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Trackwise Designs

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Trackwise Designs has developed a proprietary, proven technology, IHT, for manufacturing extremely long, flexible circuits that can replace conventional wiring harnesses. This disruptive technology is applicable to many industries including electric vehicles (EVs), medical devices and aerospace. Trackwise has already manufactured prototypes for customers in each of these sectors and received its first series production order from an EV manufacturer this September. Since IHT is an adaptation of the proven technology Trackwise uses for making advanced printed circuits, IHT has the transformative potential of a new technology but with much less risk.

Year end	Revenue (£m)	EBITDA (£m)	PBT* (£m)	EPS* (p)	DPS (p)	P/E (x)
12/18	3.5	0.6	0.3	2.1	0.0	77.7
12/19	2.9	0.6	0.2	1.1	0.0	148.3
12/20e	7.1	0.7	(0.3)	0.4	0.0	453.3
12/21e	14.3	2.7	1.3	6.2	0.0	26.1

Note: *PBT and EPS are normalised, excluding amortisation of acquired intangibles, exceptional items and share-based payments.

Lightweight replacement for wiring harnesses

Improved Harness Technology (IHT) is a lightweight, space-saving, easy-to-install alternative to traditional wiring harnesses. For example, IHT is being evaluated by GKN Aerospace for use in ice protection systems because it saves on space and weight, as well as reducing part count and assembly time.

Order from EV customer worth up to £38m

Management expects that commencement of series production for its EV customer in H121 will be followed by ramp-ups for customers in other sectors. Trackwise is collaborating with five medical catheter customers on development work, some of which management expects will convert to production volumes by the end of FY21. Its ongoing collaboration agreement with GKN Aerospace could potentially lead to production volumes in FY23. Trackwise is currently in the process of transferring most of its advanced printed circuit production to Stevenage Circuits (SCL), acquired in March 2020, so that it can increase IHT production capacity at its Tewkesbury site to support the anticipated growth in demand.

Valuation: Addressing several high-potential sectors

Our peer multiples-based analysis suggests that the shares would be fairly priced at current levels if Trackwise was merely another specialist printed circuit board (PCB) manufacturer rather than the inventor of a disruptive technology such as Ceres Power or Ilika. However, as this approach fails to recognise the potential of the IHT business, we have augmented it with a scenario analysis. This explores how the three key segments in which Trackwise has developed prototype IHT products for customers (EVs, medical devices and aerospace) have the potential to generate revenues of at least £100m each at even relatively modest levels of market penetration.

24 September 2020

Price	**163.1p**
Market cap	**£36m**
Net cash (£m) on 30 June 2020 (excluding IFRS 16 lease liabilities)	1.6
Shares in issue	22.1m
Free float	61.0%
Code	TWD
Primary exchange	AIM
Secondary exchange	N/A

Share price performance

%	1m	3m	12m
Abs	88.8	93.1	120.9
Rel (local)	92.6	105.6	170.9
52-week high/low		174p	61p

Business description

Trackwise Designs is a UK manufacturer of specialist products using printed circuit technology. These include a lightweight replacement for conventional wiring harnesses known as IHT and RF antennae. 64% of FY19 revenues related to exports.

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Trackwise Designs is a research client of Edison Investment Research Limited

Investment summary

Company description: Revolutionary alternative to wiring harnesses

Trackwise was formed in 1989. Using the techniques it has developed for processing unusually long RF (radio frequency) circuits as a starting point, the company has created a patented, proven technology (IHT) for making flexible, multi-layer printed circuits of unlimited length. Management believes it is the only company globally that can do this. This technology presents a lightweight, compact and easier-to-install alternative to wiring harnesses suitable for use in many industries. Trackwise has already received its first series production order, which is from a UK manufacturer of electric vans and buses. It is also working on development projects as diverse as electro-surgical catheters, ice protection systems on aircraft and wind turbines, unmanned aerial vehicles, satellites, oil pipeline leak detection, nuclear fusion and particle accelerators.

Financials: Long-established RF business is profitable and cash-generative, supporting high-growth IHT activity

Group revenues grew by £0.8m year-on-year during H120 to £2.4m. IHT revenues halved to £0.3m as the pandemic delayed installation of key equipment. Advanced PCB revenues rose by £1.1m to £2.1m, £1.2m of which was attributable to SCL. Operating losses widened by £0.4m to £0.5m. SCL operated close to breakeven during the period and the Advanced PCB activity at Tewkesbury made an undisclosed profit. Reported profit before tax benefitted from £1.5m negative goodwill arising on the acquisition of SCL, resulting in a switch from a small £0.1m loss before tax in H119 to £0.8m profit before tax in H120. The Placing in March raising £5.9m (gross) at 80p/share supported a shift from £0.3m net debt at end FY19 (excluding £0.7m lease liabilities) to net cash totalling £1.6m at end H120 (excluding £2.6m IFRS 16 lease liabilities). Our IHT revenue estimates are underpinned by the first EV-related series production order, of which up to £5.0m is scheduled for FY21. It excludes production volumes in the medical devices sector, which could potentially generate meaningful revenues from 2021 onwards, and production orders in the aerospace industry, which may commence in 2023 if the ongoing programme with GKN Aerospace is successful. We note that the pipeline of future IHT revenue opportunities is growing as the number of IHT customers and qualified opportunities (ie where the two parties have signed an NDA and there is ongoing collaboration) is currently 82 compared with 57 in June 2019. 14 new NDAs have been signed since the start of the year.

Valuation: Scenario analysis captures IHT potential

Our scenario analysis explores how the three key segments in which Trackwise has developed prototype IHT products for customers (EVs, medical devices and aerospace), contingent on successful customer trials and the appropriate regulatory approval, have the potential in the longer term to generate revenues of at least £100m each at relatively modest levels of market penetration.

Sensitivities: RF business more exposed to global trends

The key sensitivities are Brexit, the US/China trade war and the recessionary impact of the coronavirus pandemic. The uniqueness of the IHT technology means that potential tariffs on exports to Europe in the event of a no-deal Brexit is not an issue, but the potential of tariffs does have an impact on demand for smaller RF circuits. On the one hand, the ban on Huawei, which is not a customer, has intensified competition among infrastructure manufactures in Europe, but on the other it presents opportunities in the US for manufacturers such as Ericsson. While a recession may delay 5G roll-out, targeted stimulus packages may actually accelerate adoption.

