Mynaric

Technology

5 November 2019

Getting ready for launch into space

Mynaric is moving forward on serial production of its communications terminals, which can transmit data via laser between moving airborne or space platforms at rates similar to conventional optical fibre, but with the light transmitted through free space rather than along a cable. It aims to have a complete portfolio of commercial terminals available by the end of 2020. This should make it the first company to offer laser communications terminals in the volumes and at the price point required by communications systems such as those being developed by Loon, Telesat and SpaceX.

Serial production ahead of first on-satellite launch

In October 2019, Mynaric announced it will deliver multiple laser communication flight terminals to an undisclosed customer in an initial contract for a product validation mission valued at €1.7m. These will be part of a demonstration programme prior to rolling out the full satellite constellation. The contract confirms market demand for Mynaric's cost-effective, serially produced, laser communication inter-satellite product designed for mega-constellations. Mynaric is focused on delivering the first satellite units in readiness for launch into space in H220. It has recently increased the number of terminals in production to be able to support missions from additional customers at short notice.

Raised finance to complete pre-commercial phase

Total operating performance (which includes capitalised development) during H119 was €2.9m. This was similar to H118 (€2.8m) with intensified development work on space- and air-borne terminals substituting for milestone payments on project work in H118. Losses after tax widened by 3% to €3.8m. Net cash (there is no debt) increased by €3.3m during H119 to €18.5m at the period-end. Free cash outflow totalling €7.8m was offset by €11m from the issue of shares at €55/share to a lead investor in a low Earth orbit (LEO) satellite constellation in March.

Valuation: Analysis of potential revenues

As Mynaric is not expected to start delivering commercial units until H220 and generate an operating profit until FY21, we present a scenario analysis rather than a peer group comparison of multiples. This analysis shows that a cluster of 250 airborne communications platforms could require €113m of Mynaric's terminals and a constellation of 100 small satellites could require €150m of its equipment.

Consensus estimates

Year end	Revenue (€m)	EBITDA (€m)	EBIT (€m)	PAT (€m)	DPS (€)	P/E (x)
12/17	1.7	(6.8)	(7.0)	(6.9)	0.0	N/A
12/18	1.6	(6.2)	(6.7)	(6.7)	0.0	N/A
12/19e	4.0	(5.1)	(6.8)	(7.0)	0.0	N/A
12/20e	19.3	3.0	1.9	(2.1)	0.0	N/A

Source: Refinitiv, company data

Price	€43.4
Market cap	€126m

Share price graph

Share details

Code	MOY
Listing	Deutsche Börse Scale
Shares in issue	2.9m
Last reported net cash at end June 2019	€18.5m

Business description

Mynaric is commercialising free space laser communication equipment that uses light to transmit data in high-capacity communication networks in the air and in space.

Bull

- Wireless laser technology gives faster data rates than conventional microwave transmission.
- Wireless laser technology potentially brings internet connectivity to remote regions without installing fibre optic cables.
- Mynaric technology is cost effective for mega-constellations.

Bear

- Technology not proven in complete satellite or airborne communications networks yet.
- Rate of commercial roll-out dependent on network operators securing funding.
- Limited number of potential network operators to which it can sell equipment.

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H119 technical and commercial progress

Although Mynaric has transitioned from a technology company delivering one-off prototypes to delivering reliable product suitable for multiple customers, it is still at the pre-revenue stage, so technical and commercial progress is more important than financial metrics.

First contract for terminals on satellite pathfinder mission

In October 2018, Mynaric announced that it had signed a memorandum of understanding (MoU) with an undisclosed company building an LEO satellite constellation under which it would provide space-borne terminals for several satellites forming a demonstration mission. The full LEO constellation is expected to consist of several hundred satellites potentially requiring more than 1,000 Mynaric terminals. In October 2019, Mynaric announced it will deliver multiple laser communication flight terminals under an initial contract valued at €1.7m for a product validation mission. This will be the first launch of its complete satellite terminal into space and is scheduled for H220. Although the name of the customer has not been disclosed and it is not clear whether it is the same company that signed the MoU last year, the contract confirms market demand for Mynaric's cost-effective product for laser communication between satellites in mega-constellations.

