

The Opus



IAMCALLUM

Copyright Callum Nash
1st September 2011

The Opus is a new take on personal transportation. It's not just another electric motorcycle, The Opus goes way beyond that.

Segmented battery
System.

Modular drive
system.

Integrates into
recycling streams.

Craft production.

Crash protection

Exercise-capable.

Experience
focused.

Nearly 100% bio-
degradable.



Web integration.

Craft production.

User maintenance.

Lightweight
technologies from
cycling industries.

Customisation as
standard.

Flexible
ergonomics.

It's a vessel for many new ideas about the way vehicles could be produced over the next 50 years, but we can make it *right now*.

It looks to the future. "The further into the future you go, the less competition there is."

Design.



Packaging.

Steering.

Chassis.

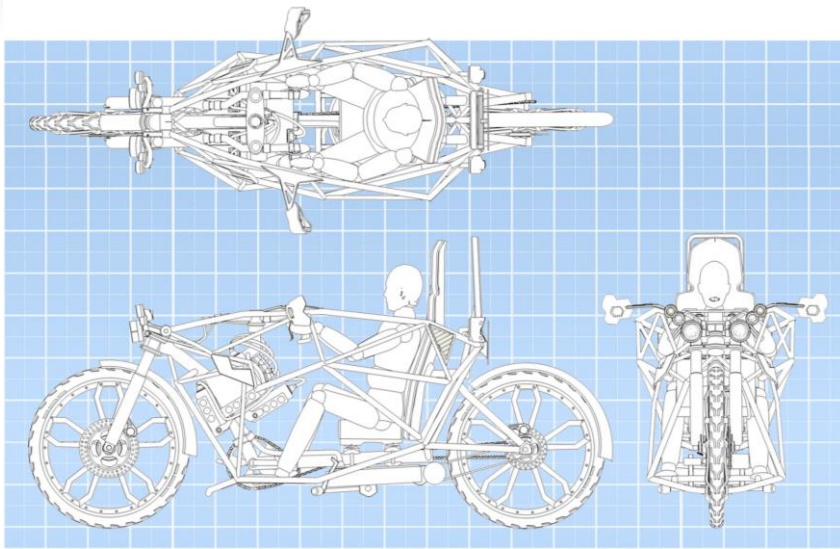
Safety.

Ergonomics.

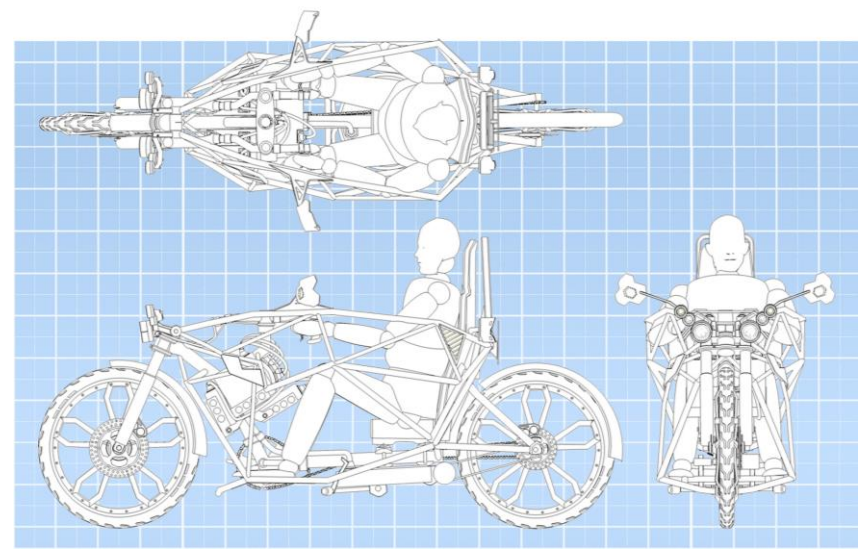
Aero.

Opus Callum Nash

The package was designed around the user with an adjustable back rest, and saddle that place the user nearer or further from the controls based on limb length (like a car.) This actually opens up cycling for many users who might normally struggle because of saddle height.

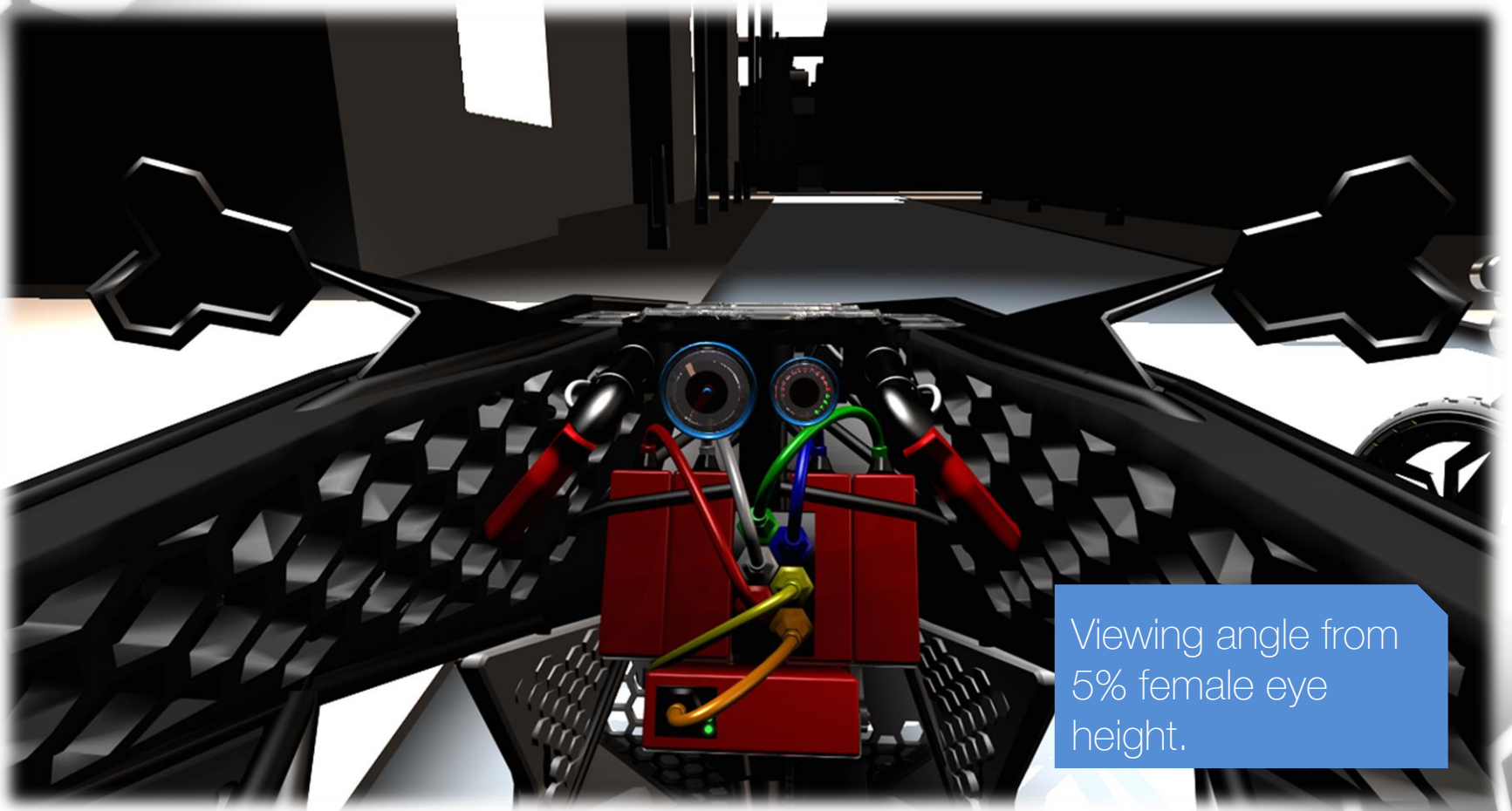


5% UK female.



95% UK male.

The right height is equal to the average car at 475mm and gives you excellent visibility. The Opus' large shape is clearly visible to other road users.



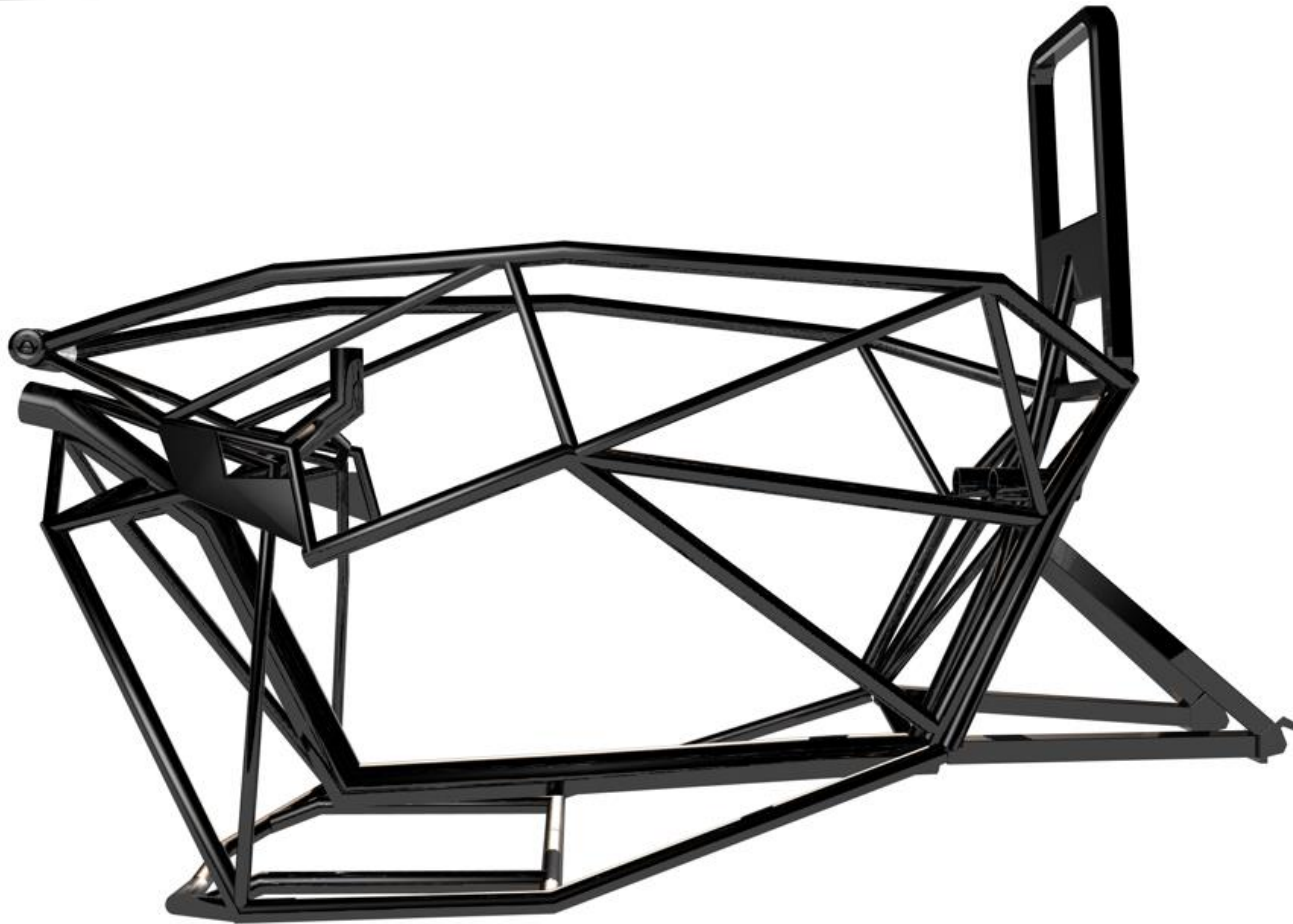
Viewing angle from
5% female eye
height.

Visibility

Opus

Callum Nash

The chassis is a triangulated space frame built around the user. It's rigid, light weight and capable of directing impact force around the user. It can be manufactured almost anywhere in the world at a multitude of scales.



Chassis

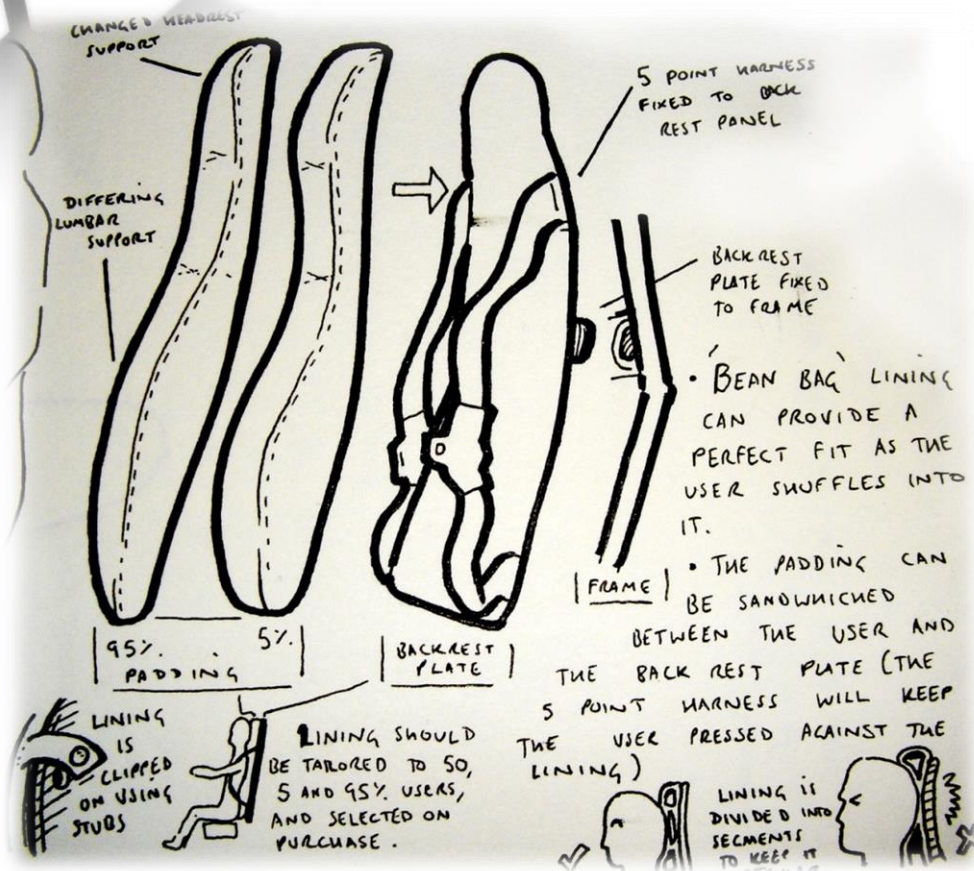
Opus Callum Nash

The rider's chair is a combination of a sprung saddle to allow leg movement and a back rest to provide proper support in a reclined position.



