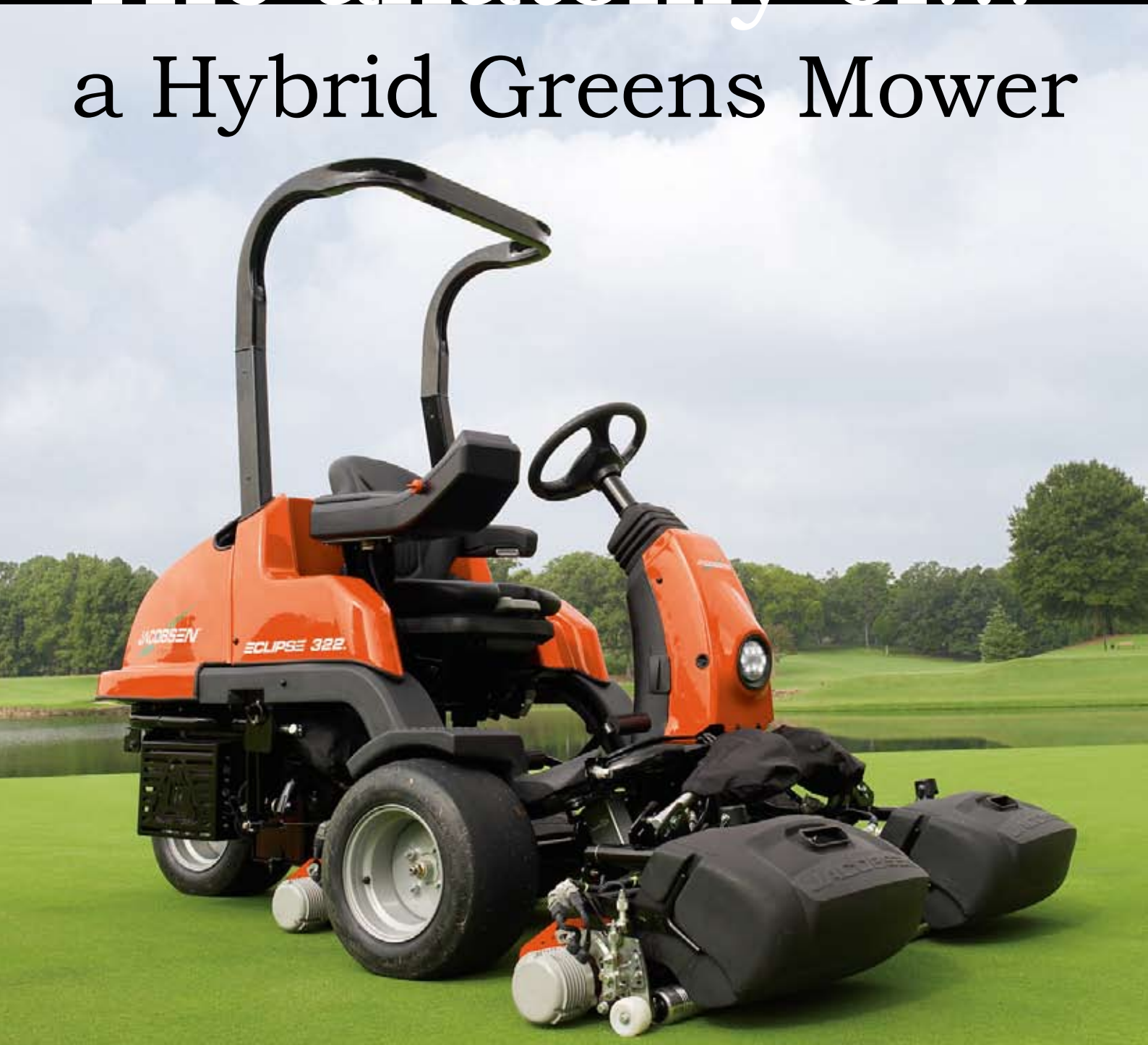
The third of the series, in which James de Havilland takes a closer look at the intricacies of current machinery

The anatomy of...

a Hybrid Greens Mower



James de Havilland casts his eye over the new Jacobsen Eclipse 322. Another nail in the hydraulic oil drum?