Company description: Disruptive, proven technology

Trackwise manufactures specialist products using printed circuit technology. It has developed a patented, proven technology for making flexible, multi-layer printed circuits of unlimited length. Management believes it is the only company globally that can do this. This technology enables designers to reduce the weight of wiring harnesses in aeroplane structures, for example, by up to 75%, thus improving fuel efficiency, reducing carbon emissions and saving cost. The ability to save weight is also key in the space industry and the automotive industry, especially EVs. Since the technology reduces bulk compared with conventional wiring harnesses and can withstand higher temperatures, it is also being used in applications as diverse as catheters, oil pipeline leak detection and nuclear fusion. Following the acquisition of Stevenage Circuits (SCL), IHT revenues currently account for less than one-fifth of Trackwise's revenues, but management's aim is for IHT to become the dominant activity.

The IHT technology is a refinement of that used for the longer length printed circuit boards Trackwise manufactures for the antenna market. These antennae are used primarily in 4G and 5G network infrastructure. The antennae are also used in security applications, defence and aircraft radar systems, avionics and ground penetrating radar.

Management listed on AIM in July 2018 to maximise the IHT opportunity. The associated fund-raising, which was oversubscribed, raised £7.0m (gross) at 105p/share, of which £5.5m (gross) was for Trackwise and £1.5m for the selling shareholders. The funds were used to purchase equipment to expand IHT manufacturing capability to support initial project volumes and strengthen the sales team promoting the technology. Having raised finance for expanding IHT at its Tewkesbury site, management still needed a route for substantially expanding capacity to support the higher IHT volumes that are likely to be required from 2021 onwards as more customers move to commercial IHT deployment. This required capacity expansion was achieved through the acquisition of Stevenage Circuits in March 2020 for £1.8m in cash. The acquisition was financed through a placing and subscription collectively raising £5.9m (gross) at 80p/share. The balance of funds raised is being used to improve Stevenage Circuits' capability and for working capital.

Exhibit 1: Company history

Date	Event
May 1989	Formation as specialist PCB design bureau.
1996	Production of first PCB antenna, which was a nine-foot long unit for an early GSM900 mobile phone base station antenna.
2000	Management buyout led by CEO Philip Johnston. Transition to a specialist PCB manufacturer for the antenna market. Sale of legacy business. Rebranding as Trackwise.
2005	Awarded Queen's Award for Export.
2010	Start of IHT development.
2014	Patent granted for IHT in UK.
2015	AS9100 certification for aerospace industry first received. Patent granted for IHT in US.
2017	Move to modern factory and office facility in Tewkesbury, Gloucestershire expands and augments IHT manufacturing capacity.
2018	Patent granted for IHT in China. Admission to AIM.
2019	Announcement of collaboration agreement with GKN Aerospace for the industrialisation of an ice protection system. Patent granted for IHT in Europe.
2020	Patent granted for IHT in Canada. First series production order from a UK-based designer and manufacturer of EVs. Acquisition of Stevenage Circuits.

Source: Trackwise Designs data, Edison Investment Research

Trackwise currently operates two sites. It is headquartered at its Tewkesbury site where the IHT products are manufactured. Around 80% of the advanced PCB manufacturing at the Tewkesbury site is being moved to the Stevenage site, a process that management expects to complete in December. Including the Stevenage staff, the group employs over 100 people.

The diverse customer base includes aerospace OEMs, electric vehicle OEMs and their suppliers, Alpha Wireless, Ion Science, Kappa Sense, Leonardo, Qualcomm and Thales Alenia Space. 31% of all H120 revenues were attributable to exports to mainland Europe, 6% to exports elsewhere.

Technology

PCBs are an overlooked but vital and near ubiquitous part of electronic devices. Before the widespread deployment of printed circuit boards in the 1950s, individual electronic components were connected to each other manually using wires. This was time-consuming, error-prone and expensive. In the simplest form, a single-sided PCB, a design of conductive tracks is created on a non-conductive board by using chemical etches to remove unwanted copper. Components are then attached on the surface of the board so that the conductive tracks connect them up. The substrate provides a mechanical support for both conductive tracks and components.

As tracks on a single-layer board cannot cross each other, more complex designs are typically double-sided, while for the most complex circuits a multi-layer PCB is required. This consists of multiple layers (up to 50) of insulating substrates with conductive tracks etched onto on both sides. The substrate layers are sandwiched together with the insulating substrate stopping each of the copper layers from touching and forming an electrical connection. The connective tracks loop around each other, passing from layer to layer through conductive regions, which are formed by drilling through the insulating substrate and depositing conductive material on the drilled area to make an electrical connection through the hole. Manufacturers of electronic equipment typically outsource PCB production to third parties.

Typically, the manufacturing process limits the size of PCBs to a length of 610mm. These restrictions mean that PCBs are only used to connect electrical components that are relatively close to each other. To connect components that are further apart, for example at either end of an aircraft wing or from the rear lights of an automotive to the dashboard, individual wires still need to be used. If there are multiple wires going from one part of an aircraft wing to another (for example), the wires are usually bundled together to form a wiring harness.

IHT replaces wiring harnesses

Trackwise has developed a proprietary process termed IHT, parts of which are patented, for manufacturing unlimited length, multi-layer, flexible printed circuits. This is beginning to be adopted as a lightweight, cost-effective alternative to traditional wiring harnesses in the automotive, aerospace, medical, space, scientific and industrial markets. In the same way that conventional PCBs transformed the electronic industry in the 1950s by displacing traditional wiring harnesses in electronic devices, IHT has the potential to displace wiring harnesses outside electronic devices. Since IHT is an adaptation of a proven technology, it has the transformative potential of a new technology but with much less risk.

Key benefits of IHT

The key benefits of the technology for users are:

- up to 75% weight saving;
- space saving;
- improved precision with regards to which components are connected to each other;
- improved reliability;
- deployable on a machine-intensive production line (unlike wire harnesses);
- reduced installation time;
- ability to be bonded either onto or into a supporting structure such as an aircraft wing;

- Ability to integrate electronic components such as sensors and microprocessors into the PCB, changing passive interconnect into a 'smart harness'. This potentially represents a mechanism for Trackwise to develop its own products longer term, complementing its 'build-to-print' service.

Exhibit 2: 26m long, multi-layer flexible printed circuit for a UAV*

Source: Trackwise Designs. Note: *Unmanned aerial vehicle.

Adapting proven manufacturing methodology to create novel solution

Trackwise's process is an evolution of existing techniques for manufacturing flexible printed circuits that adapts the processing steps (drilling, imaging, pressing and plating) so that previous length restrictions are removed.