Saddle

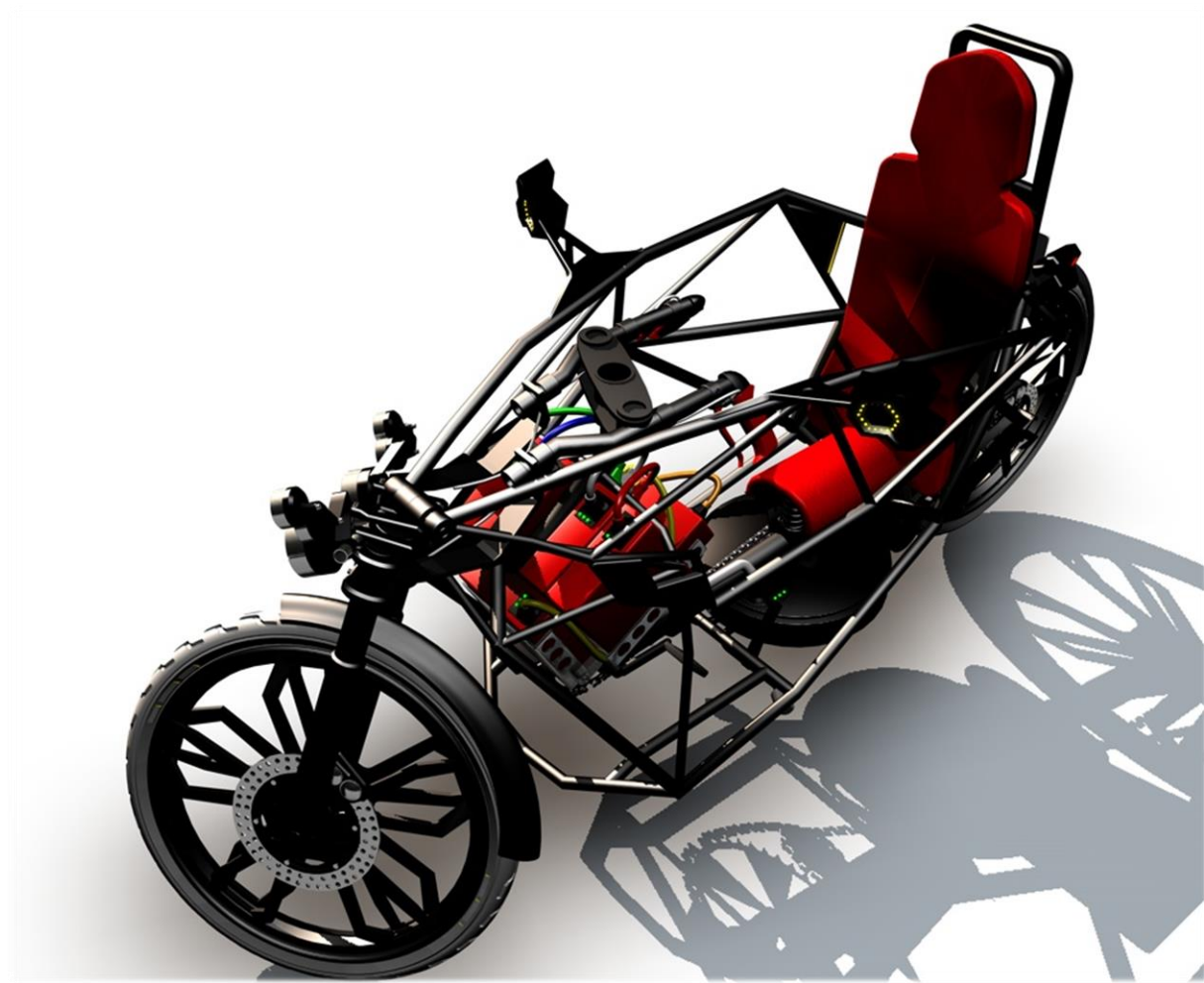
Opus Callum Nash



To provide a perfect ergonomic fit for all riders, the padding for the back rest clips on and is interchangeable in small, medium and large sizes which vary the lumbar and head rest positions. Instead of using foam, it is segmented into sections and using beans, so that shuffling into the lining will provide a perfect fit for any rider.

To make a this package possible a new steering mechanism has been designed.

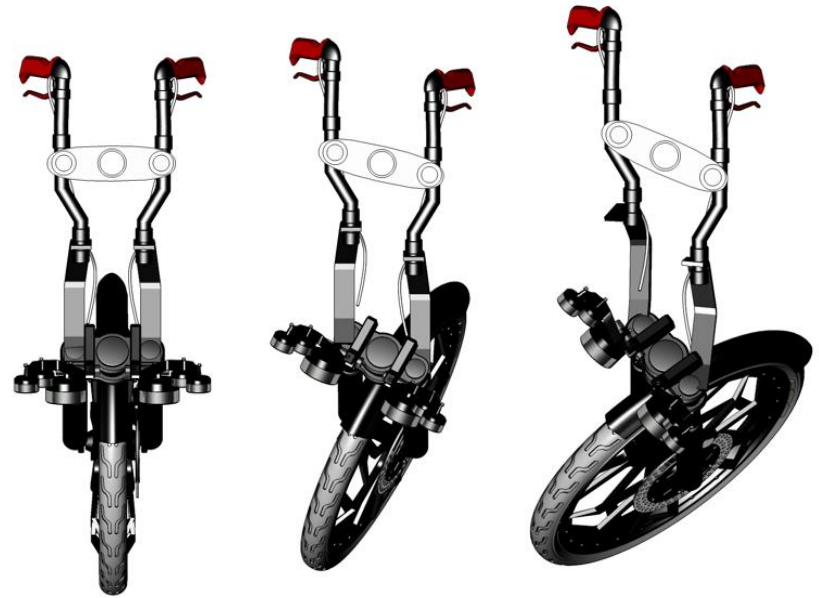
This mechanism gives the bike a turning circle of under 3.5m. It essentially duplicates the motion around the fork crown closer to the rider.



Steering mechanism

Opus Callum Nash

The mechanism solves the problem of over-rake in straight forks, making for excellent manoeuvrability in urban environments.



The structure would reduce vibration at the controls.

The flattened front sections can act as crumple in a head on collision.



Door mechanism

Opus Callum Nash

Getting into the vehicle is made easy by an innovative hatching mechanism that locks onto the subframe at its strongest points. The door then becomes part of the triangulated space frame, and does not rely on the hinge for strength, allowing both the door and sub-frame to divert impact forces around the rider.



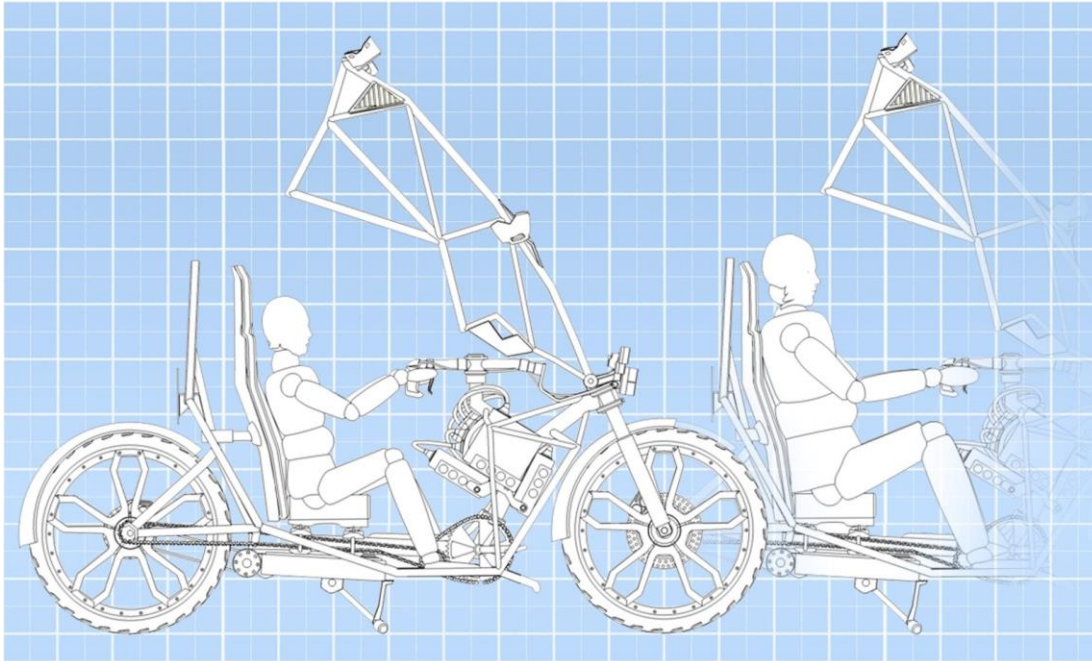
Door mechanism

Opus Callum Nash

It does not intrude out to either side of the bike, and stands at 2.1M tall once open, making it usable in the tightest spots and indoor car parks.

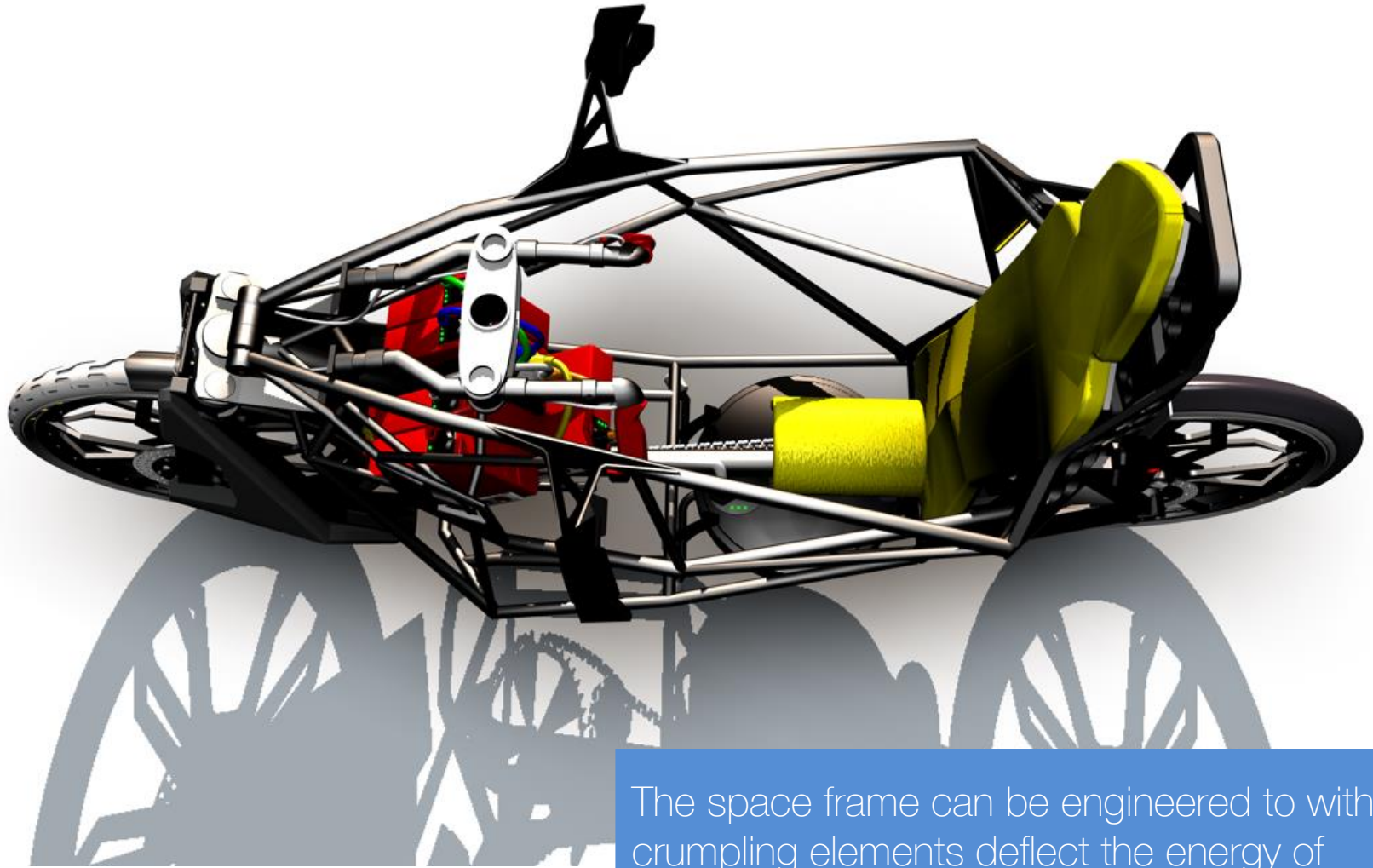
The door catch is located in the centre of the door in easy reach of even the smallest riders (5% UK female pictured here)

Door mechanism



Opus Callum Nash

In a motorcycle accident, the rider is mostly injured when they hit the road after being thrown from the bike. In The Opus the rider is secured by a five point harness in what is effectively the type of roll cage you might see in a rally car.



Safety system

Opus Callum Nash

The space frame can be engineered to with crumpling elements deflect the energy of impact around the cabin, this way, the bike reaches a safety level comparable with a car.

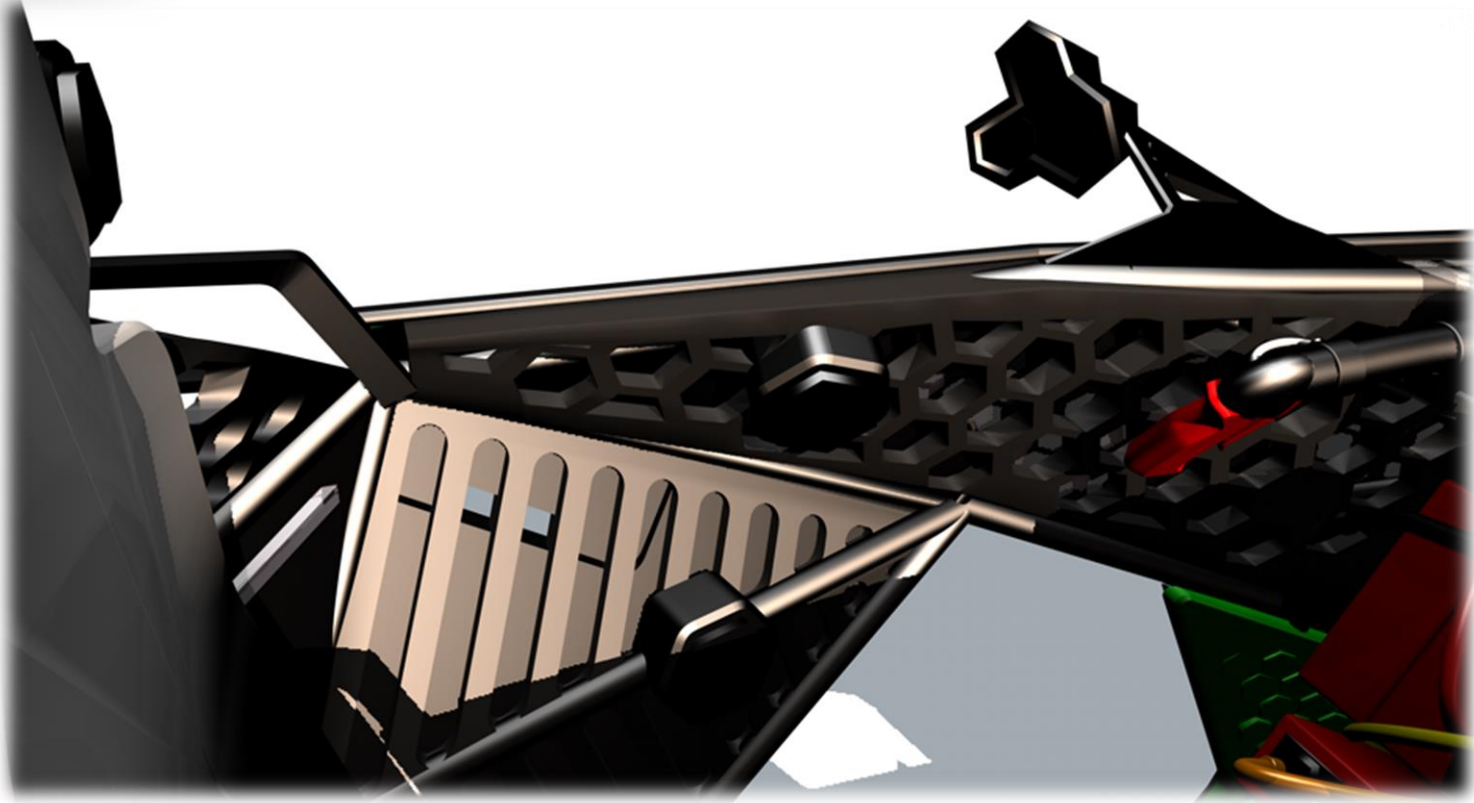
An optional airbag system can protect the rider further in an accident. Even though the rider is secure in a 5 point harness, airbags to the left and right of the riders head will secure their helmet and upper body and protect the head from impact debris.

Active safety



Opus Callum Nash

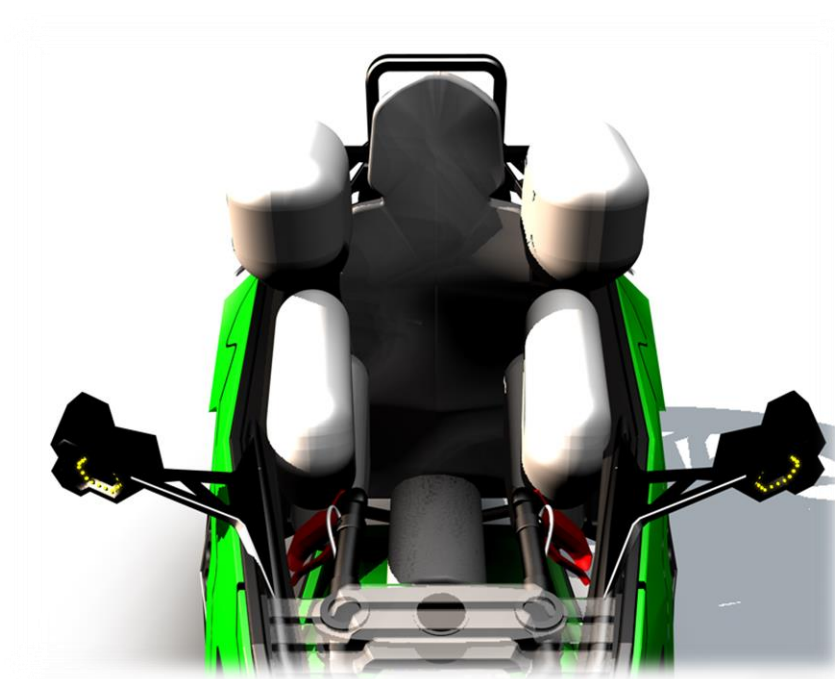
Airbags mounted on the inside of the door structure will protect the rider from the interior during a severe accident.