Jacobsen has styled its diesel electric Eclipse 322 so it looks just like a 'conventional' diesel hydraulic machine. Operating costs should be lower due to the efficiency of the driveline.

Step-by-step Analysis...

Jacobsen Eclipse 322 hybrid greens mowers

Nestling under the mower are extra batteries. These provide buffer energy to ensure instant power is always available to the mower.

Jacobsen Command Arm and steering column are both adjustable. To sit on, the Eclipse 322 feels much the same as a Jacobsen diesel hydraulic mower.

There is not a great deal to see under the engine cover, with good service access. Steering system is genuine 'fly by wire' and claimed to offer good 'feel'.

The cutting units come with a choice of options to include groomers...

... and verticutter. The Eclipse 322 is a full spec offering that happens to have diesel electric power.

Diesel electric power is hardly new. From ships and submarines through to giant dump trucks and rail locomotives, diesel electric power has demonstrated its ability to be both reliable and economical. It is when it comes to 'shrinking' the technology, however, that the system has failed to take off. But times they are a changing...

It is all too easy to look at the Jacobsen Eclipse 322 in isolation. It is, after all, the only ride-on greens mower to use electric motors to drive both its cutting units and traction wheels.

This eliminates the hydraulics that we have come to regard as the default transmission medium for both. It all seems pretty straightforward, so perhaps you could ask why it has taken so long to produce such a machine.

There are a host of reasons, but key among these has been a scarcity of electric motors that are right for the job. Big ships, locos and dump trucks are large enough to allow the use of pretty hefty generators and drive motors. A diminutive greens mower has to consider both the size and weight of all its components.

In fact, Jacobsen produced the Greens King Electric for in the '90s and there are hundreds still at work. But this mower was not without drawbacks that included heavy motors and not enough power to drive groomers and roller brushes.

In 2004 the John Deere 2500E 'hybrid' greens mower helped keep interest in ride-on diesel electric power alive, the Jacobsen pedestrian Eclipse 100 electric greens having been on sale for several years. But it is in getting the right motors for both the cutting units and traction system that has to date been a stumbling block. There is then the need to develop a control system that links everything together. It is all rather more involved that it first appears.

The Eclipse 322 also eliminates the use of any hydraulics. The steering system is electrically powered, proximity sensors on the rear steering wheel providing near 'mechanical' feedback so the operator 'feels' the wheel loading up as full lock is approached. This may not seem like much of a design challenge, but Jacobsen has gone to great lengths to make the Eclipse 322 drive as much like a conventional machine as possible.

Similarly, the raise lower system for the units had to be purpose developed for the mower. In place of hydraulic rams are motorised screw jacks.

In simple terms, motors take over the job of lowering and raising the units in and out of work, again eliminating any hydraulic hose runs. Everything relies upon electric power.

At this stage it is worth looking at where all the power comes from. Starting with the engine, this is a 2-cylinder liquid cooled 13.3hp Kubota diesel. Next is a 48-volt continuous generator that produces up to 5.8 kW.

This provides electric current to a 2.2 kW AC traction drive motor. As to the units, these are powered by three 0.97 kW DC motors.

Those who are less familiar with

electric power units will note the traction motor is AC, alternating current, the units driving the cutting cylinders having DC, direct current, drive. The reasoning behind all this can get complex but in very broad outline Jacobsen has selected and developed the most appropriate drive units to do the job.

AC motors tend to be favoured for traction, DC providing the fixed operating speeds that are vital to ensuring matched reel speeds for a consistent quality of cut.

Quality of cut and reduced operating costs

It is actually the quality of cut issue that was a key driver behind the development of the Eclipse 322. An electric motor will develop its full operating torque as soon as it gets power.

This essentially allows an electrically powered reel to run up to its cutting speed pretty much as soon as it is switched on, with any load on the system being taken care of at the same time.

Wheel rotation and reel speed are both constantly monitored to ensure frequency of cut (or clip rate) are maintained precisely as programmed, regardless of operator skill and the influence oil temperature would have were it applicable.