Developing products for pathfinder missions and beyond

Mynaric's H119 report gave the first public description of its product portfolio for the commercial laser communication market. The ground stations for both satellite and stratospheric applications are already available. The airborne terminals will be available around the end of 2019, the satellite-borne terminals during 2020. This means that a customer placing an order now could have the product within six to nine months. This lead time is a first in the industry, which historically has taken two years to produce one-off units and positions Mynaric as a key supplier to the mega-constellations of satellites and aerial platforms under development.

Exhibit 1: Product portfolio

Product	Function	Status
HAWK AIR	Terminal for air operations	Unveiled at Paris Air Show in July 2019. Serial production commenced. Available Q419/Q120.
HAWK SPACE	Terminal for inter-satellite and satellite-to-ground operations	Details to be disclosed. Will be based on HAWK AIR platform, but tailored to needs of specific mega-constellations. Potentially available by end 2020.
CONDOR	Inter-satellite operations	Preliminary stages of serial production commenced. Available for launch on-satellite H220.
RHINO	Ground terminal for satellite operations	Serial production commenced H218. Available now.
ARMADILLO	Ground terminal for air operations	Serial production commenced H218. Available now.

Source: Company data

Expanding serial production to meet anticipated demand

In May 2019, Mynaric moved to larger, customised premises just outside Munich. These house a clean room, laboratories, R&D facilities and test equipment to support serial production. Serial production is critical because it will enable Mynaric to meet the cost and volume requirements for mega-constellations. It sets Mynaric apart from the competition because, as far as management is aware, it has more space-grade laser communication units in its production schedule than have ever been launched by all of its commercial competitors combined. In October 2019 management noted that it had increased the number of units in production to be able to support additional orders for pathfinder missions from other customers at short notice.

Strengthening the management team

The management team has been augmented to reflect the requirements of a customer-facing product manufacturer. In March 2019, former SpaceX and Airbus VP Bulent Altan joined Mynaric's management board to lead the space business. He was joined by former Bosch Sensortec VP

Hubertus von Janecek, who is leading sales and production of airborne products. Dr Wolfram Peschko has remained on the management board to lead finance, administration and strategy.

Getting closer to key US customers

With a complete portfolio of products available from 2020 onwards, it is important for Mynaric to secure customers prepared to undertake pathfinder missions deploying the terminals. In September 2019, Mynaric moved its US headquarters to Los Angeles so it is physically closer to existing and potential US customers, especially those in the satellite constellation domain. Once the airborne and space-borne terminals have completed an in-house laboratory qualification, which management expects will happen in the next few months, Mynaric intends to build up engineering and production capabilities in the US. This will enable it to develop laser communication solutions which incorporate electronics and software sourced solely from within the US, which will be attractive for domestic customers, especially those working on government projects. The relocation will also enable Mynaric to tap into the talented labour pool in California.

H119 financials

Switch from project work to preparing for commercial deliveries

The German accounting metric 'total operating performance' is more significant than revenue for Mynaric at its stage of evolution, as it includes the value of the increase in finished goods and work in progress, and the amount of development activity on projects that are not linked to specific customer contracts. The total during H119 was €2.9m. Although this was similar to H118 (€2.8m), the breakdown is different and demonstrates the switch from project-based work to preparation for commercial sales. H118 had much higher revenues than H119 because it benefited from milestone payments on delivery of the first optical ground station. H119 has higher levels of capitalised work than H118, reflecting intensified development work on space- and air-borne terminals.