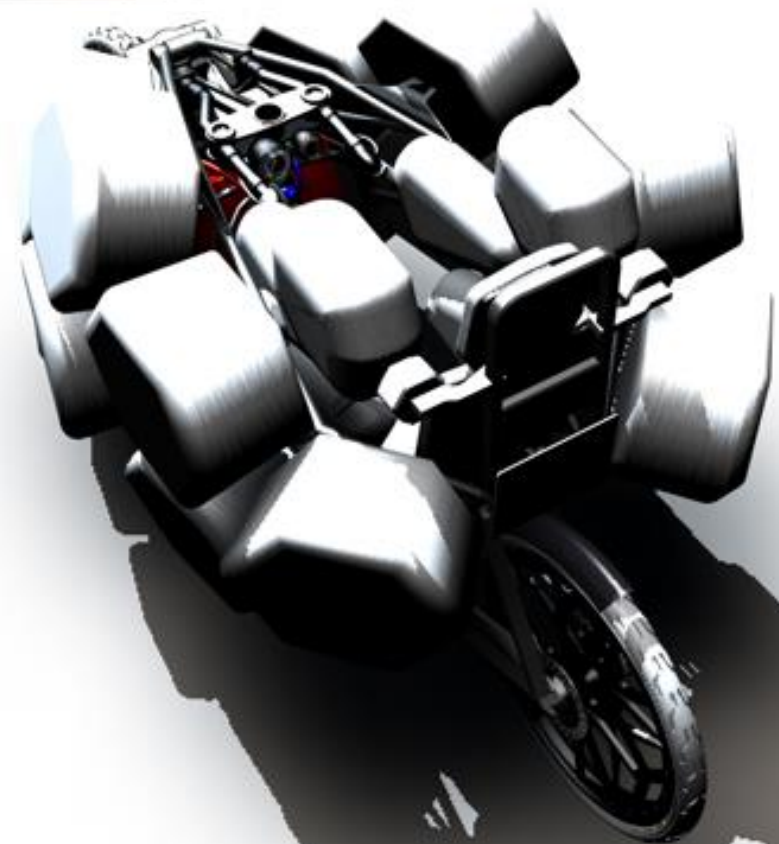
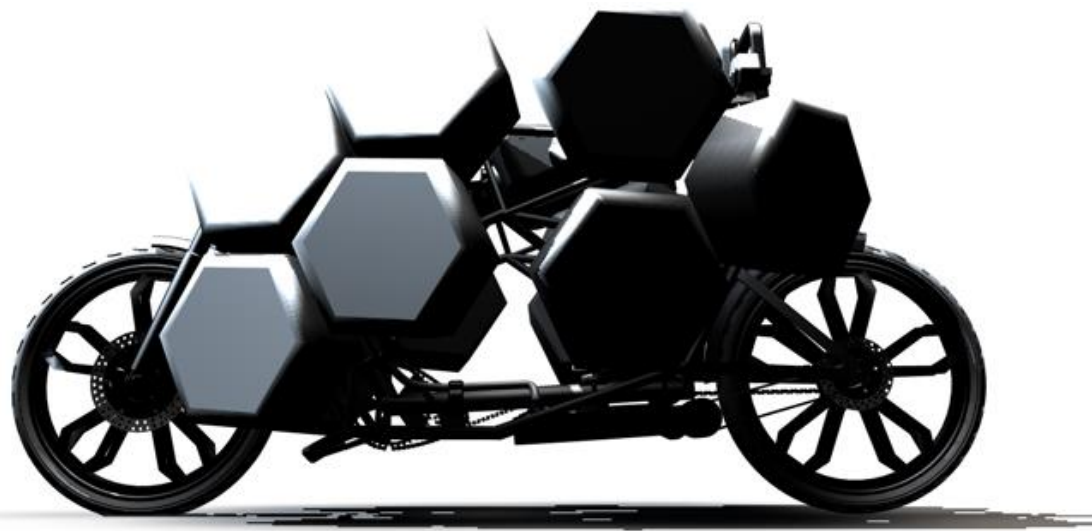
Active safety

Opus Callum Nash

Active safety



Opus Callum Nash



Active safety

Exterior air bags, inspired by the mars rover, could effectively provide crumple and protect the occupant from debris.

Opus Callum Nash

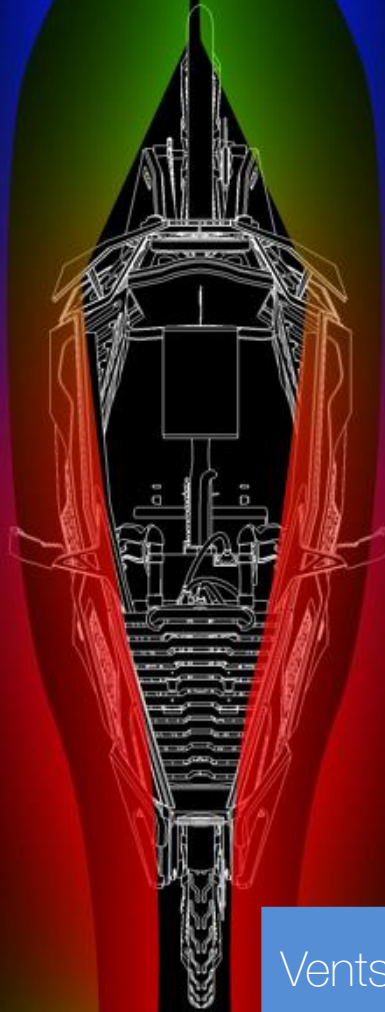
A front windscreen or full canopy can be fitted for protection from the elements.



Weather protection

Opus Callum Nash

As the helmet is against a head rest it cannot suffer from rocking at high speed.



Vents on the side of the bike alleviate cross winds and rear wings can direct the air into the vacuum at the rear of the bike reducing overall drag.

Aerodynamics

Opus Callum Nash

The Drive system.



The Opus uses a transverse mounted 7kWh electric motor, this produces 14bhp, but with 100% torque throughout its range, performance would be more akin to a 250cc motorcycle.



The motor

Opus

Callum Nash



Small petrol
Generator.



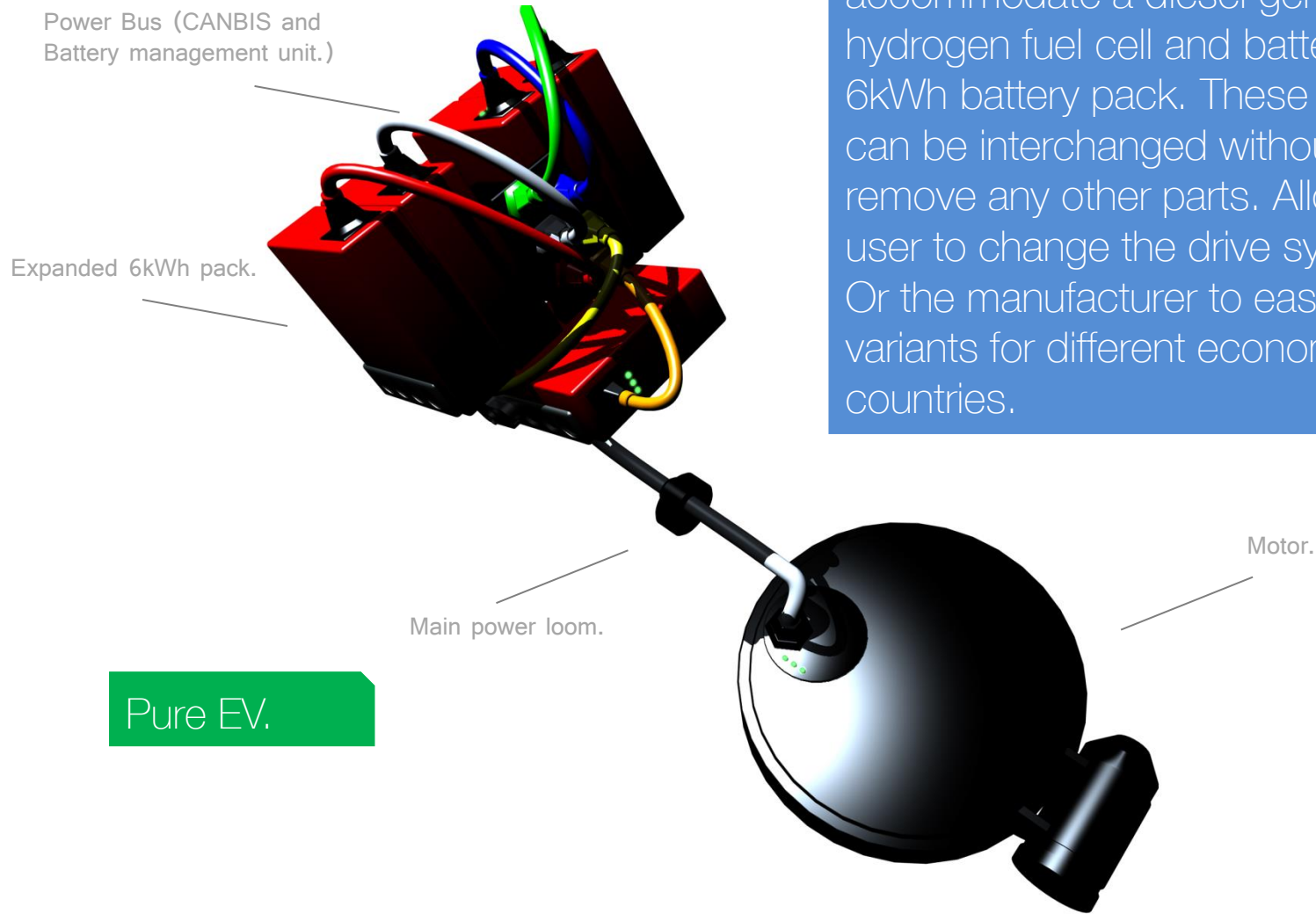
Pure EV.



Hydrogen
Fuel cell.

Opus Callum Nash

The Opus' chassis is designed to accommodate a diesel generator, hydrogen fuel cell and batteries or a 6kWh battery pack. These systems can be interchanged without having to remove any other parts. Allowing the user to change the drive system. Or the manufacturer to easily produce variants for different economies and countries.



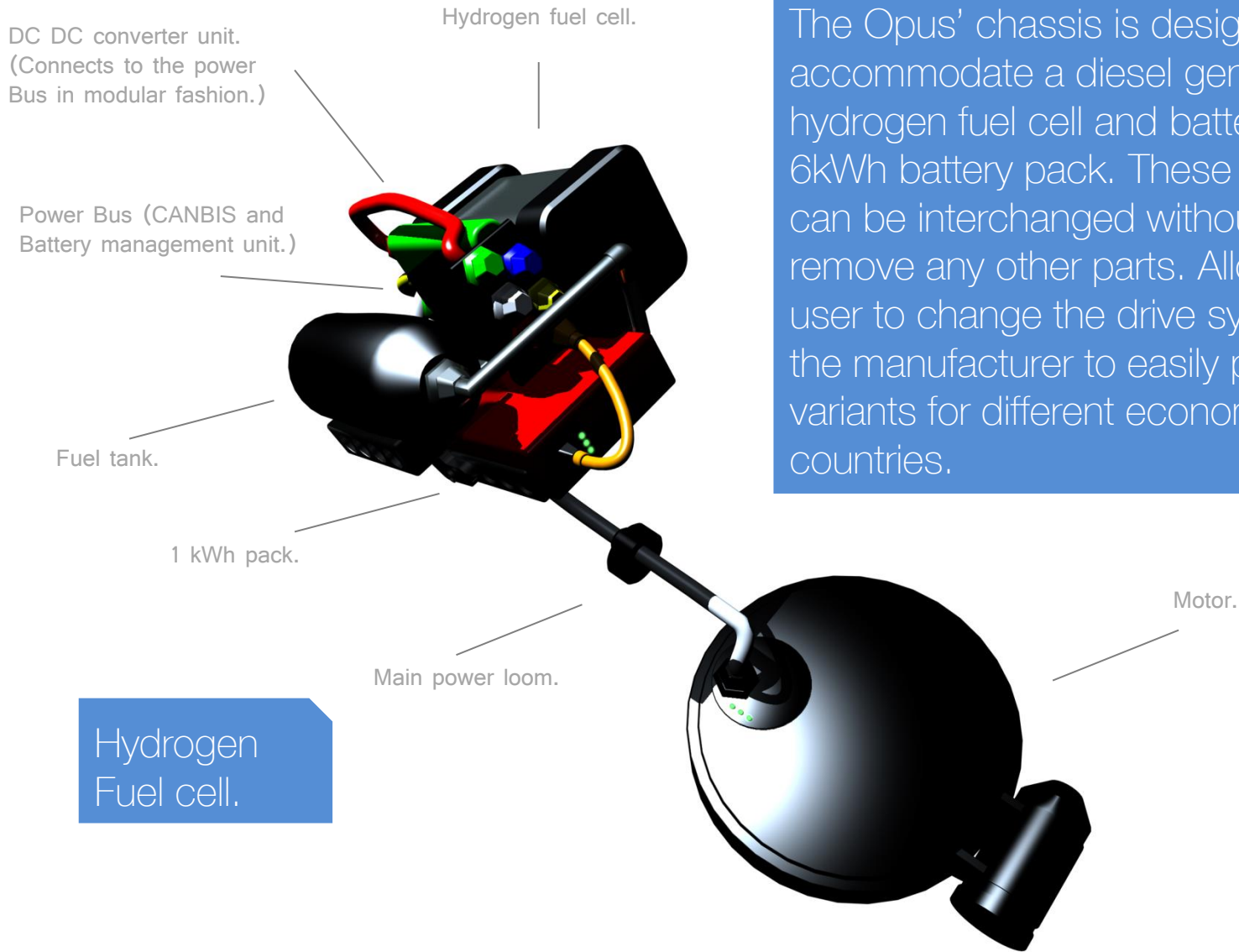
Modular drive

Pure EV.

Opus

Callum Nash

The Opus' chassis is designed to accommodate a diesel generator, hydrogen fuel cell and batteries or a 6kWh battery pack. These systems can be interchanged without having to remove any other parts. Allowing the user to change the drive system. Or the manufacturer to easily produce variants for different economies and countries.



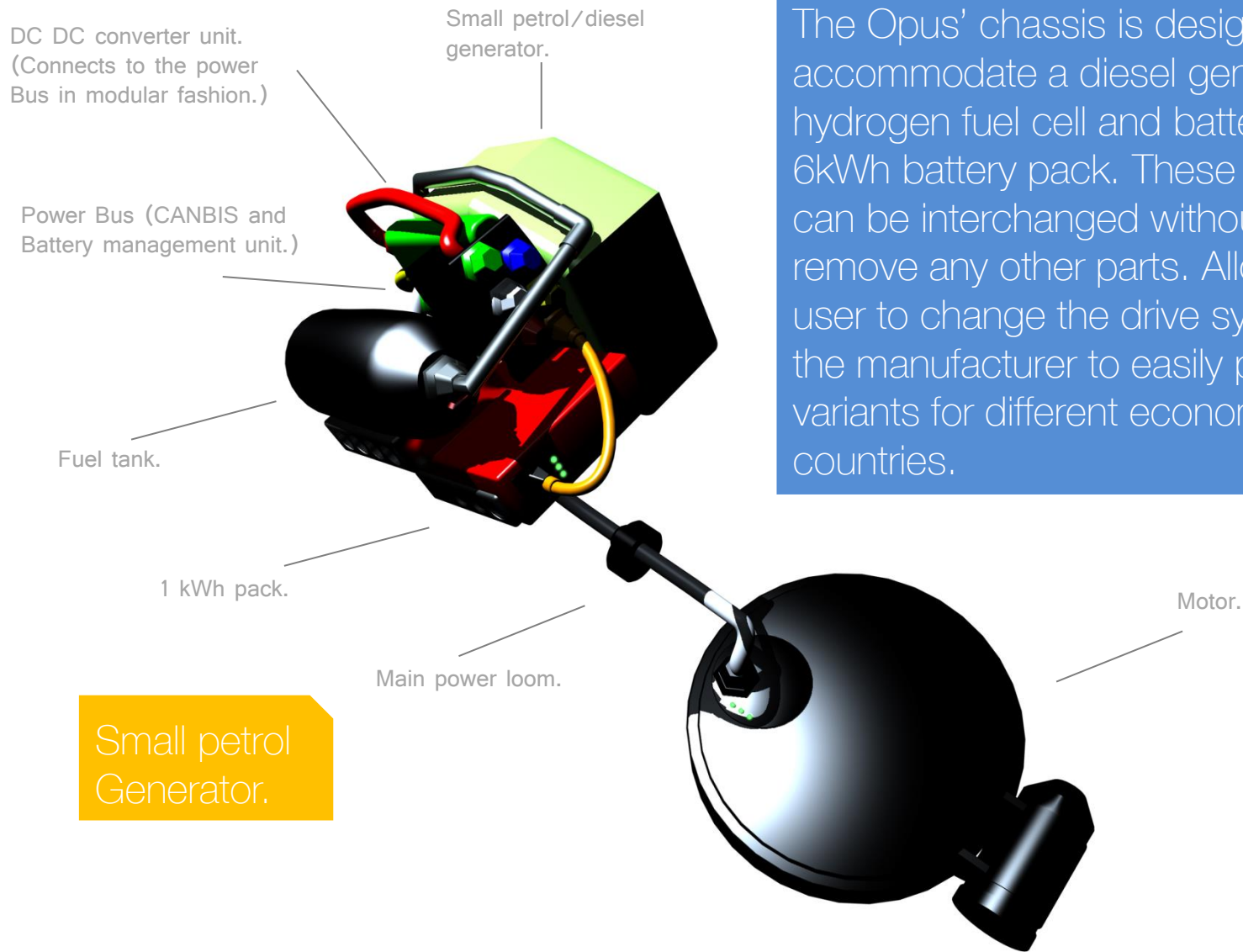
Hydrogen
Fuel cell.

