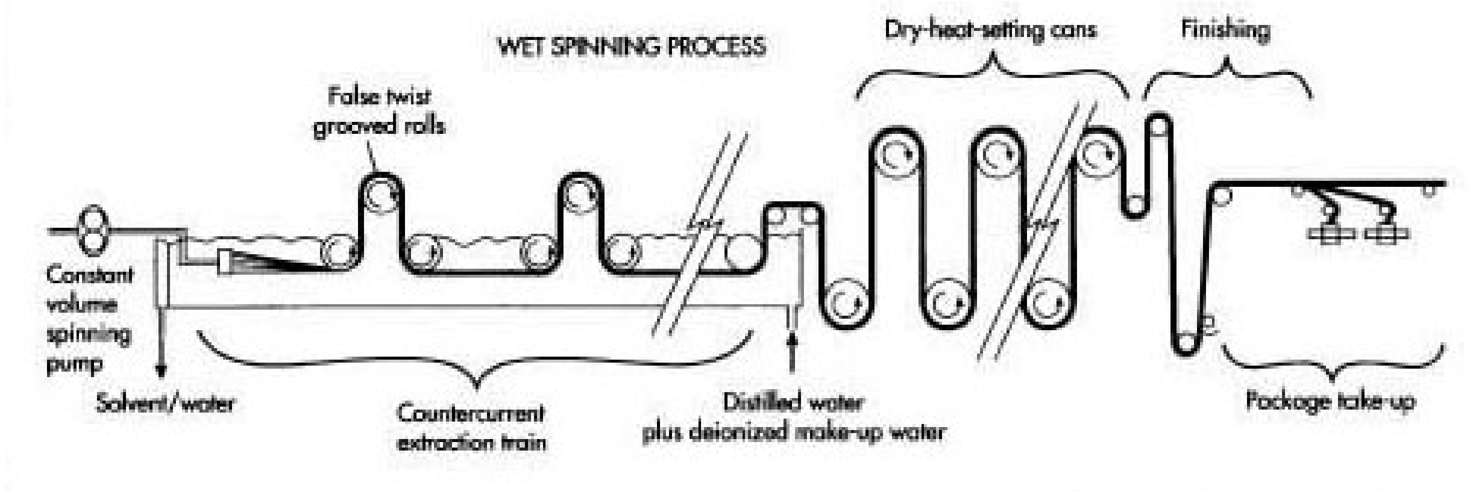
2 In dry spinning fiber production, the prepolymer is further reacted with an equal amount of diamine. This is known as a chain extension reaction. The resulting solution is diluted with a solvent to produce the spinning solution. The solvent helps make the solution thinner and more easily handled. It can then be pumped into the fiber production cell. Producing the fibers

3 The spinning solution is pumped into a cylindrical spinning cell where it is cured and converted into fibers. In this cell, the polymer solution is forced through a metal plate, called a spinneret, which has small holes throughout. This causes the solution to be aligned in strands of liquid polymer. As the strands pass through the cell, they are heated in the presence of a nitrogen and solvent gas. These conditions cause the liquid polymer to chemically react and form solid strands.

4 As the fibers exit the cell, a specific amount of the solid strands are bundled together to produce the desired thickness. This is done with a compressed air device that twists the fibers together. In reality, each fiber of spandex is made up of many smaller individual fibers that adhere to one another due to the natural stickiness of their surface. Final processing

5 The fibers are then treated with a finishing agent. This may be magnesium stearate or another polymer such as poly(dimethyl-siloxane). These finishing materials prevent the fibers from sticking together and aid in textile manufacture. After this treatment, the fibers are transferred through a series of rollers onto a spool. The windup speed of the entire process can be anywhere from 300-500 mi (482.7-804.5 km) per minute depending on the thickness of the fibers.
6 When the spools are filled with fiber, they are put into final packaging and shipped to textile manufacturers and other customers. Here, the fibers may be woven with other fibers such as cotton or nylon to produce the fabric that is used in clothing manufacture. This fabric can also be dyed to produce a desired color.” Source: Made how. http://www.madehow.com/Volume-4/Spandex.html#ixzz1c48x3AHV

BEDOUINFLEX TM stretch material



Stretch material manufacturing process

5.18 ESCAPE PROJECT CONCLUSION

The Escape project looked to redefine the airship for a modern era.

During the first 3 months of the project the basic concept behind Escape underwent several changes and transformations. Originally it was believed that Escape would largely be an interior design project - essentially a floating room or floating caravan. This idea was quickly overlooked as to shift focus to an exterior based project looking to redefine the vehicles core functions. This change was to streamline the research component of the project.

Escape was always intended to be small in comparison to traditional airships. This direction was chosen as the designer felt that larger airship concepts had been overdone and that an opportunity to design an airship for the private aviator existed.