Richard Comely, Ransomes Jacobsen Product Manager, suggests tests have shown the use of diesel electric power is extremely efficient too.

When compared to an all-hydraulic greens mower, average fuel consumption of the Eclipse 322 was up to 43% lower. That is a real eye opener.

To put this into context, a club running a ride-on greens mower that gets through 3,500 litres of fuel a year could reduce consumption by around 1,500 litres. With red diesel at 0.65p/litre, that is about £1,000.

The savings do not stop at fuel use either. The Eclipse 322 has no hydraulic oil or filters either. Although modern mowers can run much further between requiring a full hydraulic oil and filter change, it will still cost a couple of hundred quid to do the job when it is necessary.

It does look like a diesel electric Eclipse will have the operating cost advantage over is diesel hydraulic sibling.

What's it like for the operator?

Few in the UK have had the chance to actually drive the Eclipse 322 yet, but Jacobsen are keen to point out that driving this new greens mower should not be any 'different' in operation terms from an existing diesel hydraulic mower. In fact you could pretty much jump on the Eclipse and only realise it was diesel electric by the different noise it makes.

As previously mentioned, the steering system has been developed so it has a 'mechanical' feel to it, despite the fact that there is no mechanical link between the steering wheel and rear steered wheel. The joystick used to raise the units is said to operate just as it would if used to open a number of hydraulic valves too.

Without having sat on the mower and driven it, the way it reacts to the travel pedal is something that may initially feel a bit different. With hydrostatic drive, the travel pedal is just that, releasing pressure on the pedal slowing the mower. Lift off the pedal, and the mower will stop.

On the Eclipse 322, Jacobsen use the AC electric traction motor to

also control the speed of the mower. So the operator will use the travel pedal in just the same way as on a hydrostatic model. When it comes to actually stopping, the brake is automatically applied when the mower comes to a halt, automatically releasing as power is reapplied by pressing the travel pedal.

Other elements of the Eclipse are pretty much in line with existing Jacobsen ride-on greens models. The steering column tilts and the pivoting control arm, to which the main joystick and control switches are fitted, also adjust to suit.

A soft mat helps isolate the operator from any vibrations, its texture providing a degree of anti-slip; useful when climbing on and off the mower on dew laden mornings. There is also a ROPS frame and high intensity LED headlight and LED centre unit lighting.

Frequency of Clip and operation speeds

Those familiar with the Jacobsen Eclipse 100 pedestrian greens mower will be familiar with the Frequency of Clip, FOC, control. The FOC can be adjusted from 1.27 to 6.35mm for Eclipse 322 models fitted with the 11-blade cylinders and from 2.03 to 9.91mm for the 7-blade option. This allows the course manager to specify exactly how all 18 greens will be cut, irrespective of who is sitting in the operators seat. If the machine slows down, the cylinder speed is reduced to maintain the desired FOC, and similarly, as the machine travels quicker across the green, the cylinder speed increases pro-rata.

The desired FOC can be programmed in to any number of machines, ensuring that each and every green is cut to exactly the same specification.

The actual mowing speeds can also be set up to a maximum of 9 km/h. Again, this allows the Eclipse 322 to be set-up to suit particular demands more easily. Top transport speed, incidentally, is 14.5 km/h but even this can be adjusted down if necessary.

What's it like to look after?

Here we can only summarise what access is like to key elements of the mower. The rear hood flips up for access to the engine and related ancillaries, with what appears to be good access to every day service items.

The centre cutting unit swings out for easy access for routine cleaning and maintenance too. But what really shows is a lack of clutter. It is when you take a look at a hydraulic mower alongside that you realise just how many pipes there are with this type of machine.

Summary

Everything you would expect to find on a Jacobsen ride-on greens mower is available for the Eclipse 322, including the choice of cutting systems. Classic XP cylinders, verticut units, Quick Roll attachments, spikers, a Turf Groomer, choice of roller and a powered roller brush are all present and correct.

It is this 'normality' that is perhaps lost in the 'hype' surrounding the powertrain. The Eclipse is a greens mower with well proven cutting units.

The fact that it could well be cheaper to run and easier to set up to precisely match specific demands is the icing on a very tempting cake.