Dyson Supersonic Press Release

Fast, focused and intelligent
The Dyson Supersonic™ hair dryer

Conventional hair dryers can be bulky and difficult to manoeuvre, can blast air at high temperatures, which can cause extreme heat damage, all with the risk of hair being sucked into and trapped in the filter. Yet despite these well known limitations hair dryer design has not advanced in more than 60 years.

Frustrated with the limitations, Dyson engineers set out to solve these problems. The Dyson Supersonic™ hair dryer uses a fast but focused airflow, is engineered for balance in the hand and intelligently controls the temperature to help protect hair from extreme heat damage.

James Dyson: *"Hair dryers can be heavy, inefficient and make a racket. By looking at them further we realised that they can also cause extreme heat damage to hair. I challenged Dyson engineers to really understand the science of hair and develop technology which helps overcome the problems of hot, bulky and unintelligent hair dryers."*

Hair science
Dyson has invested £50 million in the development of the Dyson Supersonic™ hair dryer including creating a state of the art laboratory dedicated to investigating the science of hair. Dyson engineers studied hair from root to tip, understanding how it reacts to stresses, how to keep it healthy and how to style it.

Over four years they tested the product on different hair types and built test rigs which mechanically simulate hair drying techniques – which can differ around the world. To date over 1010 miles of real human hair have been used in testing.

Motor enabled
The Dyson Supersonic™ hair dryer is powered by the patented Dyson digital motor V9, created in-house by a team of over 15 motor engineers specifically for this machine. It is Dyson's smallest, lightest, most advanced digital motor.

It is up to eight times faster than other hair dryer motors and half the weight[1]. In addition, because the Dyson digital motor is engineered to be powerful yet compact it is small enough to be positioned in the handle rather than the head; because of this the machine is engineered for balance. Most conventional hair dryers have the motor in the head of the machine.

Helps protect natural shine
Some conventional hair dryers can reach extreme temperatures, especially when held close to your head. This can cause extreme heat damage to your hair.The Dyson Supersonic™ hair dryer has intelligent heat control, helping to ensure hair isn't exposed to excessive temperatures. A glass bead thermistor measures the temperature 20 times a second and transmits this data to the microprocessor, which intelligently controls the patented double-stacked heating element.

Fast & focused
The Dyson Supersonic™ hair dryer uses Dyson's patented Air Multiplier™ technology. The volume of the air drawn into the motor is amplified by three due to this technology, producing a high pressure, high velocity jet of air.

Traditional hair dryers can sometimes have a weak airflow, meaning they are slow. Others can have strong airflow, but it is not necessarily controlled. The Dyson Supersonic™ hair dryer creates a focused jet of air, angled at 20° for controlled, precise drying and styling. Allowing you to dry and style at the same time.

[1]Compared to the 10 bestselling hair dryers in Japan, as of March 2015.

Acoustic engineering
A team of Dyson aero-acoustic engineers sought to understand how the acoustics of this machine could be optimised. By using an axial flow impeller inside the motor they have simplified the pathway of the air reducing turbulence and swirling. And by giving the motor impeller 13 blades instead of the usual 11, Dyson engineers pushed one tone within the motor to a sound frequency beyond the audible range for humans.

Also, because the motor is small and compact they have been able to embed it in the handle, surrounded by acoustic silencers to further reduce sound. The Dyson Supersonic™ hair dryer is a hair dryer engineered to reduce noise, without compromising on speed.

Settings and Attachments
The Dyson Supersonic™ hair dryer has four heat settings, three airflow settings and a cold shot too. Dyson engineers have created three precisely engineered magnetic attachments, with 16 patents pending, to further control this airflow allowing you to achieve a range of different styles.

- The Dyson engineered smoothing nozzle dries hair gently, using smooth, wide air, allowing you to dry and style at the same time.

- The Dyson diffuser is engineered to disperse air evenly around each curl. It simulates natural drying, helping to reduce frizz and improve definition.

- And the attachments remain cool to the touch. Using Heat Shield technology the hot air is contained within a sandwich of cold air meaning the surfaces of the attachment stay cool.

- Being magnetic, each nozzle is easy to attach and adjust.

- There are multiple settings including constant cool to set your style; four heat settings, three airflow settings and a cold shot too.

Local distribution and Management
Whiteplanet Inc. is the exclusive distributor of Dyson in the Philippines. Warren Sy is Whiteplanet Inc.'s CEO, while Bobby Yan is VP-Communications.