Original concept designs for Escape were met with mixed reactions. Some thought that the concepts created were too traditional and didn't really push the fundamental idea far enough. In response to this concept 4 was created. Completely different and including unvalidated technologies concept 4 was a large risk as it required a greater deal of justification than previous concepts. Alas the concept was received much better than previous concepts so it was decided that it would form that basis of the project.

Semester two bought on a new range of challenges. Concept 4 had been met with optimism from lecturers and peers it was decided that the aesthetic proposed in the previous semester was too "cute" and needed a face lift to improve its overall visual impact. This face lift was to take place largely in clay.

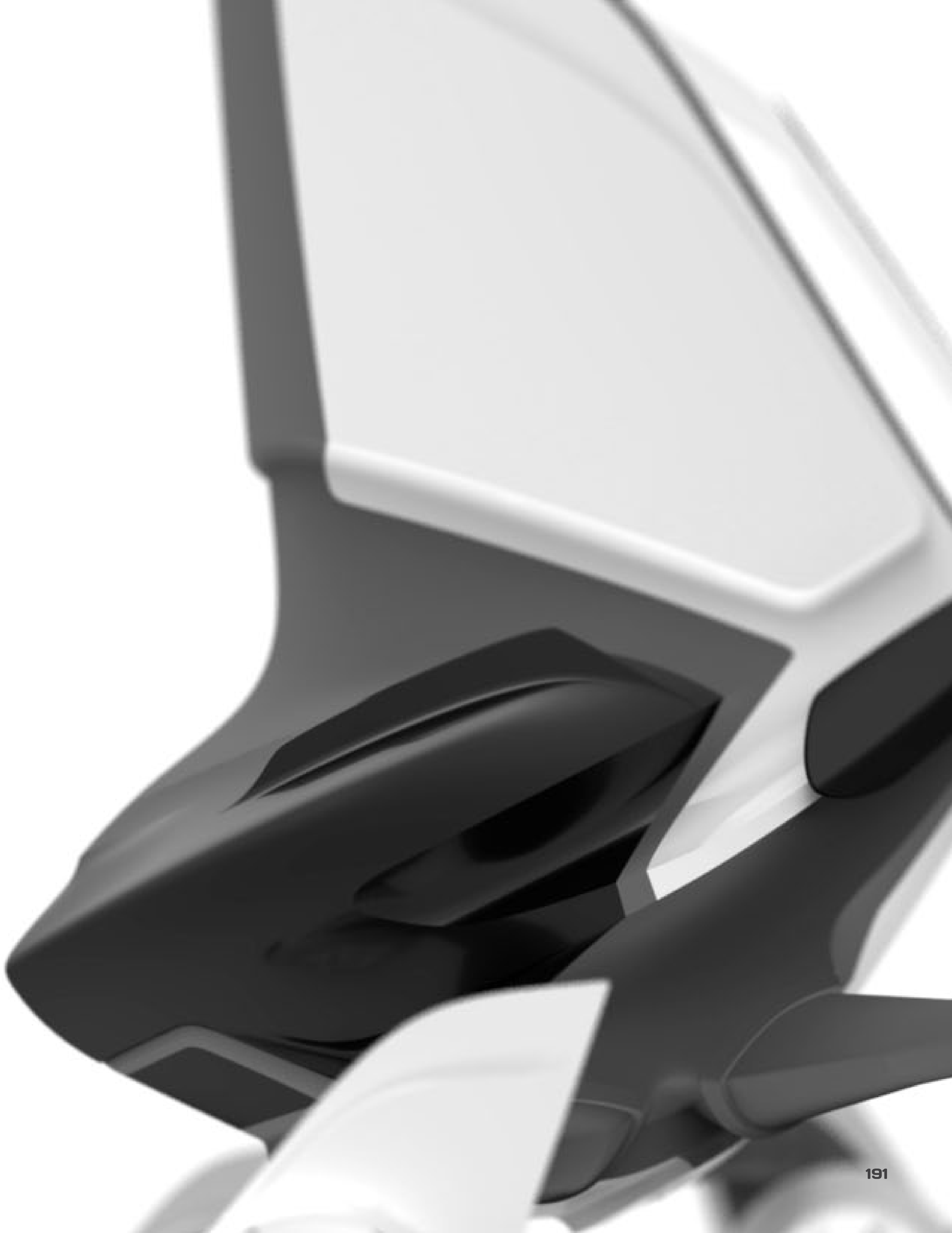
During the following six weeks Escape gradually took shape in the form of a clay model. The clay development process was an opportunity to develop and evaluate the concepts form and proportions in a relatively fast and simple fashion. After a clay property was settled on it was scanned and ready to be used as a digital underlay.