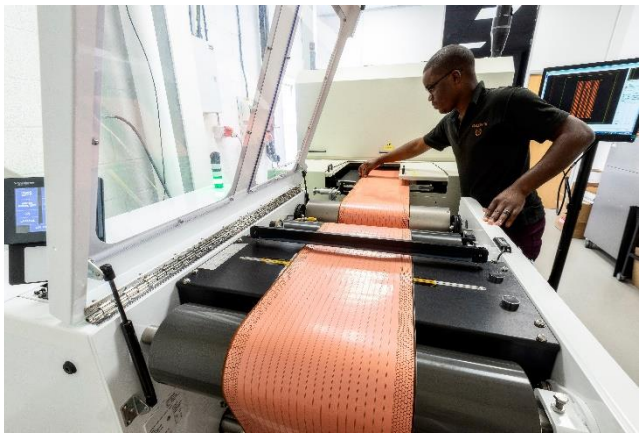
- **Drilling:** during high-volume manufacture of standard-length flexible circuits, a long (dozens of metres) thin strip of plastic substrate covered with copper foil passes through an automated drill. This drill is programmed to pierce a predetermined pattern of holes in a single circuit less than 610mm long, then repeat that step multiple times until the entire roll of material has been worked on. Trackwise has adapted the programme so that the drill pierces holes in the first 610mm of the circuit, then proceeds to pierce holes in the next 610mm and so on. The most complicated bit is making sure that the first 610mm section is aligned correctly to the second 610mm section and so on, and that any deviation in alignment is so small that all of the layers align correctly in the vertical plane along the whole length of the circuit when multiple layers are stacked on top of each other to form a multi-layer circuit.
- **Imaging:** the roll-to-roll direct imaging process has been adapted in a similar way, so that instead of selectively exposing areas where the copper is to be retained on a single small circuit and then repeating the step many times, the machine selectively exposes the first 610mm of the circuit, then the second 610mm and so on. As with the drilling process, this requires very precise control because the minimum width track created is only 0.025mm.
- **Pressing:** Trackwise has worked closely with a specialist press manufacturer to develop a continuous process that bonds the individual layers of a circuit together under raised temperature and pressure, maintaining very tight control of the process so that the horizontal layers are correctly aligned with respect to each other in the vertical plane along the entire length of a circuit dozens of metres long. At present, this press manufacturer carries out this

process for Trackwise, but management intends to bring the process in-house when volumes justify this. (This expenditure is not shown in our estimates and may be financed through leasing rather than shown as a cash outflow.)

- **Plating:** the new vertical continuous plating line, which has been operational since June 2019, is the first of its kind in Europe, enabling Trackwise to plate roll-to-roll flexible substrates and rigid substrates of any length.

Trackwise's process patent incorporates the use of a continuous press to define a method for creating length unlimited flexible, multi-layer printed circuits. While the other process adaptations have not been patented, they represent a significant body of IP which is unique to Trackwise and provides a substantial barrier to entry. Trackwise has a two-year exclusivity period with regards to the adaptations worked on with the equipment supplier for the direct imaging system.

Exhibit 3: Roll-to-roll laser drill



Source: Trackwise Designs

Exhibit 4: Roll-to-roll plating line

Source: Trackwise Designs

Competitive position

There are dozens of companies globally that can manufacture multi-layer flexible printed circuits. However, management believes that Trackwise is the only company to have extended this capability to manufacture multi-layer flexible circuits that are longer than 5m and that, while there are a few companies that can offer extremely long single- or double-sided circuits, no one else has worked out how to combine the layers to form a workable multi-layer device. While it is feasible that other companies with flexible circuit expertise would be able to modify their processes to manufacturer extremely long single- or double-layer circuits, Trackwise has the first-mover advantage. This is particularly beneficial in applications such as medical devices and aerospace where product has to go through lengthy customer and regulatory approvals. Additionally, Trackwise has patented the process required to press individual circuits together to form a multi-layer circuit.

Our independent research found that Andus Electronic in Germany claims to be able to manufacture flexible, multi-layer circuits up to 5m long, which it offers for use in tether of space exploration vehicles and in endoscopes, and US-based All Flex Flexible Circuits offers multi-layer flexible circuits in lengths up to 8 feet (2.4 metres) as a replacement for wiring harnesses. Our research did not find a company able to manufacture multi-layer flexible printed circuits of the same length as Trackwise. We believe that most companies manufacturing low volumes of flexible printed circuits will not have the ability to invest in the R&D or capital equipment required to develop a rival to IHT.

Proven product with established sales pipeline

Trackwise has been generating revenues from sales of prototype IHT circuits for the last two years. The customers are from a wide range of industries (see Exhibit 5). The most immediate opportunity is the automotive sector, where Trackwise secured its first production order in February 2020 followed by a series production order in September. Depending on how long it takes for its customers in the medical sector to gain regulatory approval for replacing wiring in catheters with IHT, Trackwise could potentially start shipping volumes of circuits for this application towards the end of 2021. Gaining FDA (US Food and Drug Administration) approval is not likely to be protracted because catheter variants with discrete wiring already have approval, so the customers only need to prove that the functionality is not changed by replacing wiring with IHT. The collaboration project with GKN Aerospace in the aerospace sector could potentially move to volume production by 2023. Although theoretically the current recession could reduce customers' innovation budgets, there appears to have been little impact so far. We expect this situation to continue since adoption of IHT cuts the cost of manufacturing medical devices and reduces the operating costs of aircraft because of the weight it saves.

This staggered programme of customer ramp-up fits well with Trackwise's schedule for increasing capacity. Travel restrictions related to the pandemic also delayed commissioning of the direct imaging line in Tewkesbury by around nine months to September and the final piece of equipment for volume IHT production will not be commissioned until towards the end of 2020. We explore the potential size of these three key segments (EV, medical and aerospace) in our Valuation section.