The Engineering Journey

Engineering story

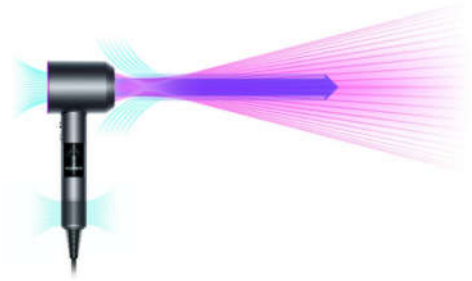
The engineering brief:

Drawing on expertise in digital motors, acoustics, fluid dynamics and ergonomics, James Dyson challenged his engineers to develop a high performing machine that addressed the frustrations with existing hair dryers.

Key milestones:

1 and 2. Initial concept rigs
3. 1st working rig
4. A-rig – Initial integrated rig, with V9 motor and custom heating element
5. B-rig – 1st fully integrated rig, V9 motor, electronics, heater
6. C-rig – further iterative developments
7. Thermal rig – Concept air amplifier to detail the thermal characteristics
8. D-rig – Multiple rigs for user trials and testing
9. E-rig – Fully detailed rigs proving specification
10. 01-rig – Last prototype build prior to tooling and manufacture
11. First engineering build from plastic components

Air Multiplier™ technology:



Dyson's patented Air Multiplier™ technology means that the volume of air coming out of the hair dryer is 3x that going into the motor. Air is taken into the motor and accelerated over an annular aperture. This creates a jet of air which passes over an airfoil-shaped ramp that channels its direction. Surrounding air is drawn into the airflow (this is called inducement and entrainment).

Engineers developed 25 variations of the annular aperture in an 8 week period, fine tuning the balance between noise and performance. When this rig was complete, assembled and calibrated the engineers took James Dyson to the acoustic chamber to see the result, at first James thought they had turned down the power to make it quieter than expected, he put his hand in front of the amplifier and was shocked by the force of airflow.

Double stacked heating element:

The Dyson Supersonic™ hair dryer has a unique heating element. In order to fit the format of the machine Dyson engineers needed to develop a double stacked, interwound heating element with a hole through the middle.

Competitor machines often use flat sheets of Mica slotted together in a Christmas tree shape, wire is then wrapped around this structure.

But, due to the shape of the Dyson Supersonic™ hair dryer, Dyson engineers needed to develop a heating element which uses specially produced Mica tubes, positioned in a donut shape with two, resistive wires made from a chrome aluminum alloy wrapped around them. These wires are structured in a wave-form pattern and interwoven around the tubes.

Initially the engineers developed a one layer heating element, using wire which was more loosely woven, creating larger wave shapes. However they found that this had limitations. The large wave shapes of the wire would wobble and touch each other, causing the machine to cut out. This is why the heating element has two layers and two wires – allowing for smaller wave patterns, tightly woven.

The most challenging aspect of the development was ensuring the heating element worked in this unique format. The process took a total of 3 years, making iterative developments and doing extensive testing on the element to ensure it worked and did so safely.

The challenges:
Learning about hair: how to test with it, how to make it repeatable and how to measure it. Using real hair was crucial to development, we found that imitation materials could not replicate the unique characteristics of real hair fibres and would often lead to misleading results.

*Learning about hair drying and styling:*Pairing better technology with detailed user insights to ensure the product meets and exceeds user's expectations – both professional and consumer.

The Acoustics: Every aspect of the product affects its sound, every screw, electronic component and cable. An intimate and detailed understanding of every aspect of the system was needed by every member for the engineering team.

Keeping the technology compact: Every engineering challenge is made simpler when there is more space to play with. But James' challenge was to keep the technology small and compact. This drove a huge focus on the detail design and system engineering to a level we haven't encountered on other Dyson machines.

The Science of Hair

Hair science

Understanding hair:
Dyson engineers have carried out tests on a variety of hair types in order to get a full understanding of performance. In total this covers 7 different hair types –
Japanese - Asian
Other – Asian
Fine straight Caucasian
Medium straight Caucasian
Medium wavy Caucasian
Bleached medium brown Caucasian
Mixed ethnicity

Different types of hair handle stresses differently. Asian hair is actually different in shape (always circular instead of circular or oval; like Caucasian) and is the heaviest & coarsest. This means that it tends to align more easily & therefore tangle less – even under turbulent air flow. Caucasian hair has the highest density of all. It grows at an oblique angle to the scalp and is slightly curved. This means the hair is more likely to be wavy or curly.