Modular drive

Opus

Callum Nash

The Opus' chassis is designed to accommodate a diesel generator, hydrogen fuel cell and batteries or a 6kWh battery pack. These systems can be interchanged without having to remove any other parts. Allowing the user to change the drive system. Or the manufacturer to easily produce variants for different economies and countries.



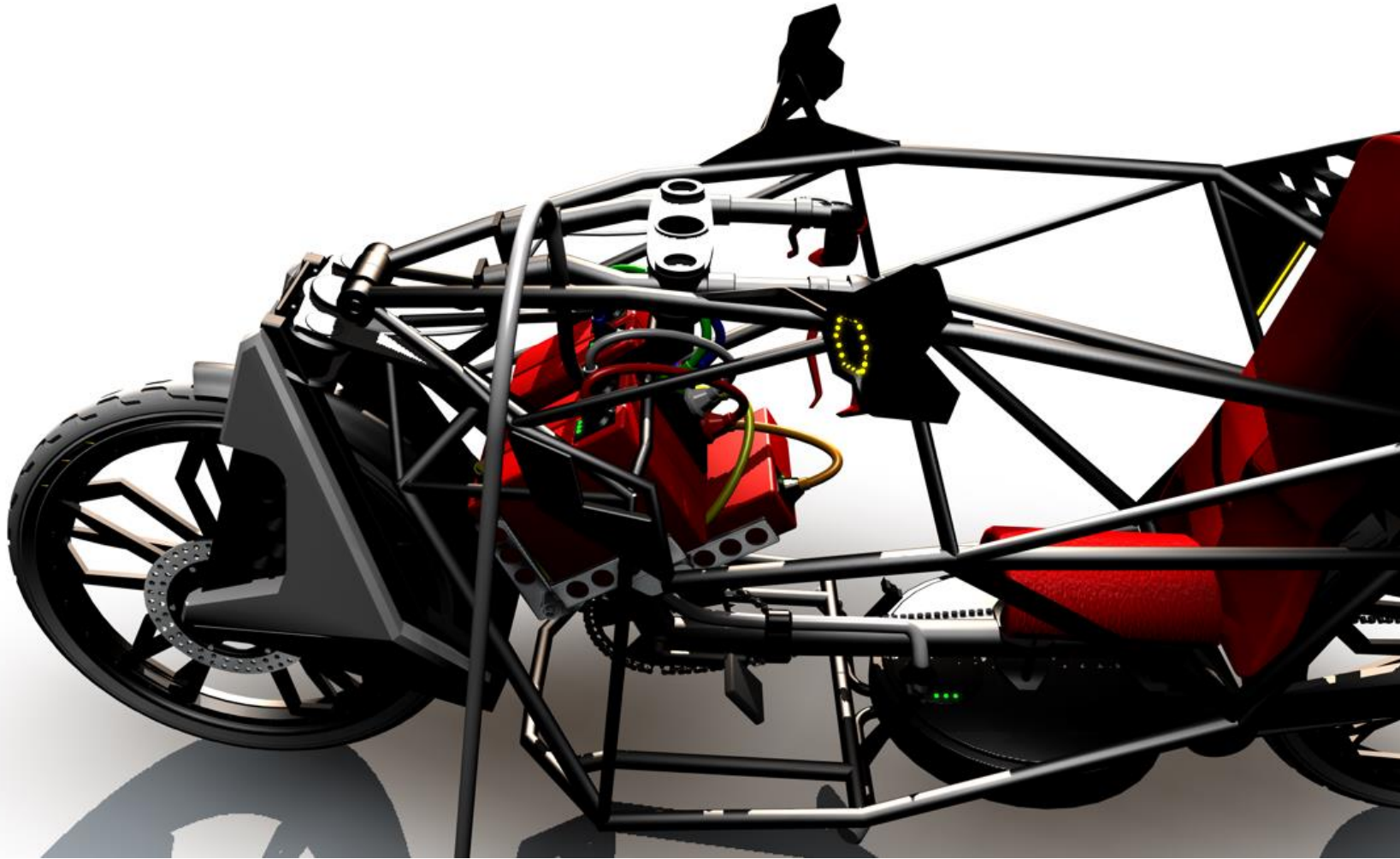
Small petrol
Generator.

Modular drive

Opus

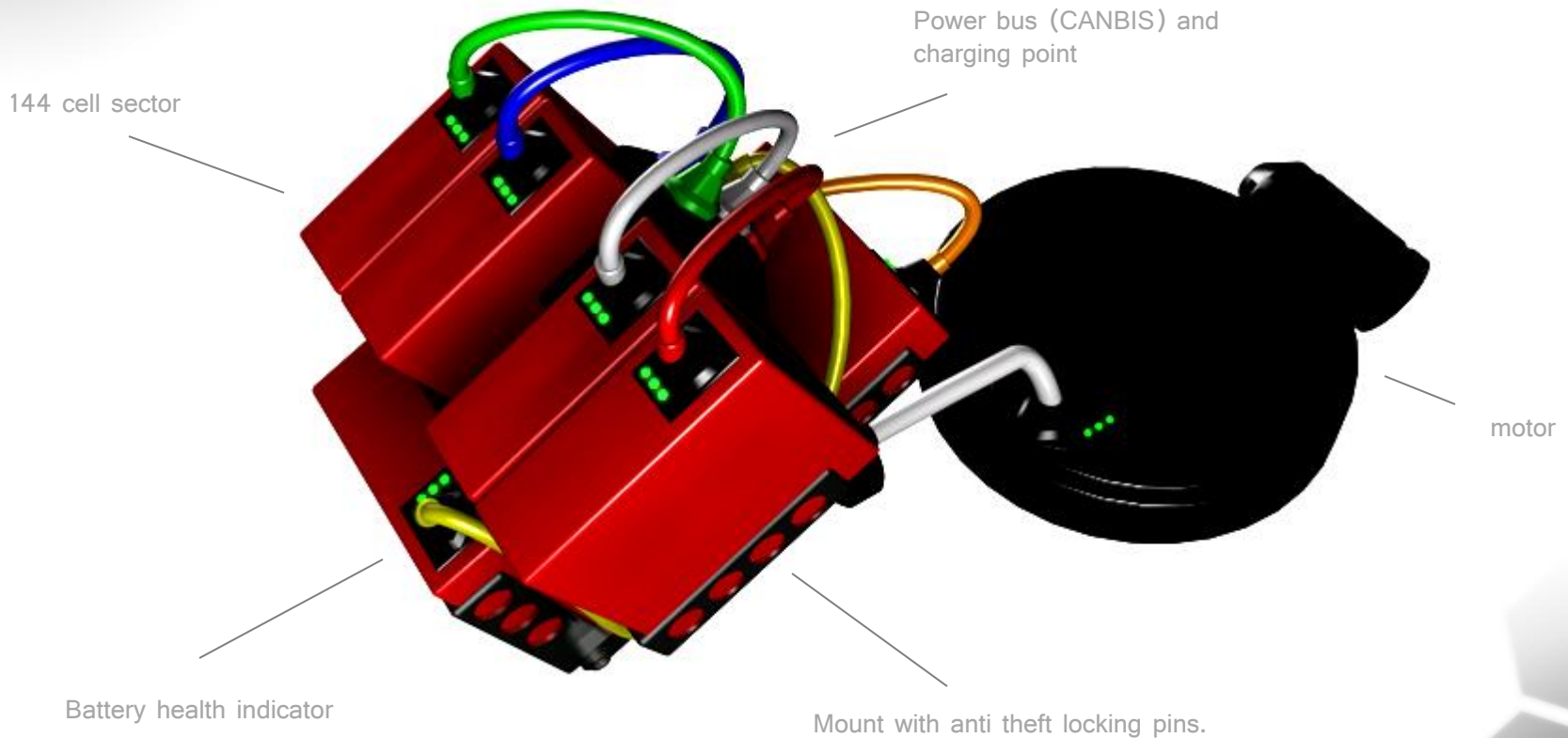
Callum Nash

The Battery System.



Opus Callum Nash

The battery pack is made up of six sectors of 144 “18650” Li Ion Batteries. It provides over 6kWh of energy, weighs just over 50kg and costs about £7000 to manufacture, if produced in small numbers.

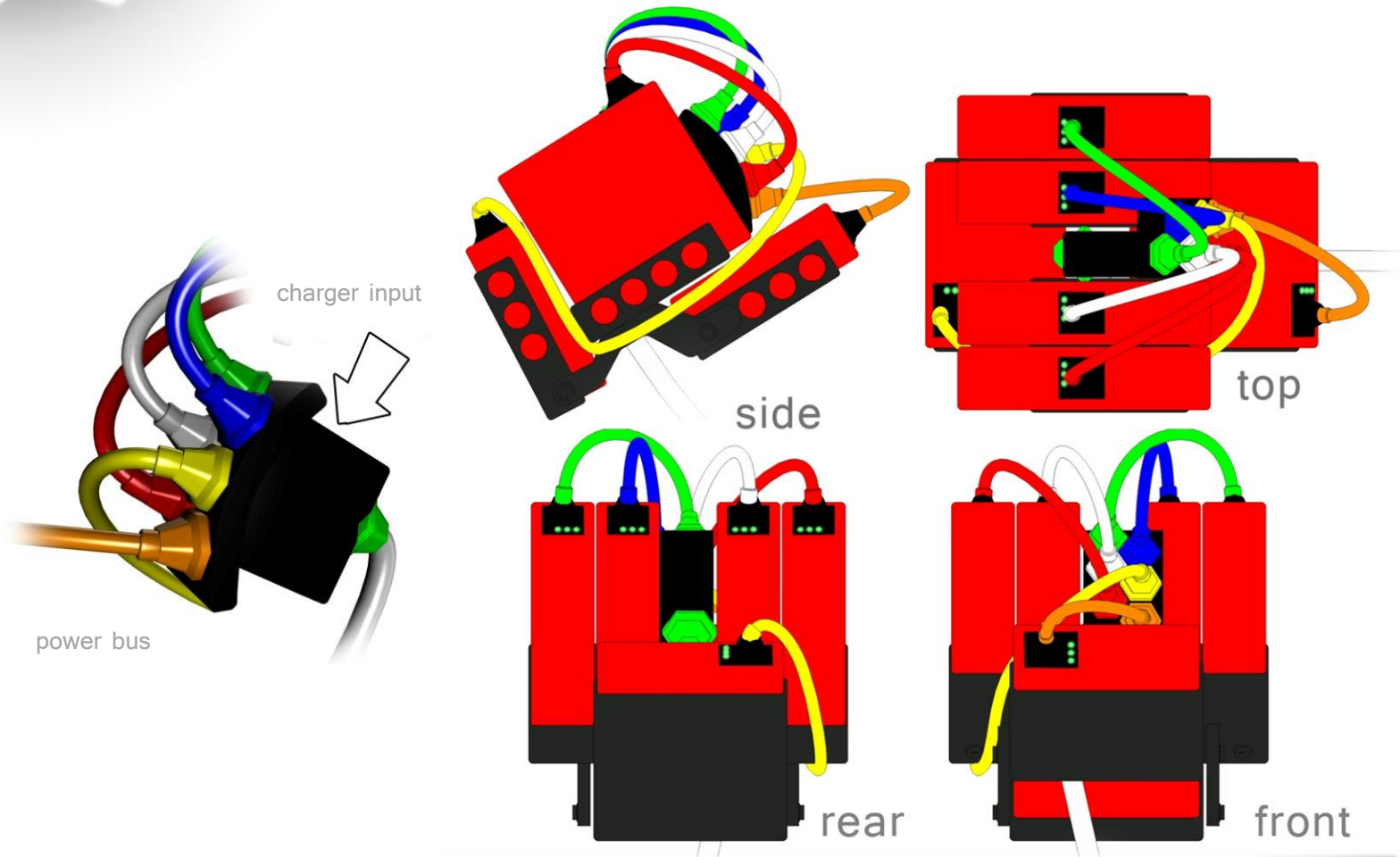


Battery Pack

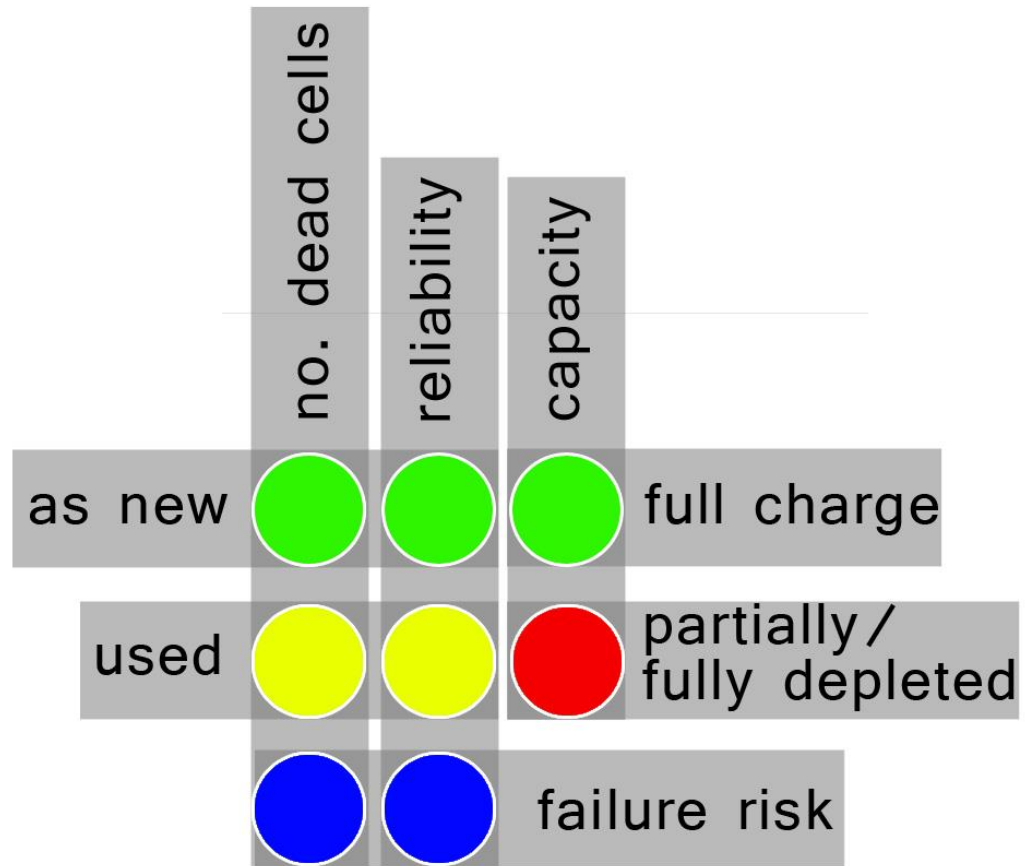
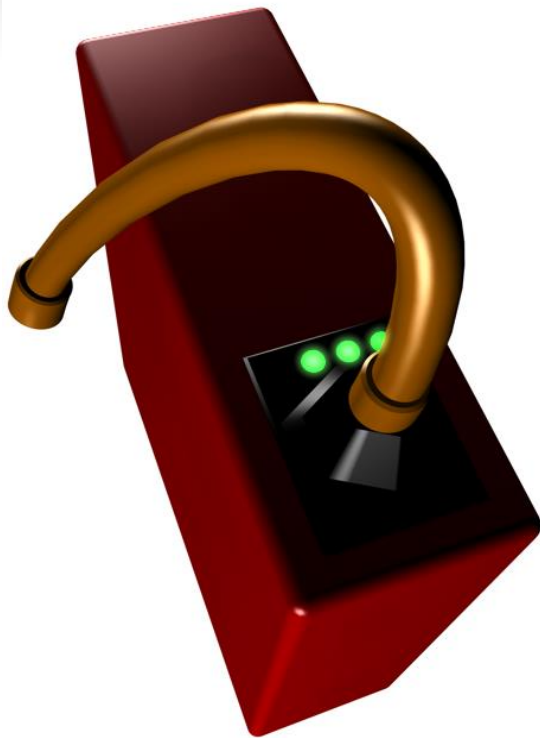
Opus

Callum Nash

There are many advantages to using numerous small cells, each can be fused to prevent short circuit overloads and temperature monitors can cut bad cells from the system. When a cell fails it has little impact on the entire system and this makes for a highly reliable battery pack.