Exhibit 5: Customer programmes

Sector	Opportunities
Automotive	Funded development work for UK-based electric vehicle company during FY19. First production order (£0.6m) received in February 2020 for circuits used in both low- and high-voltage circuits in battery packs. Series production agreement worth up to £38m over three years from January 2021 announced in September 2020. Discussions with other high-voltage battery module manufacturers ongoing.
Aerospace	AS9100 certification first received in September 2015 with the transition to the new AS9100D standard achieved in October 2017. Signed collaboration with GKN Aerospace in August 2019 for the industrialisation of an ice protection system. This is the final step before potentially moving to volume production in 2023. Collaboration agreement signed after almost two years of joint development. Study underway into use of IHT in Airbus 'Wing of Tomorrow'. Multiple conversations with aircraft interior developers. Growing US market awareness. Second set of circuits supplied to Boeing subsidiary Aurora Flight Sciences for high-altitude pseudo-satellite (HAPS) customer following first flight in 2018. Includes a 26-metre-long, multi-layer circuit for the distribution of power and control signals across the wings. Discussions underway with four urban air mobility developers. IHT patents now secured for all main civil aerospace manufacturing locations except Brazil, which is pending.
Medical devices and machinery	Five cardiac catheter customers in developmental collaborations, which could potentially generate meaningful revenues from 2021 onwards depending on time required to obtain regulatory approvals (see page 15 for more details). Two of these customers are based in the US, one in Sweden.
Space	Collaboration with large EU spacecraft OEM for deployment in both spacecraft and in solar arrays. Qualification underway for first flight hardware.
Industrial	Pipeline leak detection project.
Scientific	CERN contract proceeding to plan. UK customer involved in nuclear fusion.

Source: Trackwise Designs

Advanced PCBs for RF applications

Prior to the development of IHT, Trackwise's Tewkesbury site focused on advanced PCBs for RF applications. Conventional printed circuit boards are not suitable for RF applications because the signal leaks from the circuit. Instead specialist substrate materials such as polytetrafluoroethylene (PTFE) are needed. There are many types of RF substrates. While they all use the same processing equipment, each requires slightly different etch times and other changes to the basic process. Unusually, Trackwise is able to manufacture RF circuits that are longer than 610mm. This means that rather than connect several PCBs together in a daisy chain, an antenna can be made from a single PCB, thus simplifying production and reducing manufacturing costs.

Established customer base

Trackwise primarily supplies antenna circuits for deployment in 4G and 5G network infrastructure. It also supplies antennae circuits for security applications, defence and aircraft radar systems, avionics and ground-penetrating radar. Trackwise's customers are tier two or tier three suppliers to global telecommunications companies. For example, Trackwise manufactures unpopulated antennae (ie without electronic components attached) for Alpha Wireless in Ireland, a provider of innovative carrier-grade antenna solutions. These antennae are combined with other equipment by mobile network operators. Trackwise manufactures the antennae according to designs created by Alpha Wireless. Other RF customers are Kathrein Mobile Communication, one of the world's largest antenna manufacturers, which was acquired by Ericsson in 2019, Amphenol Antenna Solutions, which is part of global interconnect group Amphenol, and the Telnet Group, a private Spanish telecoms equipment company.

In June 2020, market analysts Valuate Reports noted that the global 5G infrastructure market size was valued at US$371.4m in 2017 and projected that it would reach US$58.174bn by 2025, representing a CAGR of 95.8% between 2018 to 2025. 5G technology provides an enhanced mobile experience through reduced latency, lower cost-per-bit, and consistent and higher data rates. This enables applications such as real-time gaming, augmented reality (AR), virtual reality (VR) and autonomous vehicles, and the wider deployment of networks of smart devices, often referred to as the Internet of Things, for example networks of sensors in smart cities and smart buildings and automated industrial processes, often referred to as Industry 4.0.

Exhibit 6: Mobile phone mast with antennae

Source: Trackwise Designs

Exhibit 7: Antenna circuit

Source: Trackwise Designs

In July 2020, Gartner noted that although investment in 5G outside China was being held back by the coronavirus pandemic, global infrastructure market revenue would almost double in 2020 to reach US$8.1bn, with competition between communications service providers in all regions encouraging them to prioritise 5G projects. The report also noted that governments and regulators

are directing investment towards mobile network development in the hope that this will generate economic growth to counteract the recessionary impact of the pandemic and that communications service providers are likely to increase investment in 5G networks during 2021 in order to take advantage of changed behaviours as consumers have increased their reliance on communications networks during lockdowns.

Competitive position

There are dozens of relatively small companies in North America and Europe that manufacture PCBs requiring specialist substrates such as those required for RF applications. These include GSPK Circuits, PW Circuits and Teledyne Labtech in the UK and Advanced Circuitry International, Cirexx and Epec Engineered Technologies in the US. Management believes that Trackwise is the only company in Europe able to manufacture long RF printed circuits. While it is feasible that other companies in Europe with RF circuit expertise would be able to modify their processes to manufacturer larger circuits, the proportion of large RF circuits has substantially reduced since Trackwise developed the technique because the frequency at which signals are transmitted has increased. This means that it is unlikely that a new market entrant would recoup its costs.

Trackwise's RF business is focused on prototype and lower-volume PCBs, particularly those using specialist substrates. This niche is relatively unattractive to high-volume PCB manufacturers working with conventional (non-RF) substrates, most of which are based in China, because they rely on making boards in very high volumes to be economic.

Acquisition of Stevenage Circuits

In March 2020, Trackwise announced the acquisition of privately owned Stevenage Circuits (SCL). SCL operates a 5,000m^2 facility in Stevenage with the capacity to output up to £12m of advanced PCBs annually. It manufactures high density interconnect (HDI) PCBs, microwave and RF PCBs, flexible and flex-rigid PCBs and multi-layer PCBs with up to 44 layers. SCL offers quick-turn-around prototyping, pre-production and small production volumes in-house, with a route to higher-volume, offshore manufacturing in Asia through partners in Hong Kong. (Most European and North American PCB manufacturers outsource high-volume production to Asia.) SCL serves a diverse range of markets including defence, aerospace, space, telecommunications, medical, industrial controls and oil & gas. It is currently the only approved production PCB manufacturer in the UK for implantable medical devices. SCL employs around 60 staff including four dedicated salespeople.

Exhibit 8: Clean-room facility at Stevenage Circuits

Source: Trackwise Designs

The primary motive for the acquisition was that SCL had unused capacity, enabling management to transfer around 80% of its RF circuit production to Stevenage, thus freeing up capacity for IHT

production in Tewkesbury. Management expects this transfer to be complete by the end of December. The alternative would have been for management to acquire and develop a new site. This would potentially have taken 12–15 months and cost around £8m, so the acquisition represents a much quicker way and less expensive route for creating additional IHT capacity. As well as being advantageous strategically, the transaction is expected to be cash and earnings enhancing since SCL generated £6.5m revenues and £0.4m adjusted EBITDA for the year ended September 2019. The acquisition will also broaden the technical knowledge base, particularly in flexible circuits, strengthen the sales effort and create a larger customer base with opportunities for cross-selling.