Hair tresses:

A single hair tress costs between £12 and £20 depending on the length of hair we are using. On average Dyson engineers use 40 hair tresses for every test – so that's up to £780 a test and 640 inches of hair.So far we have spent £40,000 on human hair tresses.

For testing, engineers need a very controlled source of hair with the hair being as close to undamaged virgin hair as possible, all the cuticles aligned and closely colour matched to remove contrast variability.

How much does each hair tress weigh?
The weight depends on the length of tress the engineers are working with – and whether it is wet or dry. Healthy hair can absorb as much as 10% of its own weight. A dry standard 8 inch tress weighs 4g. If the engineers added up the number of tresses they have used for all testing, the total weight would be around 8000g or 8Kg.

What length of hair tress do you need?
Hair Tresses come in 8 & 16 inches, and are carefully checked individually for quality of each tress and quality of the individual hair fibres for testing – only ''virgin'' or non-damaged hair (i.e. hair that has never been dyed, over brushed or damaged by heat) are used in our testing. If Dyson engineers were to place all of the hair tresses they have used in testing end to end, we would cover as much as 32000 inches which is nearly ½ a mile. If we put the individual hair fibres end to end we would cover 1010 miles!

Hair drying techniques:
In our passion to get to the deepest insight we have watched over 100 women over 2 continents wash and dry their hair over a total of 275 hours – that's nearly 12 days of continuous study.

What have we learnt?
From the hours of insight test footage engineers have analysed they have been able to define some interesting figures against common hair dryer usage. Here are some facts from the UK (57 women using their hair dryer for a total of 2 weeks):

- The average number of visible angle changes a consumer needs to adjust her hair dryer to during one drying session is a grand total of 15.

- The average length of time spent drying hair is 20 mins – this is actually significantly shorter than what women perceived, they believed they were drying their hair for an average of 30 mins.

- Given the number of angle changes and the average weight of a professional hair dryer it is not surprising it feels longer!In fact, of the women we spoke to, it took them on average less than 5 seconds for women to feel the strain on their wrists and arms.

- The area women struggle with the most is the back of the head – on average consumer spends 40% of their time in this area – with over half of them redoing these sections to try and get the smooth finish they want.

- Average number of brush strokes = 225
- Average number of sections = 12
- Average number of passes per section with hair dryer = 4
- Average Distance hair dryer is held from the hair = 0.5cm
- Average speed per pass = 1.3s/cm
- Also, after this detailed and aerobic routine 39% rewet their hair & started again and 58% simply gave up and put their hair in a bun/ponytail.

Hair Myths

Hair is best brushed when wet
Hair is actually 50% weaker when wet. Wet hair stretches more than dry hair before it breaks. Wet hair has a co-efficient of friction that is significantly higher than dry hair, therefore combing/brushing whilst wet will increase the amount of force applied to the hair increasing the likelihood of breaks occurring.

Running cold water at the end of your shower makes your hair shiny
The general premise of this rumour is that colder water will cause the cuticle layer (surface) of hair to close. Hair however is dead and there are no active mechanisms (e.g. opening & closing of cuticle layers) caused by either hot or cold water. The hair cortex swells slightly with water due to penetration into the hair, however this occurs with both hot and cold water.

Cutting your hair frequently makes it grow faster
No it doesn't, hair grows from the root & the body doesn't know when it has been cut (shaving, plucking, tweezing is a different story). Cutting the hair removes split ends which help the hair stay more aligned and look healthier. Perceptually if you get your hair cut more frequently you will probably be more aware of how quickly it grows.

If you pluck a grey hair more will grow back
When a hair follicle begins growing grey hair, all new hairs from this follicle will be grey. If you pluck the hair the follicle will be forced back into the anagen growth phase and will produce another grey hair. There is no clear evidence that plucking a single hair will cause other hair follicles to start producing grey hairs instead.

The more you brush your hair, the healthier it will be
Brushing the hair mechanically damages the hair, breaking bonds in the cortex weakening it over time. The abrasion to the cuticle (surface) of the hair will break off small bits of cuticle that stick up due to other damage, this will enable the hair strands to align better which will make it temporarily look healthier however it is still more damaged than before & less resistant to chemical, environmental, physical & heat damage in the future.