Exhibit 2: Analysis of total operating performance

	H119	H118	Notes
Sales revenues (€m)	0.2	1.2	H118 includes final milestone payments for the first optical ground station that was delivered in the summer. Revenues include investment grants from subsidised projects: €140k in H119 and €186k in H118.
(Decrease)/increase in finished goods and work-in-progress (€m)	0.3	(0.3)	Cost of materials, personnel and overheads of products in production. H119 increase shows impact of serial production.
Other own work capitalised (€m)	2.1	1.8	Cost of development activity on projects that are not linked to customer contracts. H119 increase reflects intensified activity on space-borne and airborne terminals.
Other operating income (€m)	0.3	0.1	
Total operating performance (€m)	2.9	2.8	

Source: Company data

Personnel costs rose by 14% year-on-year as the total number of employees increased from an average of 52 during H118 to an average of 78 during H119 (excluding executive board members and managing directors). This reflects the transition to serial production, with additional employees in test, production, logistics, procurement and quality control. Other operating expenses were at a similar level to the prior year period. Losses after tax widened by 3% to €3.8m.

Lead investor in satellite constellations providing finance

Net cash (there is no debt) increased by €3.3m during H119 to €18.5m at the period-end. In addition to €5.1m cash consumed in operations, the company invested €2.1m in intangible assets, primarily the capitalised costs of developing the CONDOR and HAWK AIR terminals, and €0.6m in fixed assets, most of which related to fitting out the new facility, which is rented. In March 2019, Mynaric raised c €11m funding through the issue of shares at €55/share to the lead investor of a satellite constellation with which it is working. This is the same satellite constellation as the one referred to in the October 2018 announcement (see above). Assuming that cash burn stays at H119 levels and the first commercial deliveries are made by the end of Q320, this level of cash should be

sufficient to take Mynaric through to full commercialisation. Management is assessing the potential level of volume ramp-up in 2020. Depending on the rate of growth, Mynaric may seek additional financing to support its expansion and production plans. This could include strategic partnerships with or without related equity deals, structured debt products and equity financing with interested mid- and long-term investors seeking exposure to the satellite constellation sector.

Outlook: Faster 'internet in the sky'

Other than the MoU with the undisclosed satellite constellation builder and recent contract award, also with an undisclosed party, there is frustratingly little public information advising whether an individual communications network intends to deploy Mynaric's laser communication terminals. We believe it is likely that the list below includes the existing customer or customers. Moreover, since Mynaric's technology can potentially support data rates c 1,000 times faster than conventional microwave links between satellites, substantially improving the economics of a satellite, drone or balloon-based communications network, we believe it is likely that it is in discussions with other parties in this list regarding potential deployment.

- **Amazon:** a latecomer to the party, in July 2019 Amazon formally sought approval from the US Federal Communications Commission (FCC) to launch a network of 3,236 satellites through a subsidiary called Kuiper Systems. The satellites will be launched in five waves, the first one consisting of 578 satellites. Amazon did not disclose in the filing when those satellites would launch or what launch vehicle it would use. However, we note that Jeff Bezos, the founder of Amazon, also owns launch company Blue Origin, whose New Glenn orbital rocket is scheduled to make its first launch in 2021.
- **Facebook:** after abandoning its in-house development of an unmanned aircraft for carrying broadband communications links, Facebook embarked on a partnership with Airbus based on the Zephyr High Altitude Pseudo-Satellite (HAPS). Although the Zephyr had set a world record for uninterrupted solar-powered flight, a trial in Australia in April 2019 experienced a setback when the drone crashed on take-off. We note that Facebook has been confirmed as Mynaric's partner for the successful air-to-ground test carried out in 2017 but have no information either way as to whether this relationship has continued. Facebook's subsidiary, PointView Tech, is building a test satellite, Athena, which was launched in September 2019. This has millimetre radio wave connections between the ground and space.
- **LeoSat:** LeoSat Enterprises intends to launch a constellation of up to 108 LEO communications satellites connected with optical inter-satellite links. The system is being developed in conjunction with Thales Alenia Space. In November 2018, the FCC gave LeoSat approval to provide non-geostationary satellite orbit services in the US.
- **Loon:** in April 2019, SoftBank's HAPSMobile invested US$125m in Loon. The two companies announced a long-term strategic relationship to advance the use of high-altitude vehicles, such as balloons and unmanned aircraft to bring internet access to more remote areas. In July, Loon announced that its was supplying an internet service from balloons to customers in Peru following the magnitude 8.0 earthquake that hit the Amazon region, disrupting existing communications networks. Prior to this, Loon was already negotiating a commercial contract with Telefónica to extend mobile internet access to unserved and underserved areas of Peru, specifically remote parts of the Amazon region. In September 2019, HAPSMobile announced the successful completion of the first HAWK30 solar-powered HAPS test flight in California. The HAWK30 will have an operational altitude of over 20km, which is similar to Loon's balloons.
- **OneWeb:** following the successful launch of its first six demonstration satellites in February 2019, OneWeb secured US$1.25bn funding in March led by SoftBank. Tests in July with Intellian, the developer of OneWeb's user terminals, demonstrated that the satellites could deliver real-time video streaming in full HD from space. OneWeb aims to start with 650 satellites and expand to 1,980 satellites. This will give a partial service in 2020 and a fully functioning global constellation in 2021.