The total consideration paid was £1.8m cash, which represents 0.3x historic sales and 4.5x adjusted EBITDA. The consideration payable was at a discount to net asset value to cover repairs and maintenance work on property and equipment that Trackwise is undertaking to improve production efficiencies. The acquisition was funded through a placing and subscription collectively raising £5.9m (gross) at 80p/share. The remainder of the funds raised is being used to invest in additional capacity and capability and the provision of growth working capital to include the continued development of the company's IP and know-how.

Management

Ian Griffiths – non-executive chairman: Ian joined Trackwise on its admission to AIM in July 2018. He has wide-ranging international experience of the engineering business-to-business sector at both strategic and operational levels, having spent nearly 30 years with GKN. He is currently a non-executive director of AIM-listed Autins Group, which he joined in 2016, and served as a non-executive director at Ultra Electronics Holdings from 2003 to 2012, at Renold from 2010 to 2019 and as non-executive chairman of Hydro International between 2014 and 2016.

Philip Johnston – chief executive officer Philip's early career was in the space industry, which included a key management role in the prime contractor team for Envisat, a large European satellite company, managing multi-million ECU work packages involving different companies across Europe. Philip joined Trackwise in 1999 and led a management buyout of the company in 2000. He is the named inventor on several UK and international patents, including the IHT patents, and has led several government-supported R&D consortiums including a European CleanSky programme. He holds degrees in both Aeronautical Engineering and Law.

Mark Hodgkins – chief financial officer: Mark is chartered accountant, a former audit partner with Grant Thornton and corporate finance partner with Ernst & Young. Since 2005 he has served as CEO of several engineering businesses and a private industrial holding company and CFO of a £120m private business. His involvement with Trackwise began in May 2016, following which he was appointed to a director’s role in December 2017. Mark is also a director of EnSilica, a private fabless chip design business, where he is responsible for overseeing the management's delivery of its growth strategy and driving improvements to corporate governance.

Sensitivities

The main sensitivities as we see them are:

- **Brexit:** the uniqueness of the IHT technology means that customers in mainland Europe will be prepared to pay potential tariffs on imports from the UK in the event of a no-deal Brexit. While the potential of tariffs has already adversely affected demand for RF circuits from customers in France, management believes that there are no other companies offering large RF or flex circuits in Europe, so potential customers in mainland Europe may still need to work with

Trackwise, especially if they are wanting to sell their products in the US and need to avoid using Chinese suppliers.

- **US/China trade war:** following the addition of Huawei's addition to the US Bureau of Industry and Security's Entity List in 2019, Huawei has been obliged to focus on markets outside the US where it has resorted to offering low prices to take market share. This has resulted in increased pricing pressure on antennae manufacturers, which in turn have asked Trackwise for lower prices on RF circuits. On the other hand, infrastructure manufactures such as Ericsson which are not subject to the ban have been able to gain market share in the US.
- **Global recession related to coronavirus pandemic:** some projects deploying IHT technology may be delayed if the economic damage caused by the coronavirus creates a more risk-averse attitude to innovation. So far, however, there has been little impact, with aerospace companies continuing to invest in projects that potentially reduce the environmental impact of flying and reduce costs for airlines despite Airbus, for example, announcing production cuts of 33–42% in June. Demand for electric delivery vans is likely to increase as a result of the pandemic as consumers continue to prefer online shopping. As noted above, the recessionary effect of the pandemic may delay roll-out of 5G infrastructure but may equally result in some governments directing investment towards mobile network development in the hope that this will generate economic growth.
- **IP:** Trackwise has protected its IHT IP through patents. It also has a substantial body of process experience that it is not possible to patent but represents a significant barrier to entry. Additionally, the lengthy approval processes in the aerospace and medical sectors would make it difficult for potential imitators to displace Trackwise from existing relationships.
- **Currency:** Trackwise's trading activities mean there is a built-in hedge to a proportion of its currency exposure, which is primarily to the euro and the US dollar. The exception to this was in FY19 when the company sought to protect its position in anticipation of a hard Brexit at the end of March. This did not occur, resulting in an exceptional loss of £57k.

Financials

H120 performance affected by coronavirus pandemic

H120 revenues boosted by SCL acquisition

Production continued at both Stevenage and Tewkesbury throughout the coronavirus lockdowns. Group revenues grew by £0.8m year-on-year during H120 to £2.4m, which included £1.2m attributable to SCL. IHT revenues halved to £0.3m as the pandemic delayed installation of equipment needed to complete product for a medical customer. This equipment is now operational and samples have been shipped. Similarly, delays in installing equipment at the EV customer's site caused slippages to its production schedule and adversely affected call-offs. Advanced PCB (non-IHT) revenues rose by £1.1m to £2.1m, £1.2m of which was attributable to SCL. Demand for circuits continued to be affected by the US/China trade dispute and concerns in the European customer base about Brexit. In addition, worries about the long-term economic impact of the pandemic caused a slow-down in new orders. Gross margin dipped by 20.1pp to 17.8%, reflecting low levels of equipment utilisation. Excluding share-based payments, administrative expenses increased by £0.3m to £0.8m as a result of the additional costs associated with SCL. Operating losses widened by £0.4m to £0.5m. SCL operated close to break-even during the period and was cash generative. The advanced PCB activity at Tewkesbury made an undisclosed profit. Reported profit before tax benefitted from £1.5m negative goodwill arising on the acquisition of SCL, partly offset by £0.2m acquisition expenses, resulting in a switch from a small £0.1m loss before tax in H119 to £0.8m profit before tax in H120.

March 2020 placing funds SCL acquisition, with surplus for capacity expansion at Stevenage and working capital

Net cash totalled £1.6m at end H120 (excluding £2.6m IFRS 16 lease liabilities), compared with net debt at end FY19 of £0.3m (excluding £0.7m lease liabilities). The placing in March at the time of the SCL acquisition raised £5.9m (gross) at 80p/share. Part of the funds was used to finance the acquisition (£1.6m net of cash), with the surplus allocated for capacity expansion at Stevenage and working capital as IHT series production ramps up. Other cash outflows included payments on IHT production equipment, primarily the laser drill, direct imaging tool and clean room infrastructure (£0.4m capex net of new leases) and investment in IHT development (£1.0m capitalised R&D). The balance sheet had £3.2m cash at the end of June 2020.