A simple battery health indicator on each sector allows instant visual check of its age and reliability. This is particularly useful in quality checking and after market sales.

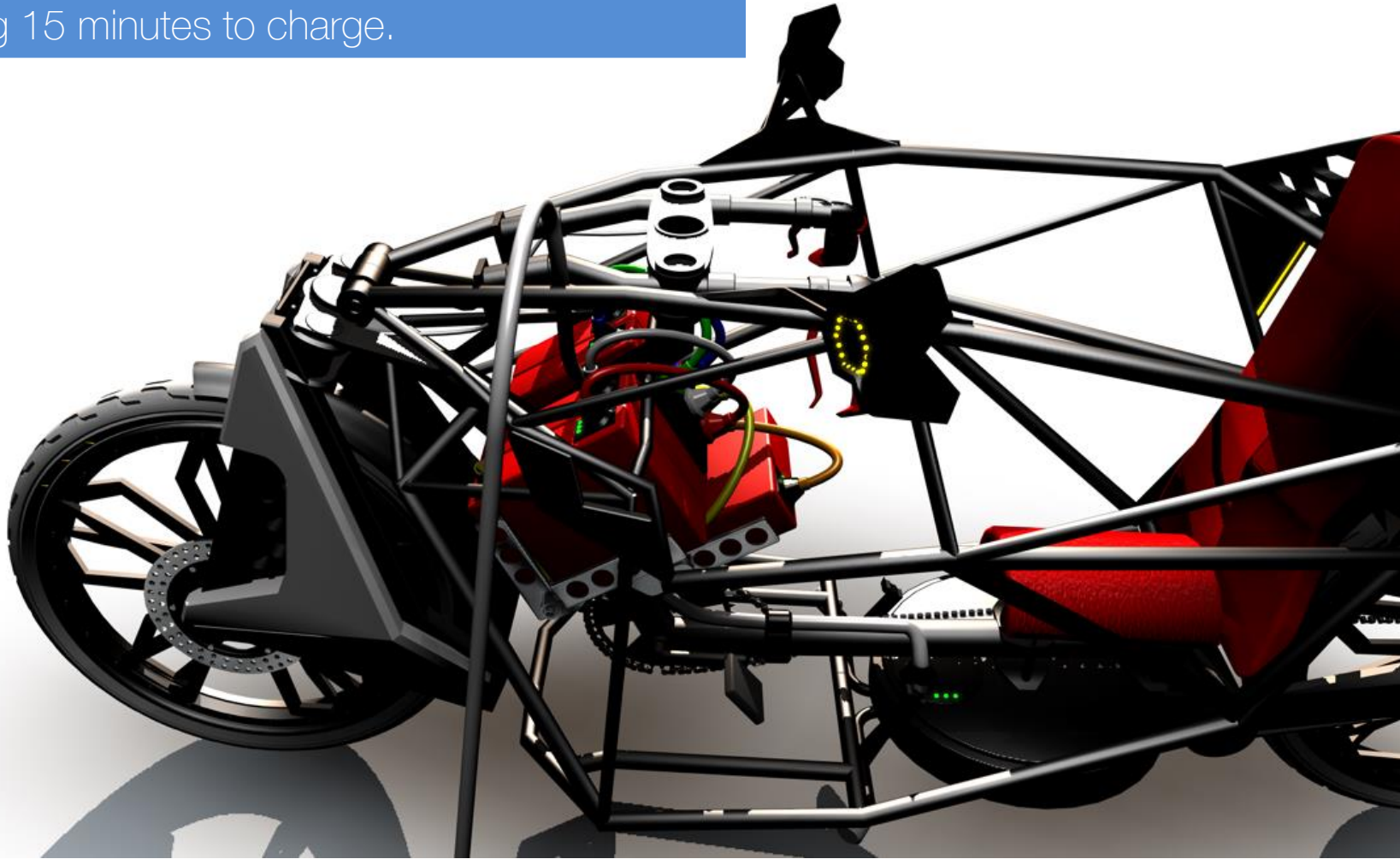


This pack design allows for “hot swapping” and introduces standardisation not currently seen in the industry.

Battery Pack

Opus Callum Nash

The pack can be charged as one within an hour, alternatively by removing the sectors you could use six points in your house to charge them individually, each taking 15 minutes to charge.



Battery Pack

Opus Callum Nash

Regenerative braking is used to increase the range by up to 70%

Comparison...

Brammos E-nertia



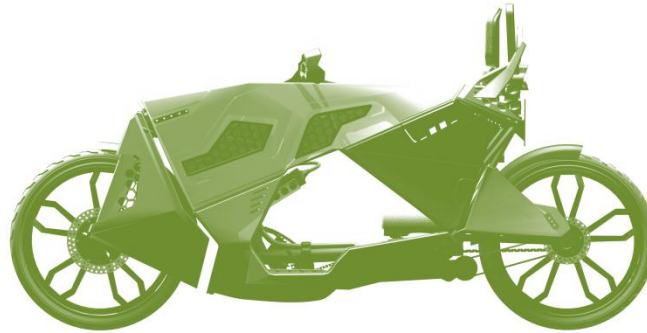
3.1 kWh



12 kW

65miles

The Opus



6 kWh



7 kW

130miles

Xtreme X-rider



3.6 kWh



5 kW

95miles

Battery Pack comparison

Opus

Callum Nash

A full battery charge costs between 8 and 36p. This works out at 0.3p per mile.



As the pack can be removed in smaller segments, this makes “hot swapping” the entire pack, when depleted, for a fully charged one at a service station much easier than when the pack is one central piece. Hot swapping may be common place in the future as a means of making long distance journeys with EVs possible.

User Maintenance.

As road users we are often held hostage by failures of reliability. This gives you a reason to own a tool box. It is empowering.

Electric vehicles require little maintenance, because of the Opus' modular construction, one can replace parts relatively simplistically. Even the Drive system.

This means the service and repair industry will be able to accommodate these vehicles more easily.

This makes things much easier at the build stage as there are few sequential component builds.

The reliability of electric vehicles will probably force the service and repair industry to undergo a paroxysmal shift over the next 2 decades, we must find another way to generate continued revenue over the product life span.

The Opus uses 26" wheels as they improve the smoothness of the ride and have thousands of suppliers worldwide. In the event of an emergency one can run into any bicycle store and buy a new one!



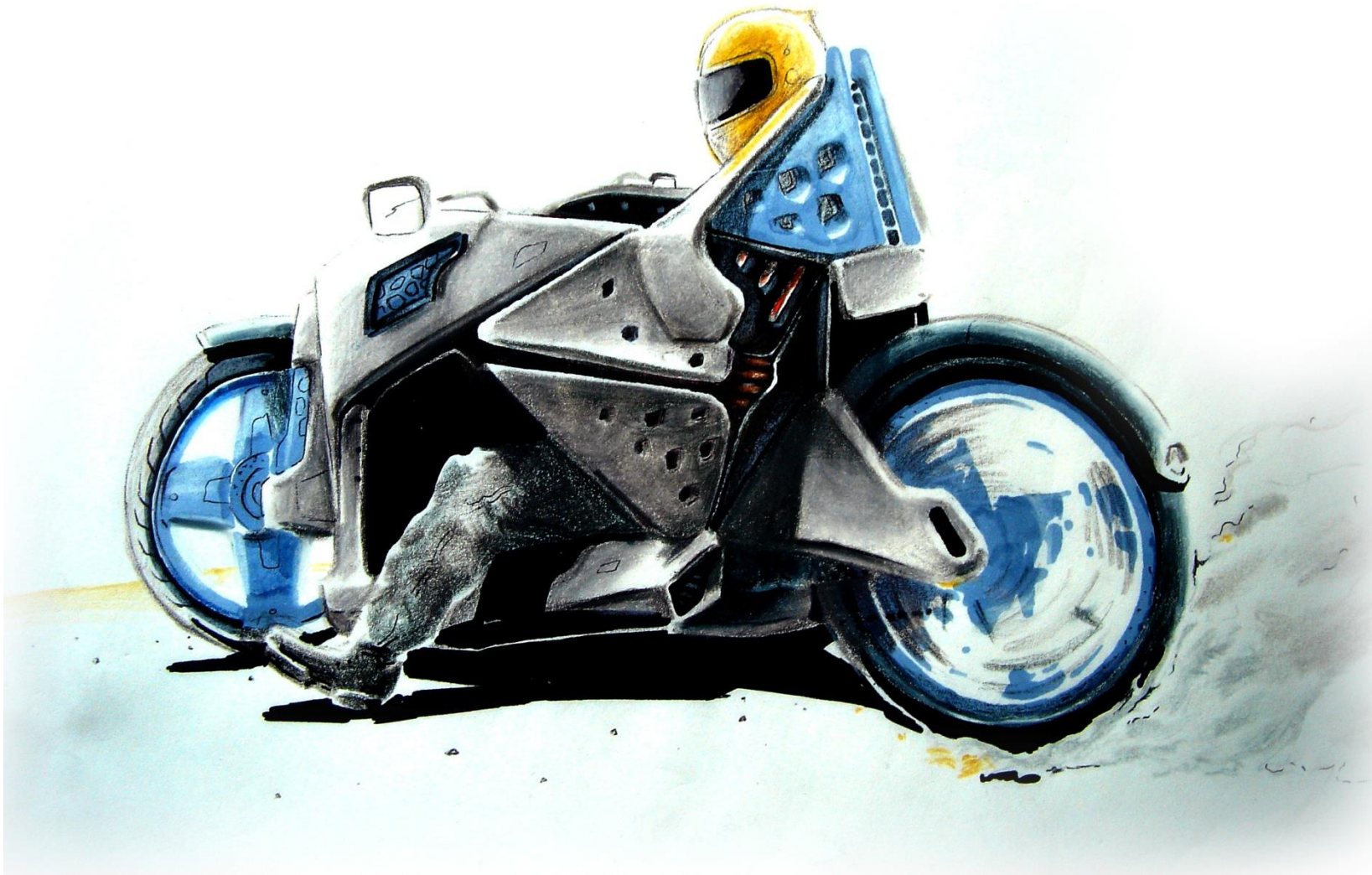
Modern 26" MTB wheels are hugely strong and lightweight and the Opus shall come with specially adapted tyres for high speed road use.

Wheels

Opus

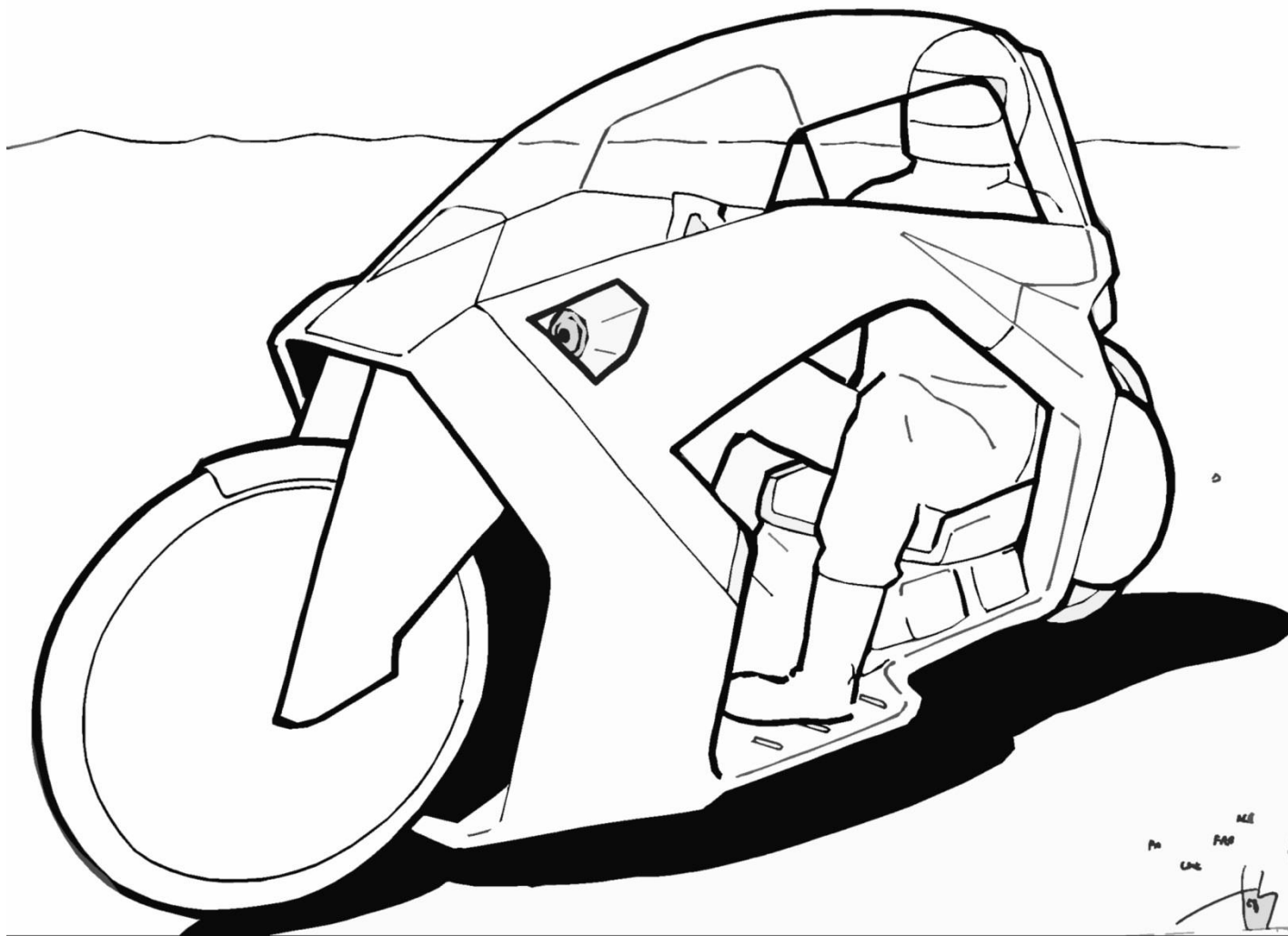
Callum Nash

Styling...