- **SpaceX:** in March 2018, the FCC approved SpaceX's applications for its planned 4,500 satellite constellation, Starlink. This was followed in November 2018 with the approval to launch an additional 7,518 satellites. The most recent request is for permission to operate an additional up to 30,000 satellites. In December, SpaceX raised $500m for its Starlink satellite internet service. In May 2019, it launched the first 60 demonstration satellites on a single Falcon Heavy rocket. In October, founder Elon Musk announced that he had sent his first tweet via the Starlink system, although SpaceX will need to have 400 satellites in orbit before Starlink can provide consistent internet coverage for small parts of the world and 800 before it can provide coverage for a significant portion of the world's population. Starlink intends to begin offering its own satellite internet service in 2020. In May 2019, Musk said that optical cross-links would not be deployed on the initial generation of satellites, contrary to the original plans, but would be incorporated in future iterations.
- **Telesat:** Telesat is planning a constellation of 292 LEO satellites, potentially growing to 512 satellites, with optical cross-links between the satellites. The satellites are scheduled to be launched in 2021 ahead of commencing delivery of internet provision in 2022. In January 2019, Telesat announced it had entered into an agreement with Loon under which Loon will deliver a network operating system design that Telesat can use to support its global LEO satellite constellation. The design will adapt and expand on the platform that Loon has already used to deliver mobile data services over its fleet of stratospheric balloons. Also in January 2019, Telesat signed a multi-launch agreement with Blue Origin.

Valuation

Although the share price has picked up from a low of €35.10 towards the end of October, it is trading around 20% below the €54.0/share price at the IPO in October 2017. It is likely that share price performance was affected earlier in the year by delays in moving into serial production of airborne terminals, while it made further improvements to the design, and a slippage of delivery of the first space-borne terminals from FY19 into FY20.

Exhibit 3: Analysis of potential revenues

Internet LEO system				
Cost of payload* (€m)	4.0	3.0	1.5	0.75
% payload composed of Mynaric systems	50%	50%	50%	50%
Number of satellites in constellation	50	100	300	1000
Revenues attributable to Mynaric (€m)	100	150	225	375
UAV, aircraft, balloon-based system				
Cost of payload (€m)	1.00	0.90	0.68	0.51
% payload composed of Mynaric systems	50%	50%	50%	50%
Number of platforms in constellation/cluster	50	250	500	1000
Revenues attributable to Mynaric (€m)	25	113	169	253

Source: Edison Investment Research. Note: *Payload is the part carrying out the communications or sensing function.

Mynaric is still at the pre-commercial phase and is not expected to generate operating profit until FY21. This limits the value of any analysis based on peer multiples, which do not ascribe any value for the substantial growth that may be realised from FY20 onwards when many of the proposed mega-constellations that could potentially deploy Mynaric's terminals are scheduled for launch. Rather than using a comparison with peer multiples, we present a scenario analysis (Exhibit 3) showing potential revenues achievable if the technology is deployed in communication systems of different sizes. We split the analysis into two types of system. The first looks at communication networks based on smaller LEO satellites, which typically have more than 100 satellites each. The second looks at communication networks based on many more, less expensive platforms, which may be unmanned aerial vehicles (UAVs), aircraft or balloons. A communications satellite has space-qualified terminals, which are more expensive than those on an airborne platform.

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