Outlook

Pipeline of opportunities remains steady

IHT revenue growth is underpinned by the first EV-related series production order, announced in September, which is worth up to £38m in total from January 2021 onwards, of which up to £5.0m is scheduled for FY21. In addition to this, the number of IHT customers and qualified opportunities (ie where the two parties have signed an NDA and there is ongoing collaboration) is currently 82 compared with 57 in June 2019, with 14 new NDAs signed since the start of the year. While some projects deploying IHT technology may be delayed if the economic damage caused by the coronavirus creates a more risk-averse attitude to innovation, the direction of travel will remain unchanged because the technology reduces weight, and thus improves fuel efficiency for aircraft and increases the range achievable by EVs. It also reduces the manufacturing cost of medical devices such as catheters. While any pandemic-induced recession may delay investment in 5G infrastructure, it could equally well accelerate investment should governments choose to invest in communications networks to stimulate recovery.

Estimates

Exhibit 9: Segmental analysis

(£m)	2017	2018	2019	2020e	2021e
IHT revenue	0.0	0.6	0.9	0.5	5.1
RF revenue*	2.8	2.9	2.0	2.1	2.3
SCL revenue**	0.0	0.0	0.0	4.5	6.9
Group revenue	2.8	3.5	2.9	7.1	14.3
Group gross profit	0.9	1.1	1.1	2.7	5.4
Tewkesbury indirect costs***	(0.7)	(0.4)	(0.5)	(0.9)	(1.1)
Stevenage indirect costs	0.0	0.0	0.0	(1.1)	(1.5)
EBITDA	0.2	0.6	0.6	0.7	2.7

Source: Trackwise Designs accounts, Edison Investment Research. Note: *RF revenues refer to RF business that was originally at the Tewkesbury site, most of which will be transferred to the Stevenage site during H220. **SCL revenue refers to the PCB business that was originally at the Stevenage site. ***Since c 80% of the RF business will be transferred from Tewkesbury to Stevenage during H220 we have split the cost on a site basis rather than a segmental basis.

Our estimates make the following assumptions:

- Strong growth in IHT revenues during FY21 includes the first EV-related series production order noted above. It excludes volume orders from any medical customers, which could potentially generate meaningful revenues from late 2021 onwards or aerospace customers, which may commence in 2023 if the ongoing programme with GKN Aerospace is successful.
- A modest recovery in RF revenues (which we classify as those relating to the advanced PCB activity that was originally at the Tewkesbury site, most of which will be transferred to the Stevenage site during H220) during FY20 and FY21, though not returning to FY18 levels. This

is supported by 5G infrastructure roll-out and completion of the Sprint/T-Mobile merger in April 2020.

- We model SCL's FY20 revenues at the level for the year ended September 2019 (ie prior to the acquisition), with a 6% increase on a pro-rata basis during FY21. This assumes that the planned withdrawal from low-margin work sub-contracted by SCL to manufacturers in Asia is offset by new business wins, eg new work already secured with existing customer Qualcomm. SCL may recommence this sub-contract activity in future if customers require it because its ability to source high volumes of circuits in Asia has not been affected by the turmoil in Hong Kong, but this is upside to our estimates. Given the operating leverage, combined with productivity gains resulting from the extensive improvements to the manufacturing capability post-acquisition, we expect that the revenue growth modelled will enable the activity to move into profit during FY21. (We classify SCL revenues as those relating to the PCB business that was originally at the Stevenage site.)
- We treat the £1.5m profit on consolidation of SCL as an exceptional item, which is netted off against £0.2m costs incurred in association with the acquisition.
- We model an R&D tax credit of £400k in FY20, to reflect the credit which SCL has already received this year. Noting the possibility that the UK government will reduce the level of R&D tax credits to help reduce its deficit, we cut the level of tax credit to £300k in FY21. We apply a normalising tax rate of 19% in both FY20 and FY21.
- We assume that capital expenditure costs will remain high in FY20 to reflect the completion of production capacity for the EV project and reduce a little in FY21.
- We assume that the level of capitalised IP will stay high in FY20 and reduce in FY21 as the development work with the EV customer is replaced by work on production circuits which is expensed.

Valuation

Peer multiples

Exhibit 10: Peer multiple analysis

Name	Market Cap ($m)	EV/Sales 1FY (x)	EV/Sales 2FY (x)	EV/EBITDA 1FY (x)	EV/EBITDA 2FY (x)	P/E 1FY (x)	P/E 2FY (x)	CAGR*	EBITDA margin 1FY (%)	EBITDA margin 2FY (%)
AT & S	749.6	0.8	0.7	4.1	3.2	17.5	9.7	13.7%	20.5	22.8
CMK	310.7	0.6	0.5	10.0	6.2	N/A	22.1	-2.6%	6.0	8.7
Compeq Manufacturing	1,942.9	1.0	0.9	5.0	4.3	11.0	9.3	9.5%	19.5	20.6
Ibiden	4,915.9	1.7	1.5	7.5	5.5	29.1	20.8	8.6%	22.7	26.8
KCE Electronics	1,185.6	3.5	3.0	18.3	14.7	38.9	25.1	2.3%	19.0	20.4
Meiko Electronics	482.7	1.0	0.9	9.3	8.1	22.8	14.4	3.1%	10.4	10.9
Tripod Technology	2,058.2	0.8	0.8	4.6	4.0	10.8	9.6	2.6%	17.9	19.5
TTM Technologies	1,222.5	0.9	0.9	6.9	6.8	12.3	9.0	-10.3%	13.7	13.7
Unimicron Technology	4,096.0	1.5	1.4	8.7	6.7	23.6	16.6	9.3%	17.6	20.9
Zhen Ding Technology	4,155.5	0.9	0.8	4.8	4.0	12.6	11.0	9.6%	19.2	20.2
Mean		**1.3**	**1.1**	**7.9**	**6.3**	**19.8**	**14.8**		**15.4**	**16.9**
Trackwise Designs	**45.6**	**5.2**	**2.6**	**52.8**	**13.5**	**453.3**	**26.1**	**121.5%**	**9.9**	**19.3**

Source: Refinitiv, Edison Investment Research. Note: Prices at 21 September 2020. *CAGR is compound average growth in revenue between year 0 and year 2.