Escape left the physical world and entered the digital. Over this four week period Escape began to take shape as a 3D CAD property. Escape was then sent off to be prototyped.

Some 4 weeks later Escape would return from the manufacturers, a complete model, a complete project.

The final outcome from this project demonstrates that it is possible to design a small, personalised airship that meets a number of criteria essential for safe, reliable, economical operation.

"The feasibility of applying advanced airship design technologies to a range of user applications relevant to commercial or recreational uses is demonstrated to be feasible for future development.



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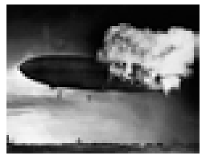
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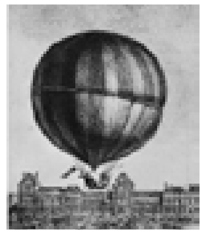
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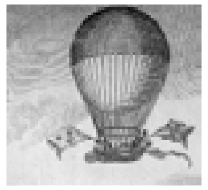
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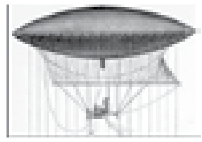
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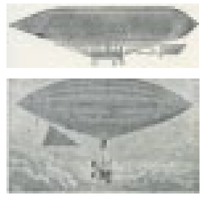
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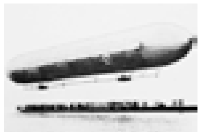
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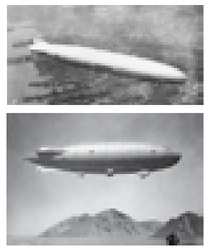
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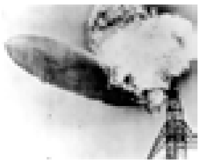
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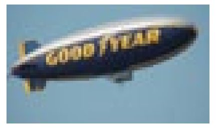

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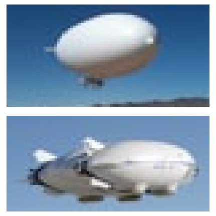
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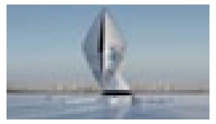
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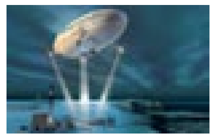
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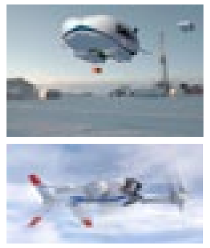
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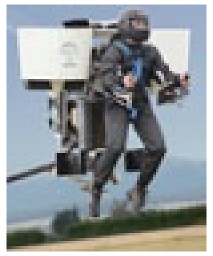
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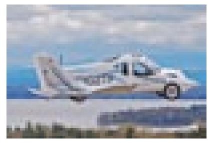
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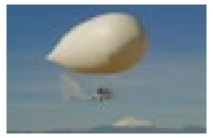
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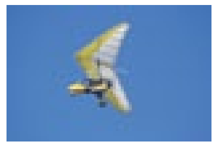
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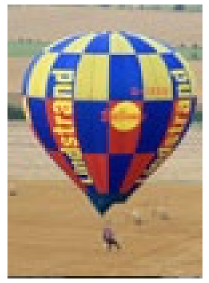
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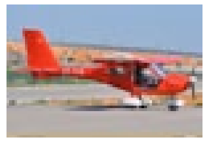

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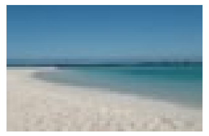

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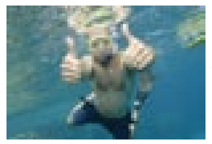

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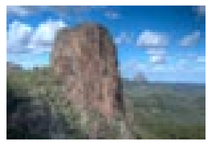

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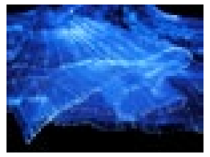

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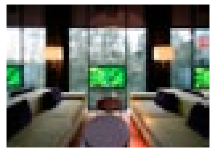

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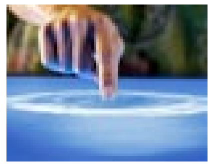

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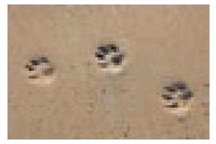

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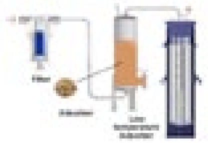

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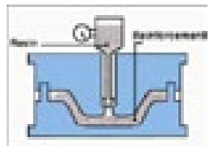

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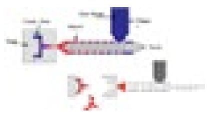

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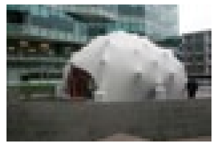

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