Fun Fact
In general, the weight needed to produce a natural hair thread rupture is 50-100 g. An average head has about 120,000 threads of hair and would support about 12 tons.

Testing

We have developed specific testing rigs to simulate hair drying techniques and behaviours – which we have found to be different around the world.

Dyson engineers use **Scanning Electron Microscopes** to look at single strands of human hair in high definition – to understand the makeup of hair and which elements affect the condition causing splits, holes and other damage.

Dyson engineers use a **Tensile Test** to measure the strength and elasticity of each hair strand before and after drying and styling; developing our understanding of the stresses which can cause hair damage.

Dyson engineers use **Thermal Cameras** to understand the temperature of the airflow coming out of the machine – ensuring it is consistent throughout, even when pushed close to your head or to a brush.

To ensure the machine is durable and safe we conduct hours of tests. These replicate the actions you would do when using a hair dryer. One example is the Durability **Tester / Shake Rig**.

The **Airflow Smoke Laser Test** looks at the shape of the airflow being produced from the machine. Engineers conducted testing to understand the most effective airflow shape for fast controlled drying.
Airflow Power test complements the **Airflow Smoke Laser Test** but looks at the power of the airflow specifically. This power is generated by the motor but amplified by Air Multiplier technology, this test is used to understand the effects of a powerful airflow on hair.
Drying with your fingers and a hair dryer rig simulates a user's behaviour when drying their hair with their hand. This helps engineers understand how the shape and focus of a hair dryer can be amended to complement the different ways users use the machine.
Hair Moisture Content Rig looks at the levels of moisture in the hair and how long different airflow strengths and temperatures take to dry different levels of moisture.

The Dyson Digital Motor V9

Dyson digital motor V9

The Dyson digital motor V9 is our smallest, lightest, most advanced digital motor. Like a modern jet engine, air travels in and out along the direction of the motor's axis, helping keep the motor diameter as small as possible whilst delivering high airflow and pressure. It is up to eight times faster than conventional hair dryer motors, and is half the weight, whilst only being the size of a ¥500 coin[2].

The engineering challenge was to build a motor to fit within the handle of the Dyson Supersonic™ hair dryer. It had to be Dyson's smallest motor to date yet able to move over 13 litres of air through the diameter of a 2p coin, just 27mm, every second.

James Dyson;*"Motors have been an enabling technology, allowing us to develop high performing technology that others simply can't. This is our smallest, lightest and most advanced motor yet and combined with our patented Air Multiplier technology it has allowed us to put the motor in the handle. "*

Power dense
V9 contains an axial flow impeller, rotating at 110,000 rpm; this impeller allows the motor to shift thirteen litres of air every second.

Intelligent
V9 is the first Dyson digital motor to use "sensorless" design: the controlling electronics carefully monitor the electric current travelling through the motor and determine when to switch the digital pulses which keep the motor spinning – a job which has always used dedicated sensors before. The sensorless algorithm makes adjustments more than 1900 times per second and simplifies the motor construction.

The tips of the fan blades travel at 335mph, and are regulated by an intelligent software system that sends 3,500 digital pulses every second - optimising the position of the impeller. The blades spin just 70 microns from the motor housing – that's less than a hair's breadth.

Acoustically engineered
Aero-acoustics – the sound from the airflow – fed into the motor's design throughout development. Dyson engineers analysed the movement of the air, how it swirls coming off the impeller, and how they could straighten it out and minimise turbulence in the airflow. Simulations ran for hours, or even days; 4865 prototypes were built and tested in the development stage.

Dyson engineers managed to push one sound frequency of the 13 blade impeller, within the motor, beyond the audible range for humans.

Precision manufacturing
The impeller within the motor is cut from a single piece of aerospace-grade aluminium on our autonomous production lines, in Singapore. Each impeller is cut using laser precision, so exact that the machines that do it are classified; requiring special clearance to be used, as it can be used in the development of nuclear weapons.

Dozens of robots, split across 20 stations, assemble V9 at a facility built to produce a motor every nine seconds. Each motor has a code laser-printed on a small area of the high speed impeller.

[2]Compared to the 10 bestselling hair dryers in Japan, as of March 2015.