Trackwise's share price has risen by over 40% since the announcement of the series production order for the EV manufacturer. At current levels our peer multiples-based analysis shows Trackwise's shares trading slightly above the upper end of the range of year 2 P/E multiples for our sample of advanced printed circuit board manufacturers (mean is 14.8x, with CMK at 22.1x and KCE Electronics at 25.1x). However, Trackwise is expected to grow revenues much more strongly than any of the sample over the next two years and its year 2 EBITDA margin is above the sample

mean. This peers multiple-based approach suggests the shares would be fairly priced if Trackwise was merely another specialist printed circuit board manufacturer but is, in our view, not valid because it fails to recognise the potential of the IHT business, which has the potential to deliver growth that is faster than the average for our sample – not just for the period covered by our estimates, but for several years beyond that.

Scenario analysis

Paradoxically, if Trackwise did not have the RF business, it would be valued purely on the prospects of the high-growth IHT activity, which would, we believe, justify a valuation substantially higher than the current market capitalisation (see below). This would put it in the same category as Ceres Power and Ilika. Ceres Power has developed a solid oxide fuel cell technology. While it is developing routes to market with partners such as Bosch, Doosan, Miura and Weichai, it has only recently started to ship product for commercial deployments. This places it at a similar stage of evolution to Trackwise's IHT activity. Ceres Power's revenues for the six months ended December 2019 were £11.0m, generating an adjusted EBITDA loss of £1.4m. Its market capitalisation is currently £857m. Ilika has developed a solid-state battery technology. Its market capitalisation is currently £86m. While Ilika has been developing routes to market with numerous customers including Jaguar Land Rover and Network Rail, it is still only shipping low volumes for evaluation purposes and has not received an order for commercial volumes yet, placing it behind the IHT activity with respect to roll-out. Ilika's revenues for the year ended April 2020 were only £2.8m, generating an adjusted EBITDA loss of £2.1m. In effect, having the RF business, which is profitable and generates cash for reinvestment in the IHT activity, diminishes Trackwise's valuation rather than augments it.

If we were to treat Trackwise in a similar way to either Ceres Power or Ilika, we would devote our valuation section to a scenario analysis which looked at the potential revenues achievable if the company was successful in penetrating specific target markets. This approach, which we include below, shows that the three key segments in which Trackwise has developed prototype IHT products for customers (EV, medical devices and aerospace) have the potential to generate revenues of at least £100m each at relatively modest levels of market penetration.

Automotive

We noted earlier that Trackwise has recently received a game changing order (up to £38m over three years) for serial production volumes of IHT for deployment in battery packs for EVs to support its customer's roll-out plans for electric vans and buses. As discussed in our December 2019 note Battery charge: The rise of lithium-ion - options and implications, there is much debate as to how quickly EVs will displace conventional ones, with reducing the cost of battery packs and increasing driving range, both of which are supported by a switch to IHT, being key drivers of adoption. While our report predates the coronavirus pandemic, governments appear keen to continue investment in EV transport, for example the UK government is considering bringing forward the ban on fossil-fuel vehicles from 2040 to 2030, so we feel comfortable adopting the growth trajectory preferred in our report. This predicts 21m EVs globally (including hybrids) by 2025, of which 13m are solely battery powered. Additionally, we take the current cost of a battery pack for a Renault ZOE subcompact car (€8,100) as typical and apply an annual price decline of 10%, which is needed if EVs are to become price competitive with conventional ones. If, for the purpose of creating a scenario, we then assume that IHT represents 5% of the cost of a battery pack (since materials such as cobalt represent a high proportion of the cost) and that 10% of all battery packs in pure-play EVs adopt IHT, this top-down approach gives $370m annual IHT revenues by 2025. There is also potential for IHT adoption in conventionally powered vehicles, as a contemporary luxury car may contain wire harnesses over a mile in length and containing up to 1,500 copper wires.

Medical applications

As noted earlier, Trackwise is currently engaged in developmental collaborations with five medical catheter customers, which could potentially generate meaningful revenues from 2021 onwards, depending on the time required to obtain regulatory approvals. The IHT circuits are being used in instruments for minimally invasive surgery, for example in cardiac catheters, which are long, fine catheters that can be passed into the chambers of the heart via a vein or artery to diagnose and treat cardiovascular conditions. Traditional electro-surgical catheter designs used microwire systems with conductor dimensions as small as 0.0254mm and insulation thicknesses down to 0.00127mm. There is increasing pressure to shrink these dimensions further, such that it is difficult to manufacturer the devices using standard techniques. Trackwise is currently working with five customers in this sector, and has developed a solution for one of them which replaces the 64 microwires connecting to the device at the tip of the catheter with eight IHT circuits, each of which is 2.2m long. A key advantage of the IHT alternative is that it easier to make all the connections correctly every time.

Looking at the size of the potential market, a report published in July 2020 by 360 Market Updates stated that the global cardiac catheters market alone was worth US$7,447.1m in 2020 and predicted that it would reach US$8,391m by the end of 2026, growing at a CAGR of 1.7% in 2021–26. If, for the purposes of creating a scenario, we assume that IHT represents 10% of the cost of a catheter and that 15% of all cardiac catheters adopt IHT, this could represent $126m annual revenues for Trackwise by 2026. Alternatively, if we assume that an electro-surgical catheter costs around $900, that IHT represents 8% of the cost of a catheter and that any one of the major medical device companies that Trackwise is talking to sells a minimum of 600k catheters each year, replacing cabling with IHT in 20% of the catheters sold by a single potential customer would represent US$8.6m annual revenues.

Aerospace

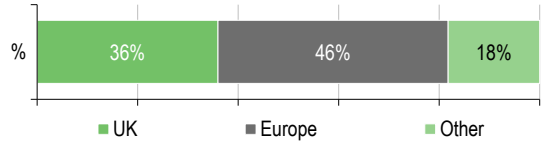
Although saving weight is important for EVs because this affects both driving range and the payload that a truck, van or bus can carry, the value per kilogram of weight saved is substantially less than it is in the aerospace industry. While the current activity in the EV and medical markets is welcome and gives Trackwise the opportunity to optimise its processes for volume production, management believes that the primary market for IHT longer term will be aerospace. It has received AS9100D certification for deployment of the technology in this sector and is currently working with GKN Aerospace in the industrialisation of an ice protection system, which could potentially move to volume production in 2023.

According to a report from MarketsandMarkets published in July 2020, the global aircraft electrical systems market is projected to grow from US$9,344m in 2020 to US$37,265m by 2030, a CAGR of 6.8%. The major factors driving the market are lightweight wiring and advancements in high-density battery solutions for electric aircraft. If, for the purpose of building a scenario, we assume that IHT is used to replace 10% of the electrical system in an aircraft and that 10% of all aircraft adopt IHT by 2030, this represents annual revenues of US$373m.