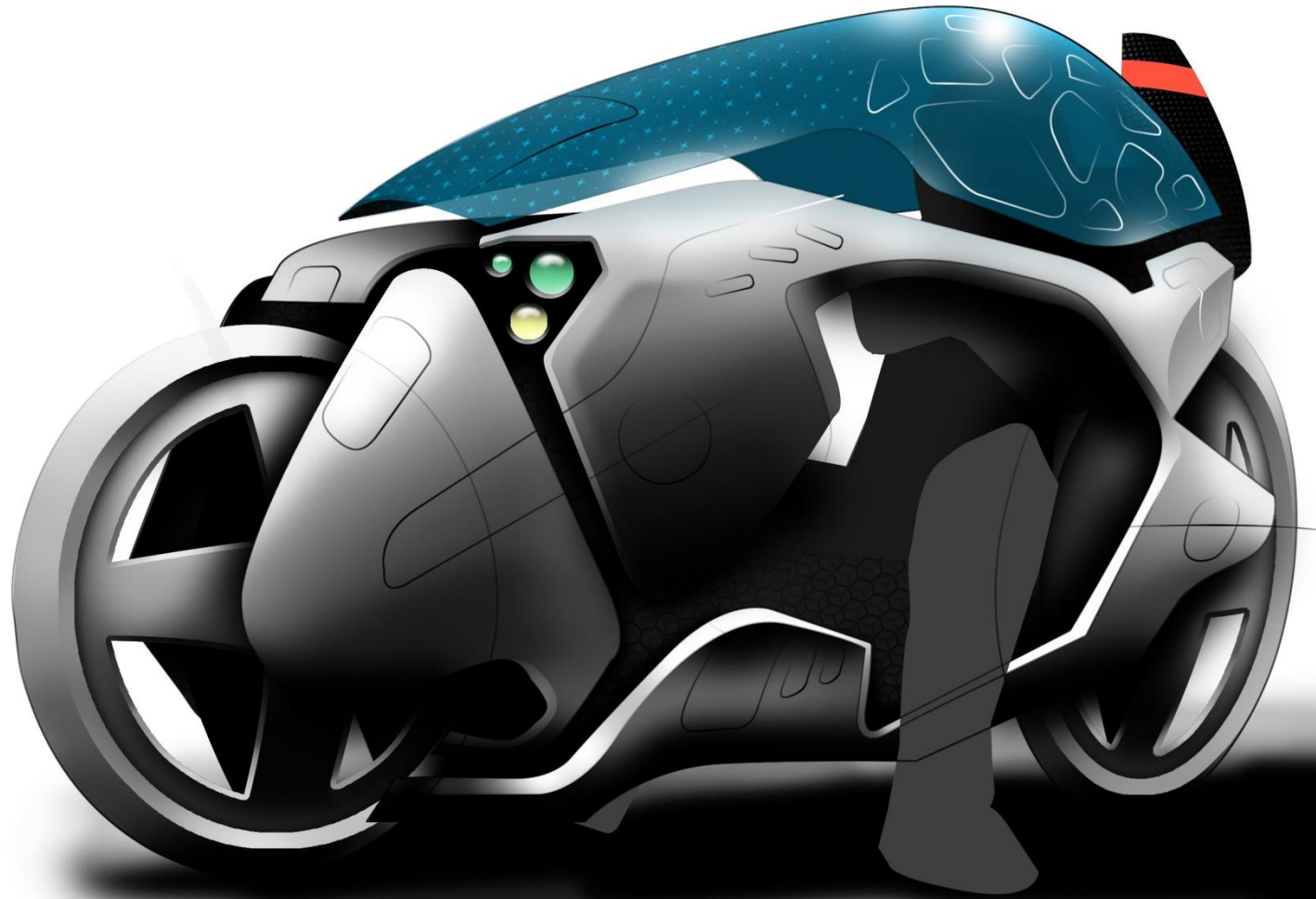
Visual Iconography

Opus Callum Nash

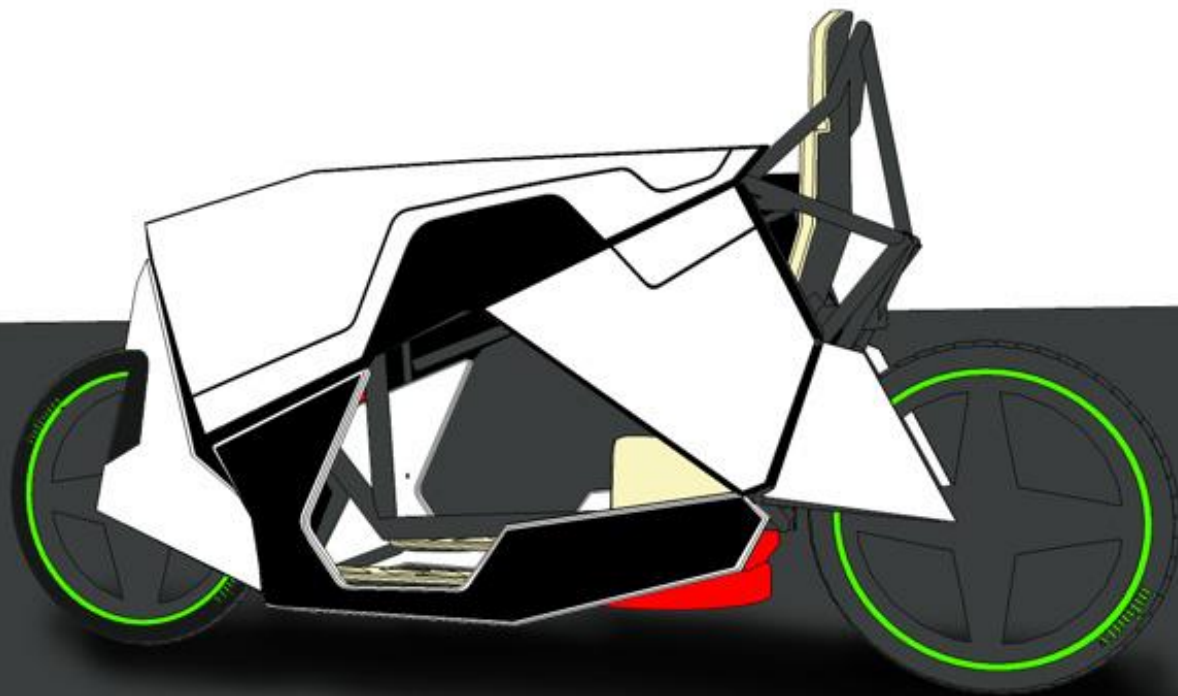


Opus

Callum Nash

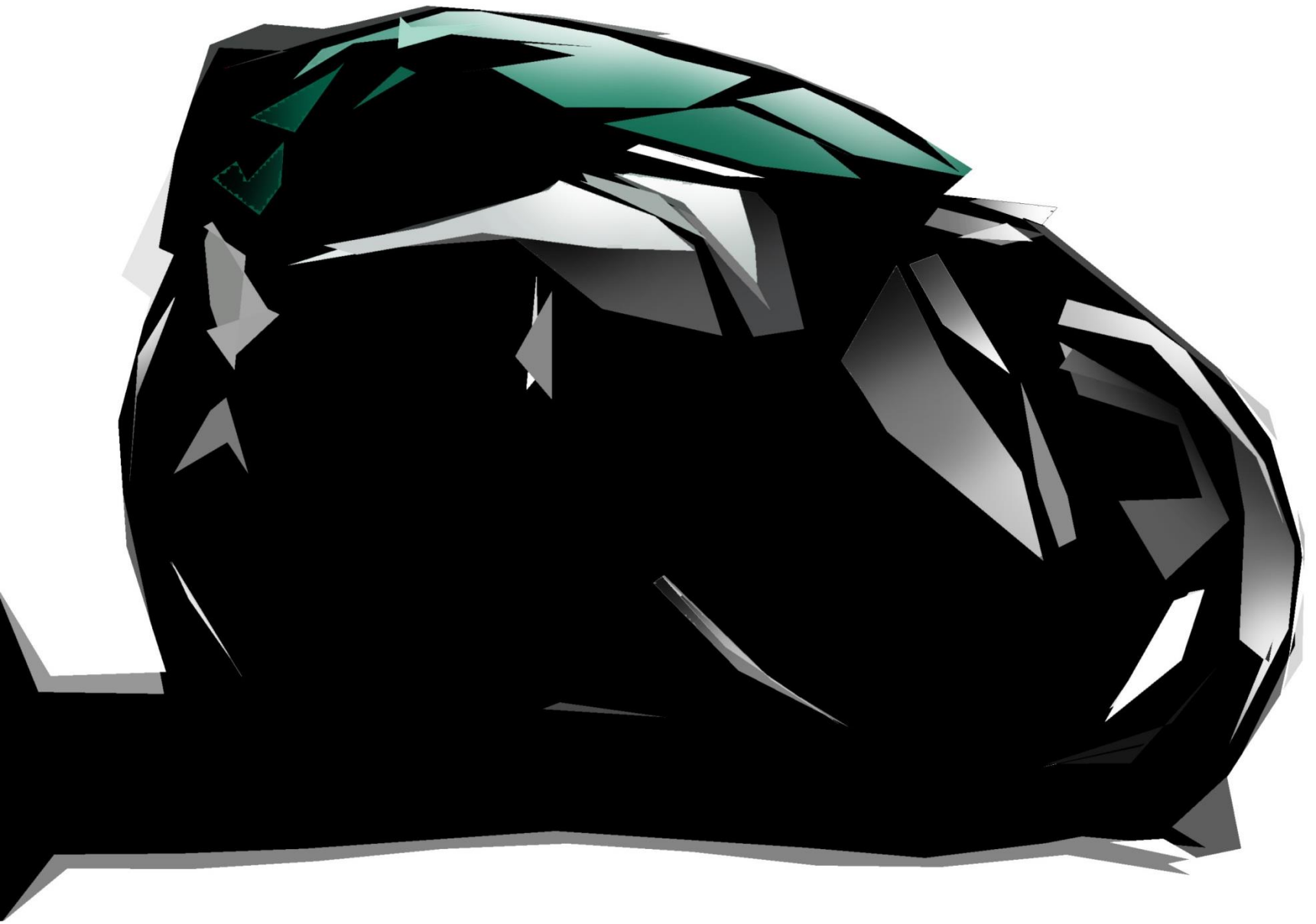


Opus Callum Nash



Opus

Callum Nash

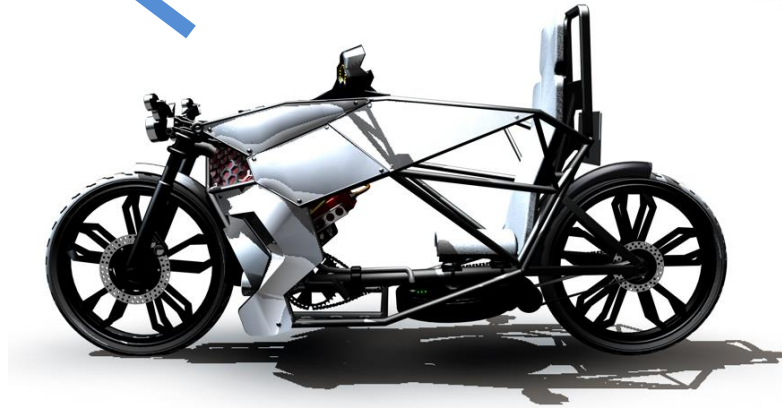
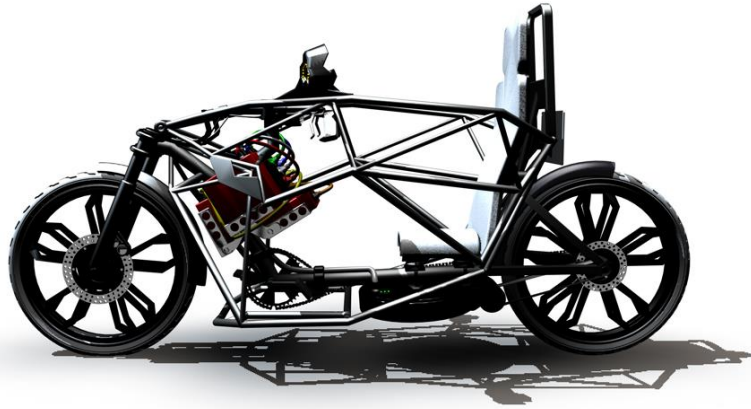


Opus Callum Nash



I conducted a variety of focus groups to help determine a stylistic direction that might have the widest appeal. I spoke to bikers, environmentalists, cyclists, petrol-heads and pedestrians. In our discussions we found the topic of customisation coming up more and more. Not just in the enthusiasts but also in regular road users.

The frame serves as a blank canvas to attachable panels, when you order the bike you can select which panels you want to make up the fairing, from classic cruiser to high tech sports bike.



customisability

Opus Callum Nash

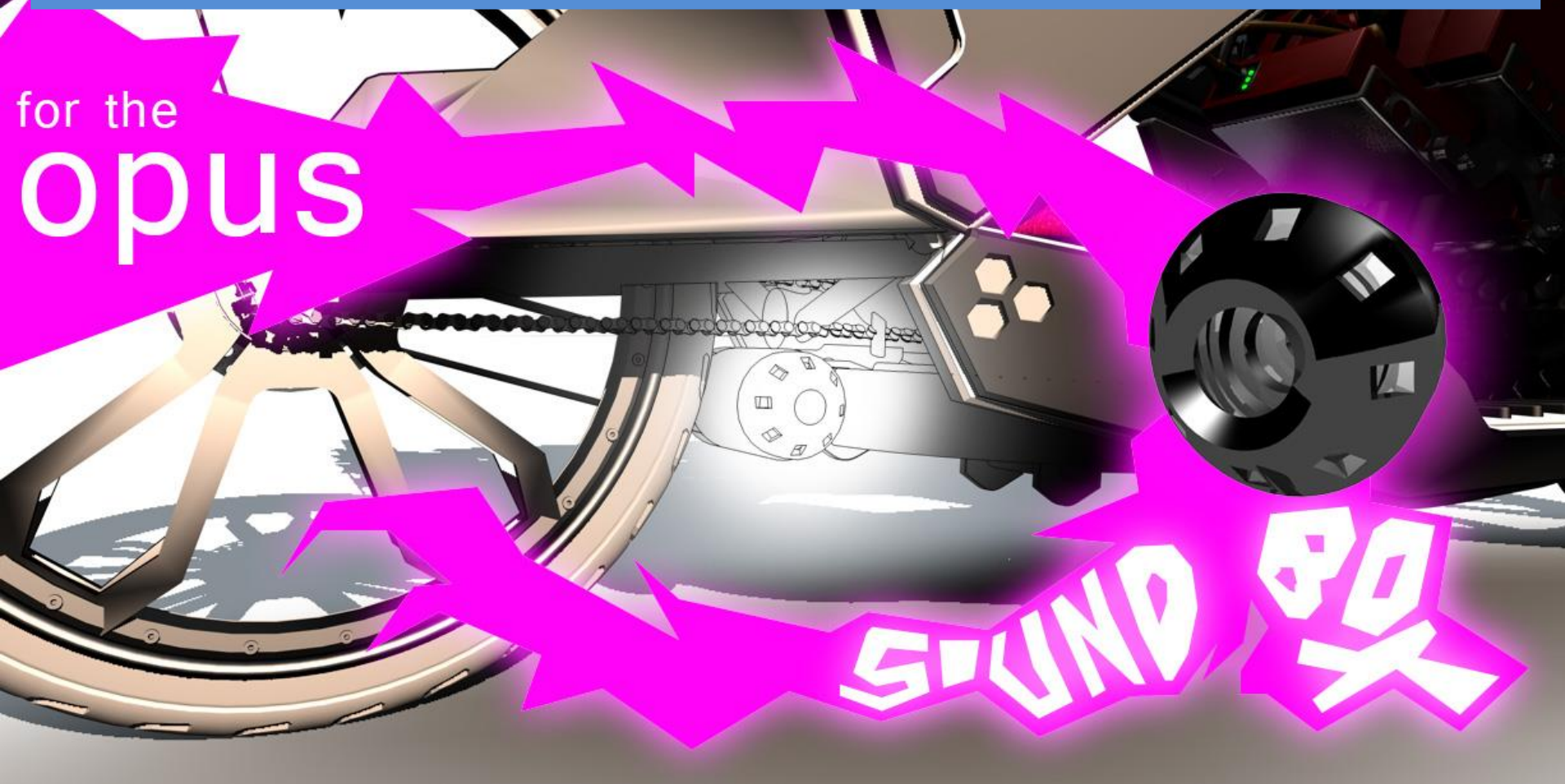


designing a chassis to accommodate a complete “face lift” without requiring new moulds gives the product a much greater life span and a much broader appeal, unlike most vehicles, this can generate revenue not just through purchase and later repair, but can continue to generate revenue over its whole life span, with users upgrading and changing the appearance of the bike, making it more personal.