Stylist Collaborations

Working with professionals

For the last year they have been working with several professional stylists to understand what their frustrations with existing hairdryers and how to solve them:

AKIN KONIZI

- HOB Salons Creative Director
- 25 salons in the UK
- Won over 40 internationally recognised awards
- 4 x British Hairdresser of the Year

BROOKE BOHAN

- Founder of FOUR London
- Leading colourist
- Collection of celebrity clients in Mayfair salon
- Styles and colours for TV and Magazine shoots

APISH SAKAMAKI

- APISH Founder
- 5 famous salons in most popular areas of Tokyo Celebrity clients
- Features in TV shows and magazines

Both Akin and Brooke have worked closely with Dyson engineers throughout the development of the Dyson Supersonic™ hairdryer. Helping them understand what professionals expect from a hair dryer.

Akin and Brooke particularly helped in the development of the professional concentrator which now has a wider nozzle opening to cover the full width of a brush and fast/precise airflow at the point where it hits the hair.

Apish advised on the cable length too which he considered too short for use in a salon, so Dyson engineers have extended the cable. This helps with reach and flexibility in a salon setting.

The Dyson Engineers

Engineer biographies

James Dyson – Founder, Owner of Dyson

Frustrated with his bagged vacuum cleaner that lost suction, Sir James set about solving the problem and developed cyclone technology. After thousands of prototypes the first dual cyclone vacuum cleaner - DC01 - was launched in 1993.

As Chief Engineer, James is an integral part of Dyson's Research and Development process and works full time out of Dyson's Malmesbury headquarters.

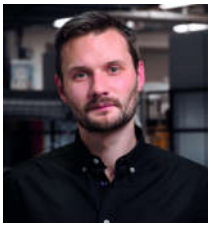
James spent one year at the Byam Shaw School of Art (now part of Central Saint Martin's College of Art and Design) before reading furniture and interior design at the Royal College of Art.

Tom Crawford – Head of Product Development, Environmental Control.

Tom secured a 1st class BSc honours in Product Design at Bournemouth University, and worked for Ford motor cars and Aqualisa, a UK based domestic shower manufacture before joining Dyson over 10 years ago. During his time with Dyson he has lived in both Malaysia and Singapore, worked on the Dyson washing machine, been the Design Manager and lead engineer on both DC24 and AM01 and was the lead engineer responsible for performance and future delivery of all Environmental Control Dyson Air Multiplier™ range of products.

Today Tom is Global Product Development Director and has overseen development, testing and manufacture.

Marcus Hartley – Design Manager



Marcus graduated from Huddersfield University in product design. Marcus won the James Dyson Foundation Award for New Designers in 2004 – taking Best in Show and Product Design for his hammer invention. His invention adds features to the standard hammer to make it a multi-functional tool. Later that year Marcus joined Dyson as a graduate design engineer.

Thrown in at the deep end early on, Marcus worked on Airblade. He was one of the engineers responsible for designing, testing, detailing and manufacturing this product from the initial concept stage all the way to production. He also worked on the Airblade dB hand dryer and the Airblade Tap.

Taking his expertise in Air Multiplier technology, Marcus started working on the development of the Dyson Supersonic™ hair dryer in 2013. His role involved overseeing all aspects of the production of the machine – from the performance, to the validation and costs. During early stages of development, he and his team started working with well-known hair dressers, such as Akin Konizi, on the design and development of the Dyson Supersonic™ hair dryer. With the help of their expertise, Marcus and his team further refined the temperature focus and precision of the machine's nozzle. In total, the engineers did over 150 real user trials with over 25 hair experts.

Since 2015, Marcus has led a team in Dyson's New Product Innovation department - these projects are still under wraps!

Ed Shelton – Design Manager

Ed Shelton started at Dyson as a Graduate Design Engineer almost six years ago. From the start, he has been working in the New Product Innovation (NPI) department on the development of the Dyson Supersonic™ hair dryer. His first

major project was the design and development of the Dyson V2 motor, and has since worked on numerous prototypes that lead to the development of the V9 motor – a motor capable of achieving the same performance but in a much smaller package.

During the development of the Dyson Supersonic™ hair dryer, Ed and the team wanted to go deep into the science of hair. To do so, they established a number of key Dyson laboratories, such as 'the laser lab' for studying the effects of airflow on hair, or 'the electron microscope lab' to examine the effects of heat on hair.

Since 2015, Ed has been overseeing the development of the Dyson Supersonic, to make spot improvements to the existing design.

Annmarie Nicolson – New Product Innovation Design Engineer

Annmarie Nicolson joined Dyson in 2012, after attaining a Bachelor of Science degree in Product Design and Innovation at Strathclyde University. She started in Reliability for a year, analysing vacuum cleaner field failures: from DC25 through to DC50 - to spot improvements which could be made to existing and future designs.