Exhibit 21: Financial summary

£'m	2018	2019	2020e	2021e
31-December	IFRS	IFRS	IFRS	IFRS
INCOME STATEMENT				
Revenue	3.5	2.9	7.1	14.3
Cost of Sales	(2.4)	(1.8)	(4.4)	(8.9)
Gross Profit	1.1	1.1	2.7	5.4
EBITDA	0.6	0.6	0.7	2.7
Normalised operating profit	0.3	0.3	(0.2)	1.5
Amortisation of acquired intangibles	0.0	0.0	0.0	0.0
Exceptionals	(0.0)	(0.1)	1.3	0.0
Share-based payments	(0.2)	(0.2)	(0.4)	(0.3)
Reported operating profit	0.1	(0.1)	0.7	1.2
Net Interest	(0.1)	(0.1)	(0.1)	(0.2)
Joint ventures & associates (post tax)	0.0	0.0	0.0	0.0
Exceptionals	0.0	0.0	0.0	0.0
Profit Before Tax (norm)	0.3	0.2	(0.3)	1.3
Profit Before Tax (reported)	0.1	(0.1)	0.6	1.0
Reported tax	0.0	0.1	0.4	0.3
Profit After Tax (norm)	0.3	0.2	0.1	1.4
Profit After Tax (reported)	0.1	(0.0)	1.0	1.3
Minority interests	0.0	0.0	0.0	0.0
Discontinued operations	0.0	0.0	0.0	0.0
Net income (normalised)	0.3	0.2	0.1	1.4
Net income (reported)	0.1	(0.0)	1.0	1.3
Basic average number of shares outstanding (m)	11.8	14.7	20.3	22.1
EPS - basic normalised (p)	2.14	1.13	0.36	6.25
EPS - diluted normalised (p)	2.05	1.06	0.34	6.00
EPS - basic reported (p)	0.63	(0.33)	4.82	6.04
Dividend (p)	0.00	0.00	0.00	0.00
Revenue growth (%)	22.9	(16.2)	145.0	100.2
Gross Margin (%)	30.3	37.9	38.4	37.7
EBITDA Margin (%)	17.8	19.7	9.9	19.3
Normalised Operating Margin	9.4	8.9	-3.3	10.8
BALANCE SHEET				
Fixed Assets	3.9	6.8	11.4	11.6
Intangible Assets	2.6	4.3	6.0	6.6
Tangible Assets	1.3	2.5	5.4	5.0
Investments & other	0.0	0.0	0.0	0.0
Current Assets	4.2	3.1	6.1	7.5
Stocks	0.4	0.6	2.4	3.5
Debtors	0.8	1.7	2.3	3.5
Cash & cash equivalents	2.8	0.6	1.1	0.1
Other	0.2	0.3	0.3	0.3
Current Liabilities	(1.0)	(1.4)	(2.2)	(2.3)
Creditors	(0.8)	(1.0)	(1.9)	(2.0)
Tax and social security	0.0	0.0	0.0	0.0
Short term borrowings	(0.2)	(0.3)	(0.3)	(0.3)
Other	0.0	0.0	0.0	0.0
Long Term Liabilities	(1.2)	(2.5)	(2.5)	(2.5)
Long term borrowings	(0.4)	(1.3)	(1.3)	(1.3)
Other long term liabilities	(0.8)	(1.3)	(1.3)	(1.3)
Net Assets	5.9	6.0	12.8	14.3
Minority interests	0.0	0.0	0.0	0.0
Shareholders' equity	5.9	6.0	12.8	14.3
CASH FLOW				
Op Cash Flow before WC and tax	0.6	0.6	0.7	2.7
Working capital	(0.7)	0.1	(1.6)	(2.3)
Exceptional & other	(0.0)	0.0	(0.2)	0.0
Tax	0.0	0.0	0.4	0.3
Net operating cash flow	(0.1)	0.7	(0.7)	0.8
Capex	(1.3)	(2.7)	(2.7)	(1.4)
Acquisitions/disposals	0.0	0.0	(1.3)	(0.2)
Net interest	(0.1)	(0.1)	(0.1)	(0.2)
Equity financing	4.4	0.0	5.4	0.0
Dividends	0.0	0.0	0.0	0.0
Other	0.1	0.2	0.0	0.0
Net Cash Flow	3.2	(1.9)	0.6	(1.0)
Opening net debt/(cash)	0.9	(2.3)	1.0	0.5
FX	0.0	0.0	0.0	0.0
Other non-cash movements	0.0	(1.4)	0.0	0.0
Closing net debt/(cash)	(2.3)	1.0*	0.5*	1.5*

Source: Company accounts, Edison Investment Research. Note: *Including lease liabilities.

Contact details	Revenue by geography
1 Ashvale, Alexandra Way, Tewkesbury, Gloucestershire GL20 8NB UK +44 (0) 1684 299930 www.trackwise.co.uk	

Management team

Non-executive chairman: Ian Griffiths

Ian joined Trackwise on its admission to AIM in July 2018. He has wide-ranging international experience of the engineering business-to-business sector at both strategic and operational levels, having spent nearly 30 years with GKN. He is currently a non-executive director of AIM-listed Autins Group, which he joined in 2016, and served as a non-executive director at Ultra Electronics Holdings from 2003 to 2012, at Renold from 2010 to 2019 and as non-executive chairman of Hydro International between 2014 and 2016.

Chief executive officer: Philip Johnston

Philip's early career was in the space industry, which included a key management role in the Prime Contractor team for Envisat, a large European satellite, managing multi-million ECU work packages involving different companies across Europe. Philip joined Trackwise in 1999 and led a management buyout of the company in 2000. He is the named inventor on several UK and international patents and has led several government-supported R&D consortiums including a European CleanSky programme. He holds degrees in both Aeronautical Engineering and Law.

Chief financial officer: Mark Hodgkins

Mark is chartered accountant, a former audit partner with Grant Thornton and corporate finance partner with Ernst & Young. Since 2005 he has served as CEO of several engineering businesses and a private industrial holding company. His involvement with Trackwise began in May 2016, following which he was appointed to a director's role in December 2017. Mark is also a director of EnSilica, a private fabless chip design business, where he is responsible for overseeing the management's delivery of its growth strategy and driving improvements to corporate governance.

Principal shareholders	(%)
Philip Johnston (CEO)	30.3
Octopus Investments	22.0
Premier Miton Investors	9.2
Unicorn Asset Management	7.5
Herald Investment Management	4.5
Adare Sladen	3.9
Richard Sneller	3.4

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