Opus

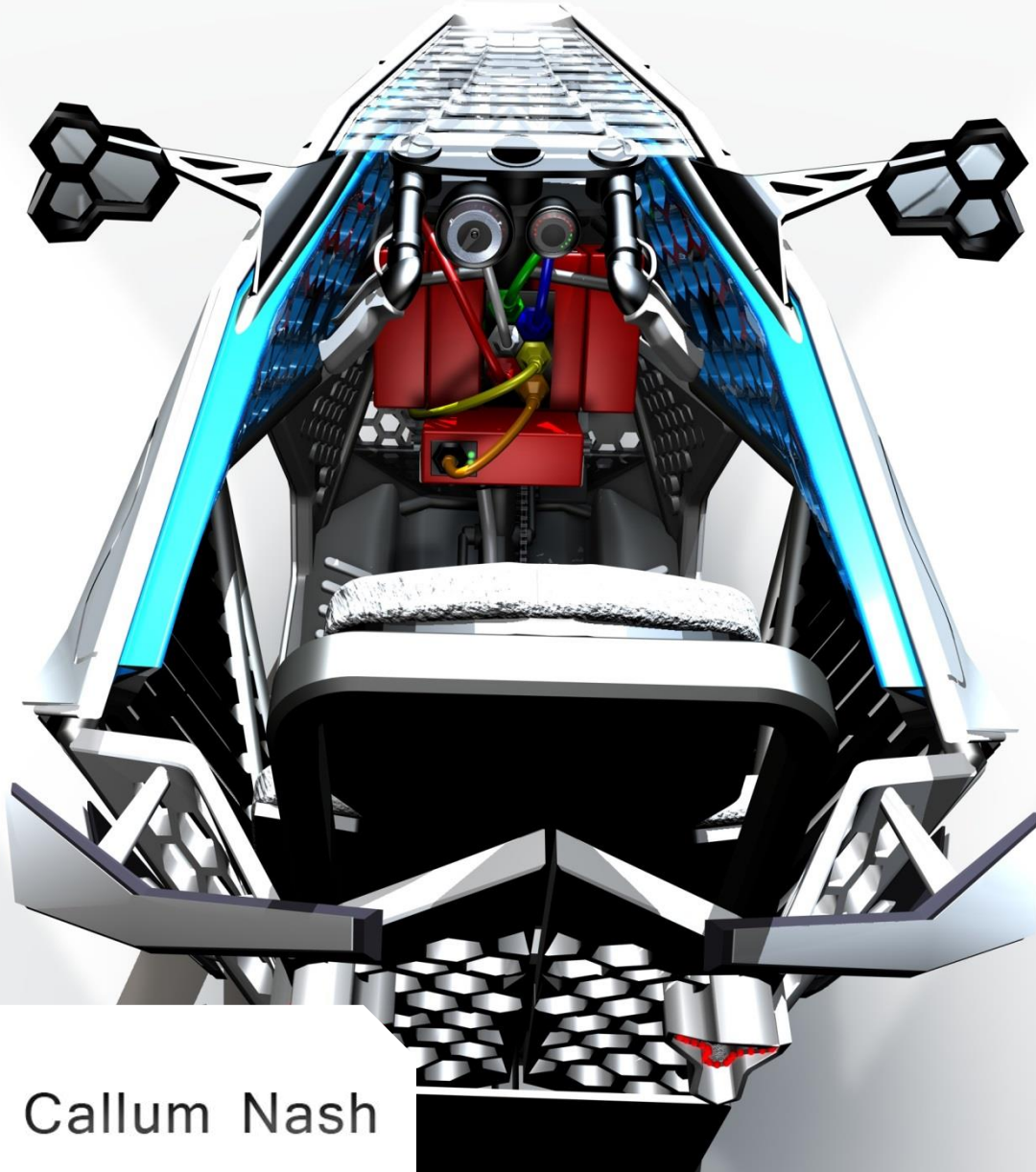
Callum Nash

A sound box mounted near the motor can modulate and amplify the sound of the electric motor, making the bike safer for pedestrians and motorists alike. This can be a customisation feature allowing you to make the bike sound like a 1964 Scuderia Ferrari 156 or even a space ship!



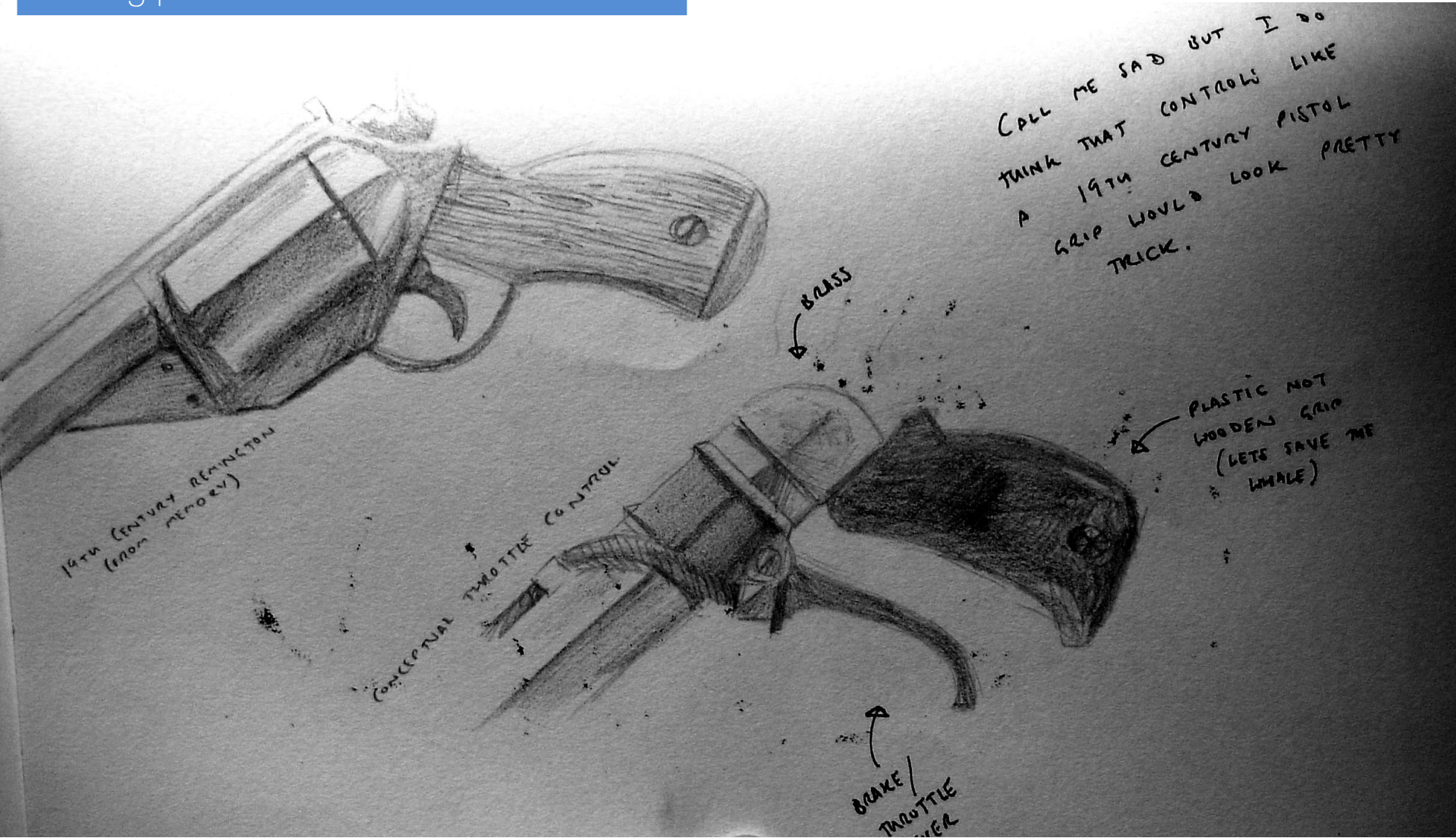
Opus Callum Nash

User experience.



Opus Callum Nash

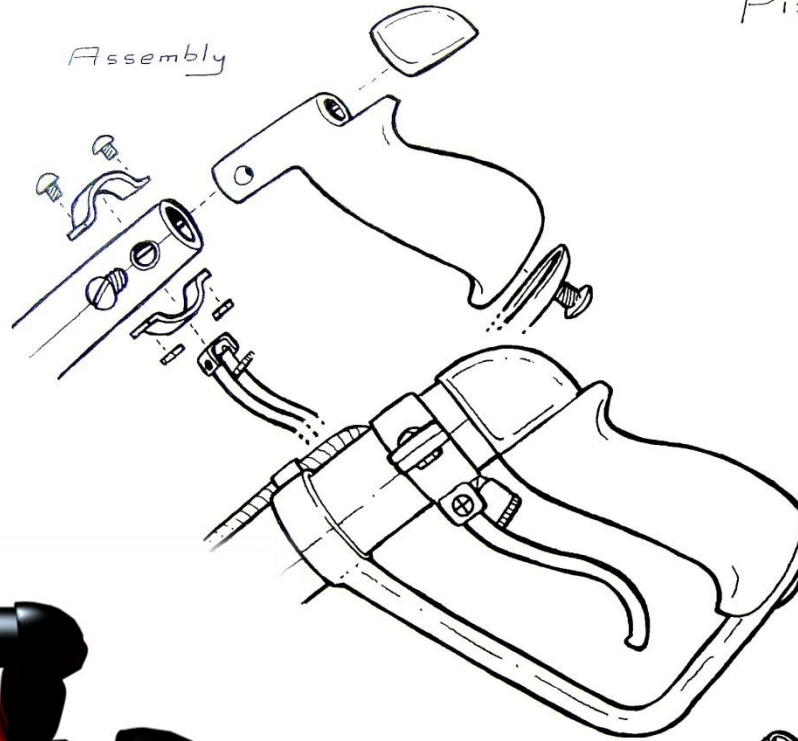
The "pistol grips" were inspired by duelling pistols.



Opus Callum Nash

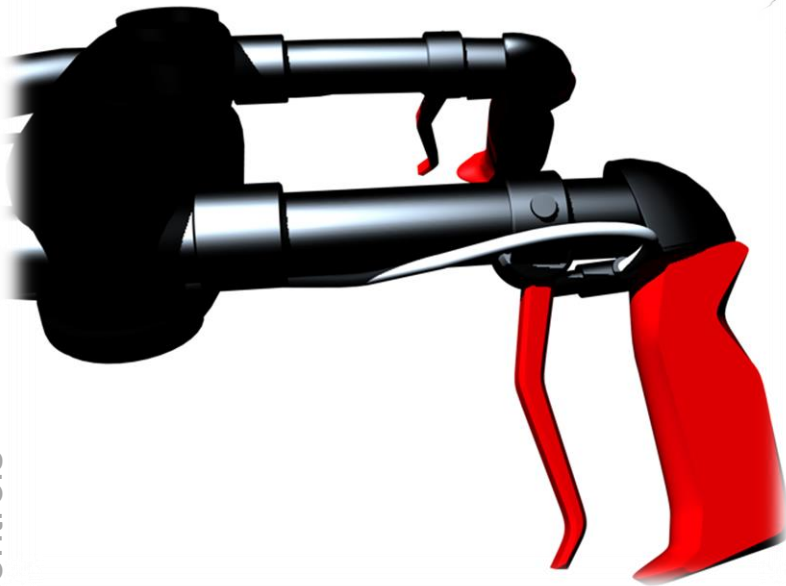
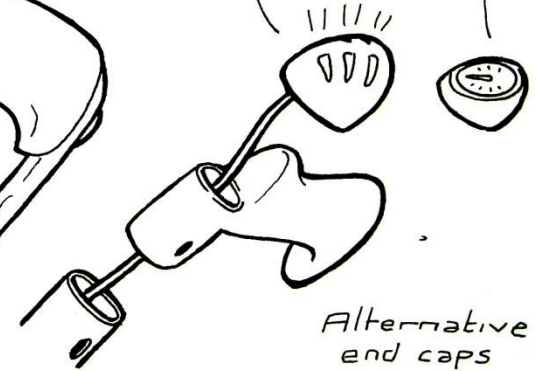
Pistol Grip Design

Assembly



could use l.e.d.s
to indicate speed &
battery life

a mechanical
speedometer could
be fitted



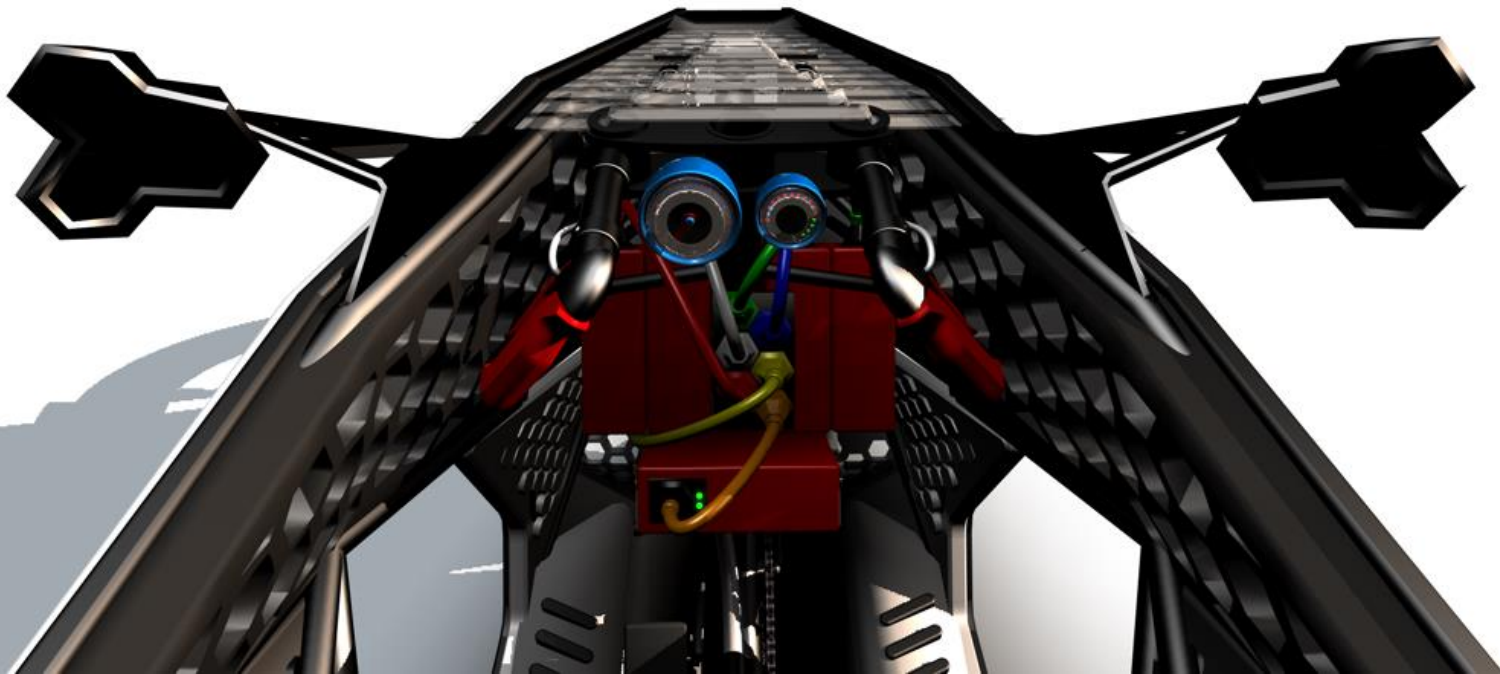
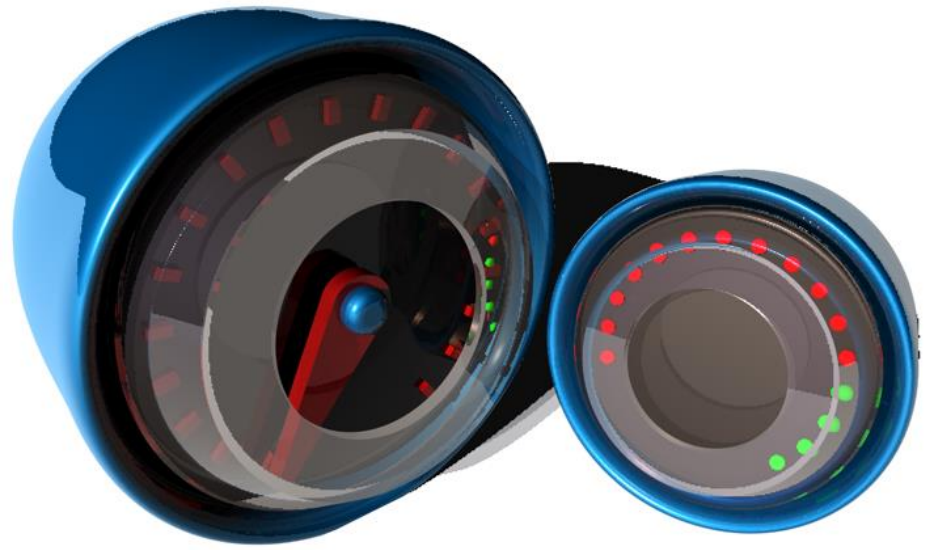
controls

Opus

Callum Nash

Obviously this is extremely cool, but it is more to do with the sensation of power and control, and it makes sense ergonomically to terminate the steering mechanism into these controls.

Retro dials showing only speed and battery life create a sense of simplicity and purpose.