A year later Annmarie moved to the New Product Innovation (NPI) team – where she began working on the Dyson Supersonic project from the very beginning. This involved conjuring up new ideas and bringing them to life through card modelling, 3D prototyping and testing. Annmarie's role was central to early stage development and involved user testing to ensure the new design was delivering an effective user experience through exciting new technology.

Two years later and Annmarie moved to the 2nd stage of the design process – New Product Development (NPD). Here Annmarie took the Dyson Supersonic™ hair dryer from assembly sketch to patented technology and has since been working on designing the hair dryer for manufacture, integrating her reliability experience to ensure the design withstands robust testing.

Stephen Courtney – Concept Director

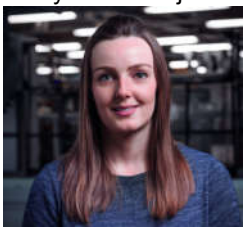
As a child Stephen always wanted to invent and create things that were new, exciting and worked better. He would catalogue all his ideas and discuss them with his father, who is also a Design Engineer. After a Design Engineering and Business degree, he gravitated to Dyson.

He is now Head of New Product Innovation. He and his team conceive ideas for new Dyson machines - they dream up product ideas and develop problem solving concepts that no one else has thought of. They decide what technologies are needed and how Dyson could develop them.

During early stages of development of Dyson's first hair dryer, Stephen and his team wanted to go deep into the science of airflow and hair drying. By investigating how the machine could be engineered to be light, compact and very quiet without compromising styling and drying performance, Stephen and his team developed the Dyson Digital Motor V9 – a motor so compact and quiet, it could actually be placed in the handle for weight balance.

Emily Menzies – New Product Innovation Advanced Design Engineer

Emily Menzies joined Dyson after graduating from Brunel University with as BSc degree in Product Design with Professional Practice, almost 4 years ago. After a year in New Product Development (NPD) working on handheld machines Emily moved to the New Product Innovation (NPI) team working on new categories.



During her time in NPI Emily has been heavily focused on understanding the process of users drying their hair. Emily has been involved in the development of the concentrator attachments for the Dyson Supersonic™ hair dryer, understanding how airflow structure and hair interactions effect individual fibres of hair and the overall style achieved. This involved looking at hair strands under the scanning electron microscope, measuring hair damage and developing test

methods to test hair tresses in realistic scenarios for different users globally. These customer needs were then translated back into requirements for the Dyson Supersonic™ hair dryer.
As well as focusing on consumer needs Emily also liaised with professionals such as Akin, and attended internal and external user trials which were invaluable to making design changes to the Dyson Supersonic™ hair dryer, ensuring it would be a product that consumers and stylists love.

Dyson Supersonic Key Numbers

Key numbers

Dyson Supersonic™ hair dryer:

- Dyson has invested almost **£50 million** in the development of the Dyson Supersonic™ hairdryer
- Dyson has built a bespoke, state of the art **Hair Laboratory** in research, design and development.
- **1010 miles** of human hair has been used in testing
- **600** prototypes
- **250+** patents pending
- **16** patents pending for the attachments alone
- **4 years** in development
- **103** engineers

Haircare industry in numbers:
The haircare industry is worth:

- **$1bn** in the US
- **$lbn** in the EU
- **$483m** in China
- **$452m** in Japan

Behaviours[3]:

- **50%** of people define their hair as "extremely important" to their overall look and feel.
- The average woman owns **3.3** different styling appliances.
- **96%** of Japanese people own a hair dryer versus **91%** of Americans.
- **37%** of Japanese men own and use a hair dryer.

Dyson general:

- **75:** Dyson machines are sold in more than 75 countries.
- **£1.5 billion**: Dyson has committed to a £1.5bn investment in future technology. **£250 million** investment in facilities this year becomes real when the Malmesbury campus opens. We are developing four new portfolios of technology, and will launch 100 new products around the world in the next four years.
- **£5 million:** Dyson works with over 30 universities worldwide to develop early stage technologies, including a £5m investment in a joint robotics lab with Imperial College, London.
- **6,000+:** Dyson employs more than 5,000 people worldwide, a third of who are engineers.
- **1995:** Dyson sold its first cylinder vacuum cleaner, DC02, in 1995. This was two years after the first Dyson upright vacuum cleaner, DC01, went on sale.

[3] Research conducted by Dyson