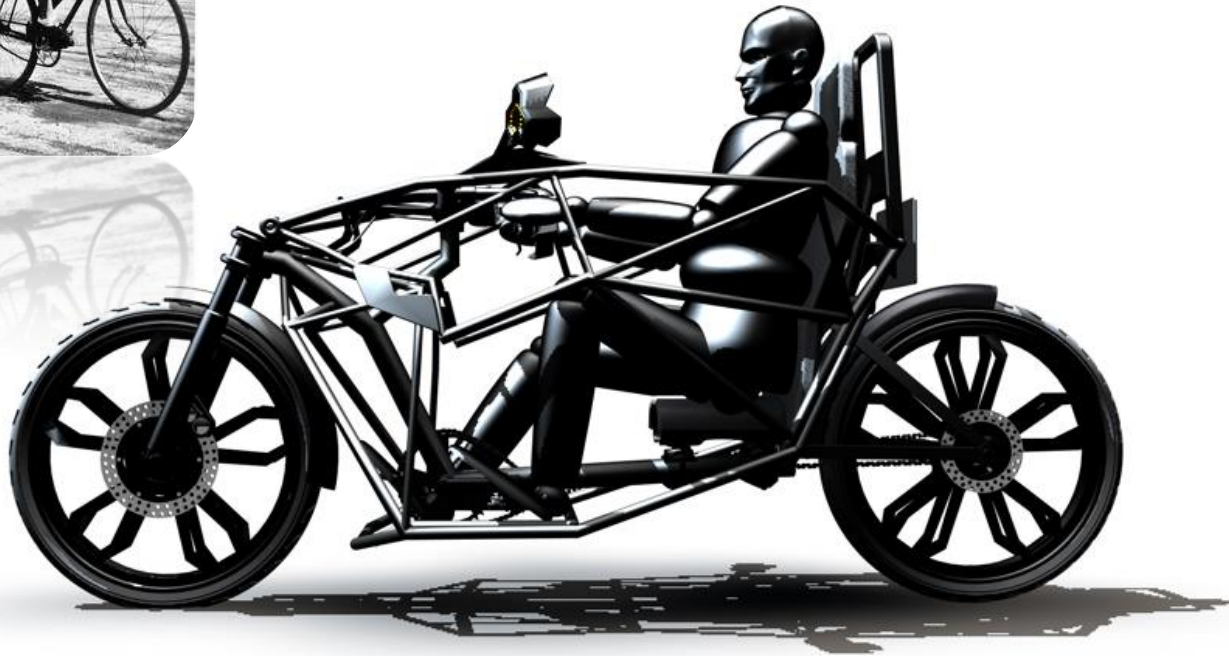
controls

Opus

Callum Nash



It is possible to pedal the Opus, allowing the user to integrate exercise into their driving routine. Which offers the benefit of extended battery range.



Opus

Callum Nash

How do we make it?



Opus Callum Nash

The Opus is designed using technologies and materials that allow simple scaling of production. Essential in an area of such strong competition.

Minimum number of laser cut, injection moulded & machined components. Large tolerances.

Very few “layered” builds (drive system can be installed after the steering, fairing, trim and front wheel fitment.)

No heavy lifts required, nearly all components (aside from frame) weigh under the legal lifting limit (25kg.)

What this means is that The Opus can be produced easily in the niche market by teams of as few as 3 people (it is even possible for a user to self build from a kit.)

But unlike most niche vehicles it does not require skilled labour to achieve a decent finish as its exterior panels sit on top of the manually assembled frame.

All of the technologies used can easily be integrated into a mass production pipeline. There are abundant suppliers for all of its components. (Batteries excluded – although there are suppliers for this type of battery.)

‘Easy build’ vehicles such as these can also open up opportunities for craft production and assembly that could actually boost impoverished economies. (we can start to build a business model for world wide distribution that doesn’t rely on one enormous corporate arm but on multiple smaller businesses building the vehicle for *their* economy.)

The Modular Cooperative concept.

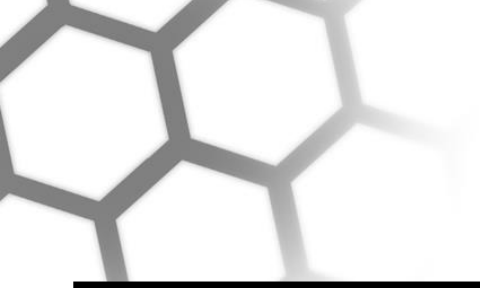
What is the manufacturing dream?

Make the specs open source, **but** protect key elements required for reproduction.

Give licences to produce the vehicle away **for free**. Ask only that new manufacturers submit their product electronically to a cloud based database, and conform to brand guidelines (much like a franchise.)

This allows global distribution without massive investment. If a supplier or an entrepreneur want to sell the bikes in their country they can become a **certified distributor**. They can easily set up production using local suppliers, or order in components from abroad to build the bikes for profit. This allows the product to reach a global market without the need for a global corporate structure. Its responsive to demand, fast growing and low risk. **This also combats the eastern cloning market.**

All sales can take place through the cloud database hub. Customers are directed to the nearest distributor. Every component is registered so each bike knows exactly what it is made from. Consumers can rate components and this knowledge can go straight back to the suppliers. This connectedness through one online database keeps the brand power in one place, surcharges for sales through this hub generate enormous revenue.




Certified distributors will have access to government funding for low emission vehicles that multi-nationals often do not.

This also allows production to be set up in local zones to create lower carbon foot prints & create jobs in targeted areas.

Certified distributors will have better insights into their own local markets, and be able to react faster to change. The Cooperative can benefit as a whole from this knowledge.

Liability is placed squarely on the distributor, protecting the rest of the cooperative if one certified distributor produces an unsafe product.



This is a model for ‘decentralised control.’ By not attempting to centralise the control of a large system, and instead distributing equally it amongst the participants, businesses can be faster, smarter and far less expensive.

Much more explanation of the “Modular Cooperative” & Certified distributor concept in the provided business plan.

Legislation.

Will fall into the same category as other large motorcycles as its clearly a road vehicle capable of motorway speeds.



Opus Callum Nash

End of life.

Most of the bike is recyclable or biodegradable, made from plastics, steel, aluminium and wood fibres.

The batteries are the only part that is not. But as the pack is segmented, it can be broken down and processed more easily than conventional large packs.

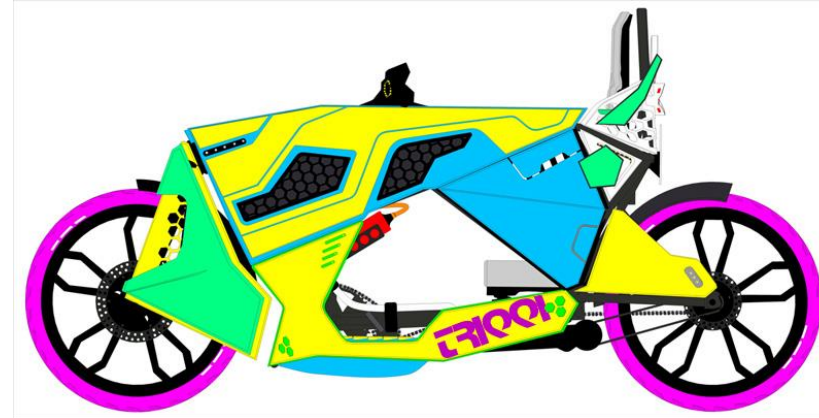
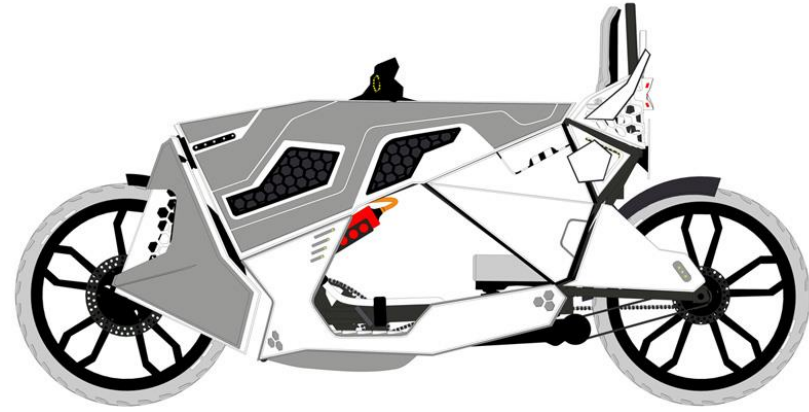
Vehicles in the future must go beyond zero-emissions, they must achieve an almost biological harmony with the eco system.

Sales?

As well as conventional show room sales, an online shop could maximise sales by offering games and features such as a forum space and a “bike builder” which allows you to build your perfect customised Opus, and order it direct from there.

This could tie into the manufacturing database, allowing users to check a bike they are going to buy second hand.

The online hub is something that distributors world wide can use for marketing. It's a massive incentive for become a certified distributor.



Opus

Callum Nash

Web integration.

The Opus becomes a portable internet device itself, by hot tethering to your phone when you get in.

This means your mobile device can function as a sort of key.

You can use your phone to modify VCU settings and share them via the cloud. You can also monitor performance from any internet connected PC.

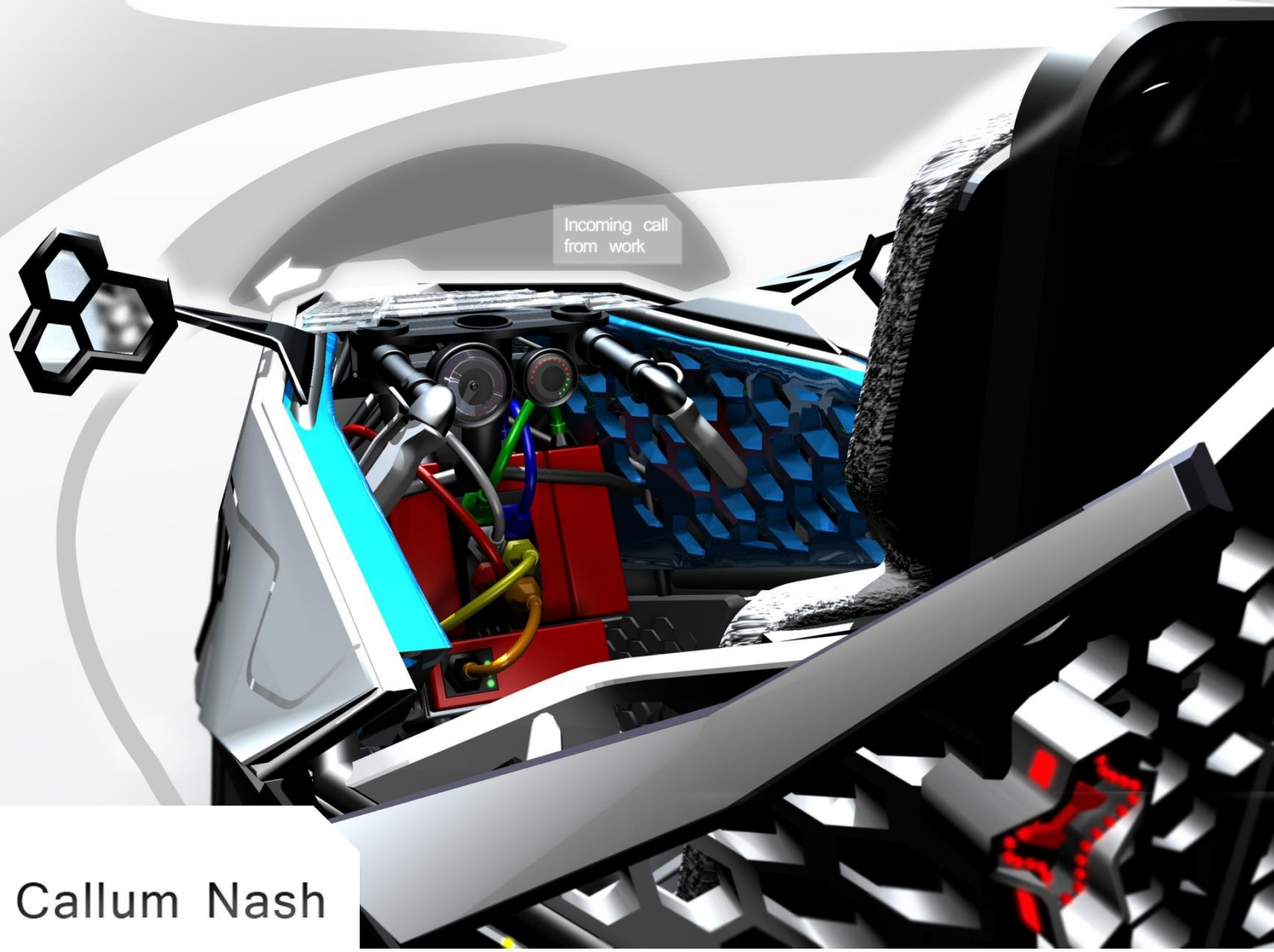


Opus

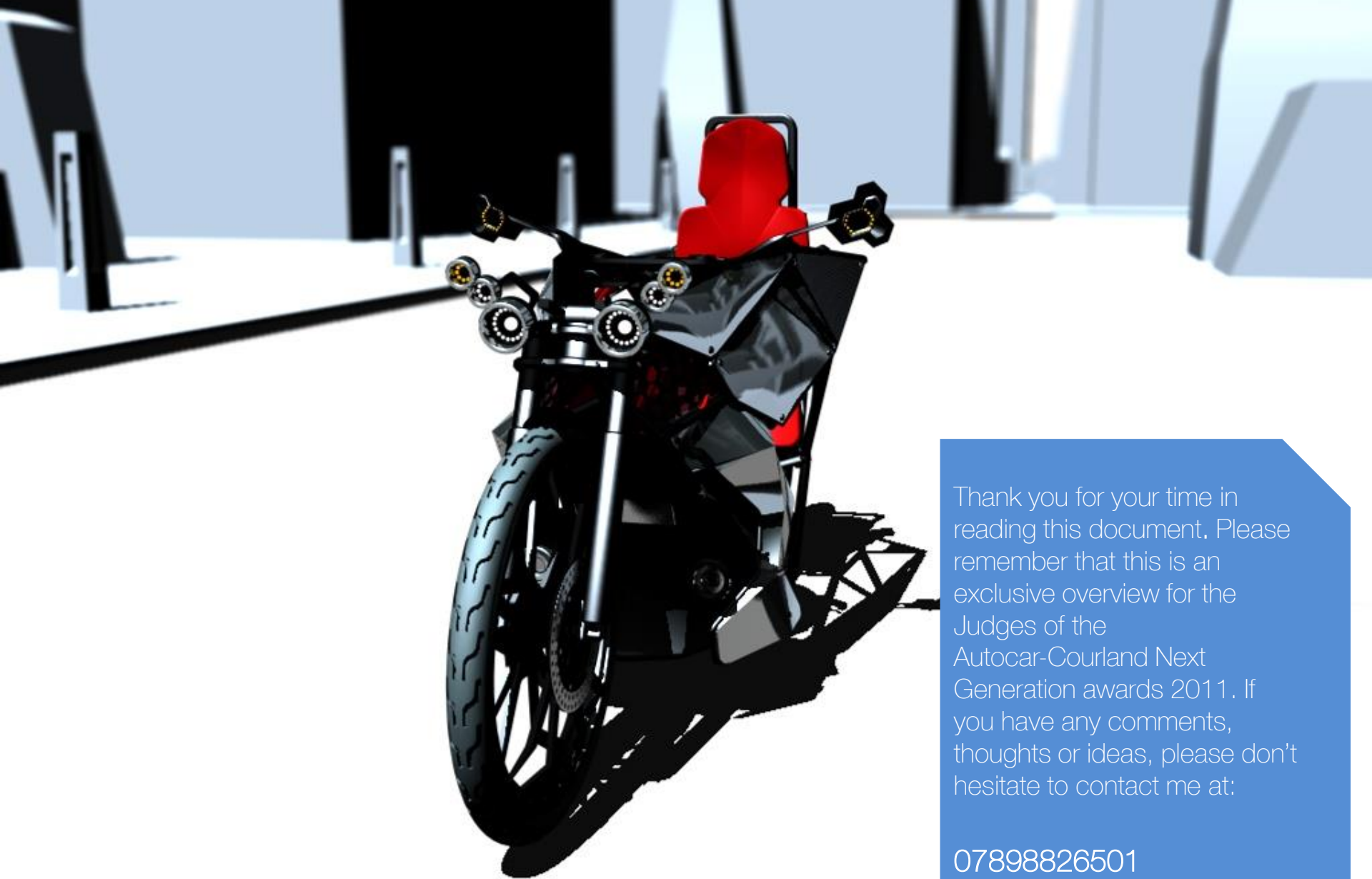
Callum Nash

Imagine augmented reality Sat Nav being projected onto the windscreen. Phone calls being received by the vehicle and social media updates and emails being spoken by Google reader. Appointments being announced by the vehicle on your way into work . Open source software will allow developers to make this happen and more.

Third party apps



Opus Callum Nash



Thank you for your time in reading this document. Please remember that this is an exclusive overview for the Judges of the Autocar-Courland Next Generation awards 2011. If you have any comments, thoughts or ideas, please don't hesitate to contact me at:

07898826501
12345@iamcallum.com
www.iamcallum.com

Opus Callum Nash